

Dissemination of Scientific Information: Adopting a Strategic Approach for the Council for Scientific and Industrial Research (CSIR), Accra, Ghana

Marian A. Jiagge¹ Mac-Anthony Cobblah (PhD)² Kirchuffs Atengble³
1.CSIR-Water Research Institute, Accra Ghana
2.Methodist University College, Ghana
3.Ghana Information Network for Knowledge Sharing (GINKS)

Abstract

The paper examined the information dissemination processes by the thirteen institutes of the Council for Scientific and Industrial Research of Ghana. The CSIR core mandate is to coordinate and manage all the national Research projects. Research findings are usually disseminated to benefit the citizenry. The main objective of this study was to develop and recommend a strategic approach for disseminating the scientific information that is generated by the CSIR institutes. The study adopted a survey research design and mixed research methods which involve the combination of qualitative and quantitative approaches in one single study. The findings revealed that the STI generated by the CSIR vary from one institute to another, it takes between 6 months to 2 years to disseminate research findings to the general public a situation which is not acceptable. The results further revealed that the CSIR disseminates STI in various formats ranging from journal articles, technical reports, radio and television talk shows, manuals, books and conference proceedings and there is a limited use of emerging technologies namely, emails, internet based group discussions to communicate STI to the general public. The study finally recommends: the adoption of electronic information dissemination methods such as emails, social media platforms, group discussions, lists to target groups who are computer literates, The CSIR must develop a policy for STI dissemination; this will help the various institutes to follow the acceptable standards in STI dissemination, Repackaging of STI. The CSIR should repackage STI and use the appropriate format, media to disseminate the information to the various targeted groups and The various institutes should conduct frequent STI needs assessment/analysis to determine the STI needs of the users, this will help in determining which STI will be relevant and in what format.

1. Introduction

Since time immemorial, the scientific community has played an increasingly important role in national development. They develop the economy through research by providing information in the areas that have already been researched into, and new areas that can be researched. In this sense, the production, management and dissemination of scientific data and information are very critical in scientific research.

The role of the Council for Scientific and Industrial Research (CSIR) among others, is to advise the government of Ghana on scientific and technological advances likely to be of importance to national development, to co-operate and liaise with national and international organizations in any part of the world in matters of research, to undertake various consultancy projects at the request of clients and to undertake or collaborate in the collection, publication and dissemination of research and other useful technical information. The CSIR carries out its mandate with the collaboration of its 13 research institutes namely the Building and Road Research Institute (BRRI), Food Research Institute (FRI), Institute of Industrial Research (IIR), Water Research Institute (WRI), Crops Research Institute (CRI), Forestry Research Institute of Ghana (FORIG), Oil Palm Research Institute (OPRI), Soil Research Institute (SRI), Plant Genetic Resources Research Institute (PGRRI), Savanna Agricultural Research Institute (SARI), Science and Technology Policy Research Institute (STEPRI), and the Institute for Scientific and Technical Information (INSTI), (CSIR Annual Report 2000).

Information is one vital resource that plays a significant part in a nation's development. Advancement in scientific and technological development is induced by the availability of information. Libraries are noted to be effective in the provision of data and current information on research and academic activities because of their role in information keeping and access.

The CSIR's Central Reference and Research Library is the Institute for Scientific and Technical Information (INSTI). INSTI has the capacity, through its scientific publications and printing divisions, to repackage Scientific and Technical Information (STI), appropriately for dissemination. It collaborates with institutional libraries of the CSIR to collect, process, store, retrieve and disseminate scientific and technical information for the socio-economic advancement of the country.

1.2 The Statement of the Problem

Scientists and researchers are the backbone of knowledge-based economies. The largest scientific research

institution in Ghana is the CSIR. Currently, there is so much information that has been generated by the research scientists. However, many people do not know the CSIR and the capabilities of its research scientists and those who do, regularly even mispronounce or state name in correctly.

Generally, scientists in Ghana have not been very good communicators, especially with the general public. Addy (2003) points out that the new generation of scientists should be able to communicate their research findings more effectively and get their message across to targeted groups. According to Addy; for scientists to undertake innovative scientific research and development the public must appreciate their efforts. This could be achieved through how “friendly” and resourceful our libraries are.

Since its establishment, the CSIR has been at the center of generating, processing and disseminating scientific and technical information in Ghana. However, the general public does not seem to have access to their research findings. This is because the CSIR still uses the traditional methods of disseminating STI to the general public. This study therefore aims at examining the current approach at disseminating STI and also develop and recommend a strategic approach to the dissemination of STI in Ghana.

1.3 Objectives of the Study

The main objective of this study was therefore to develop a strategic approach to dissemination of the STI produced by the CSIR to the general public. The specific objectives were to:

- examine the present process of disseminating, STI in the CSIR
- assess the effectiveness of the present system of disseminating STI
- develop strategies for disseminating STI
- make recommendations on the future direction of STI dissemination in Ghana

2 Literature Review

Information is defined as anything that can change a person’s knowledge (Marchionini,1995). Rasmussen (2001) described Information as knowledge that changes the state of its recipient. Knowledge and Information equips an individual with power to choose and to act in an informed manner.

2.1 Information Dissemination

Information dissemination can be described as the process of broadcasting information. Once information has been disseminated, it is up to the audience or receivers to make their own choice. The concept of Information dissemination is understood to be more than distribution of information. It also implies that action has been taken in response to the information received.

King (2003) suggests three possible intension of information dissemination:

- Scattering - which refers to the distribution of information about an innovation and this is done by publishing papers, sending emails and producing websites.
- Sowing - this refers to specifically directing the dissemination of information in a more targeted manner.
- Propagating - which refers to expecting specific results from Information dissemination.

King (2003) further identified three levels of information dissemination:

- Dissemination for awareness
- Dissemination for understanding
- Dissemination for action.

According to him, the critical questions to ask in information dissemination are:

- What do you want to disseminate?
- Who is your target audience
- Why do you want to disseminate?
- How are you going to disseminate?
- Was the dissemination successful?
- Have time been allowed for evaluation?

2.2 Information Systems

Information systems comprised of three elements:

- Source organizations which publishes the information
- Dissemination organizations which access and disseminate the information.
- Client groups - this refers to the users of information.

Information dissemination process are deemed to be effective when the information system is effective and provide the client groups with the opportunity to access information to meet their information needs.

Moxen and McCulloch (2010) also suggest that, the information dissemination process is made up of learning context, source organizations, disseminating organizations and client groups.

2.3 Communication Channels

Communication channels are pathways through which information or messages are transmitted to an audience or receiver (Akinbile&Otololaye, 2008). Communication is a crucial variable of human endeavour. Udall & Udall (1979), described communication as the process through which one person or a group of people clearly understand one another.

According to Hines, et al, (1987); Howard & McGregor, (2000); Welstead, et al (2006); Ryan & Rudland, (2002); Horsey,(2006); Janse & Konijnendijk (2007), the communication process in information dissemination should consider the following stakeholders:

Who	-	Information providers
Whom	-	The target audience
What	-	The information or issues involved
Impact	-	The urgency of the information and action required to be preferred.
When	-	The timing of the dissemination.

2.4 Challenges of Information Dissemination

Anasi, Stella (2012) identifies the following as the challenges to information dissemination:

- Inconsistent national policy on information
- Lack of political will and institutional commitment
- Weak information systems
- Inaccessibility of available information resources
- Problem of electricity supply
- Low level of ICT skills among information managers and users.
- High rate of illiteracy and poor reading culture
- Unreliable, outdated and insufficient information sources.

2.5 Methods of Information Dissemination

Anasi, Stella (2004) and M'Jambu-sie (2003), described the methods of disseminating health information in Africa to include print media such as newspapers, magazines, pamphlets, leaflets, posters, books etc.

Electronic media which include the use of radio, television, websites, mobile phones, electronic mails, internet, DVD etc.

Other media such as play and talks, seminars, workshops, public exhibitions and lectures are also used to disseminate information.

3. Research Methodology

The study adopted a mixed methods research approach. A mixed methods research approach combines the qualitative and quantitative research approach in a single study. The research used interview instrument to collect data from key players such as Directors, Deputy Directors and Head of Divisions in selected CSIR institutes to ascertain the prevailing situation with regard to STI generation, processing and dissemination. In all a total of 15 Respondents were interviewed.

The quantitative approach involved the use of questionnaire to collect data from selected subjects. Quantitative data was collected from a total number of 85 respondents, and a summary is presented in Table 1, 2 and 3, together with their biographic details. Mixed sampling methods which combined purposive and systematic random sampling techniques were used to select from the targeted population.

FINDINGS AND DISCUSSIONS

Table 1: Biographic Details (Gender, Age, Length of Service & Designation)

Variable	Values	Frequency (f)	Percent (%)
Gender	Male	67	78.8
	Female	18	21.2
	Total	85	100
	Mean	1.2118	
	Standard Deviation	0.41098	
Age	Below 30 Years	1	1.2
	31 - 40 Years	32	37.6
	41 - 50 Years	20	23.5
	Over 50 Years	32	37.6
	Total	85	100
	Mean	2.9765	
	Median	3.0000	
	Mode	2.00; 4.00	
	Standard Deviation	0.89942	
Designation	Research Scientists	67	80.7
	Officer in charge of ARDEC	1	1.2
	Director	2	2.4
	Librarian	4	4.8
	Scientific Information Officer	4	4.8
	Technical Editor	1	1.2
	RIS	1	1.2
	Deputy Director	2	2.4
	Assistant Librarian	1	1.2
	Total	83	100
	Mode	1.00	
	Standard Deviation	2.61497	

It is reported in Table 1 that of a total (85; 100%) respondents, a greater (67; 78.8%) number of them were males and the remaining 18 (21.2%) of them females. These were spread across different age groups; below 30 years (1; 1.2%); 31 - 40 years (32; 37.6%); 41 - 50 years (20; 23.5%); and over 50 years (32; 37.6%). It was also gathered from Table 1 that majority (67; 80.7%) of respondents were Research Scientists, while others included Officers in charge of ARDEC (1; 1.2%); Directors (2; 2.4%); Deputy Directors (2; 2.4%); Librarians (4; 4.8%); Assistant Librarians (1; 1.2%); Scientific Information Officers (4; 4.8%); Technical Editors (1; 1.2%); and RIS (1; 1.2%).

Table 2: Biographic Details (Institute& Division)

Variable	Values	Frequency	Percent
Institute	CSIR- Water Research Institute	35	44.3
	CSIR- STEPRI	9	11.4
	CSIR- INSTI	11	13.9
	CSIR- Animal Research Institute	8	10.1
	CSIR- Food Research Institute	9	11.4
	CSIR- Institute of Industrial Research	7	8.9
	Total	79	100
	Mode	1.00	
Division	Directorate	1	1.9
	Commercialization & Information Division	3	5.7
	Commercialization & Technology Innovation Division	3	5.7
	Energy Technologies Program	1	1.3
	Environmental Biology & Health Division	5	9.4
	Environmental Chemistry Division	5	9.4
	Environmental Division	1	1.9
	Surface Water Division	3	5.7
	Ground Water Division	6	11.3
	Fishery Division	6	11.3
	Food Chemistry Division	1	1.9
	Food Microbiology Division	1	1.9
	Animal Health and Food Safety Division	2	3.8
	Intensive Livestock Production System	1	1.9
	Food Processing & Engineering Division	1	1.9
	Materials & Manufacturing Division	1	1.9
	Industry & Service Division	4	7.5
	Thematic Mapping Division	2	3.8
	Library & Documentation Division	2	3.8
	Science Publishing Division	2	3.8
	BTSD	1	1.9
	EBCH Division	1	1.9
	Total	53	100
Mode	9.00; 10.00		

In Table 2 is displayed some institutes of the CSIR that were covered in the study. Majority of respondents were from the Water Research Institute (35; 44.3%); while others were from the Science and Technology Policy Research Institute (9; 11.4%); Institute for Scientific and Technical Information (11; 13.9%); Animal Research Institute (8; 10.1%); Food Research Institute (9; 11.4%); and the Institute of Industrial Research (6; 8.9).

Biographic details of respondents also showed that they were distributed between general and technical divisions of their respective institutes. Amongst respondents from general divisions were those from the Directorates (1; 1.9%); Commercialization & Information (3; 5.7%); and Commercialization & Technology Innovation divisions (3; 5.7%). The greater number of respondents were however from divisions such as Ground Water (6; 11.3%); Fishery (6; 11.3%); Environmental Biology & Health (5; 9.4%); Environmental Chemistry (5; 9.4%); Industry & Service (4; 7.5%); Surface Water (3; 5.7%); Thematic Mapping (2; 3.8%); Library & Documentation (2; 3.8%); Science Publishing (2; 3.8%) divisions.

Table 3: Biographic Details (Length of Service)

Range of Service Duration	Frequency (f)	Percent (%)
1 – 5 Years	25	29.8
6 – 10 Years	14	16.7
11 – 15 Years	17	20.2
16 – 20 Years	4	4.8
21 – 25 Years	15	17.9
26 – 30 Years	6	7.1
Over 30 Years	3	3.6
Total	84	100.0
Mean	3.0000	
Median	3.0000	
Mode	1.00	
Standard Deviation	1.83671	

The biographic details of respondents on their length of service with their respective institutes were grouped, and results shows that even though majority (25; 29.8%) of respondents had served within 1-5 years, they were altogether found to have served within 11 – 15 Years using arithmetic mean and median values.

The study used survey and evaluation research design, which is a measurement procedure that asks questions of respondents. Whiles some questions required respondents to choose from amongst a list of options (closed questions), others gave respondents the opportunity to provide their own answers (open-ended questions). The collected data was analyzed using the Statistical Package for Social Sciences (SPSS version16), and reported using frequency distribution tables, and graphically using pie charts and histograms.

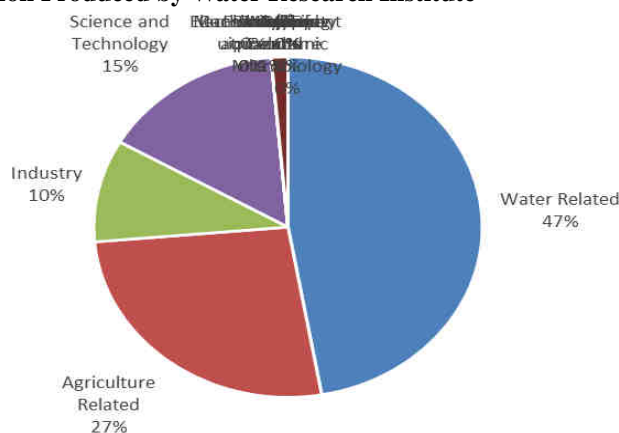
General responses from respondents were arrived at by the use of measures of central tendencies such as values for mean, median and mode. Mean values were used for generalizations when variables were generally condensed (with standard deviation less than 1.0), whiles generally scattered responses(with standard deviation more than 1.0) were reported using values for median and mode.

4 Types of Information Produced by Institutes

The study assessed the types of information produced by the CSIR Institutes. studies, and results are presented in Figure 1-6. Figure 1 presents the types of information produced by the Water Research Institute (CSIR-WRI), and water-related information (34; 47.2%) was obviously identified as the most dominant type of information produced.

However, there are other types of information produced by the institute and these include agriculture-related information (19; 26.4%); information on industry (7; 9.7%); science and technology information (11; 15.3%); and information on fishery and aquaculture (1; 1.4%).

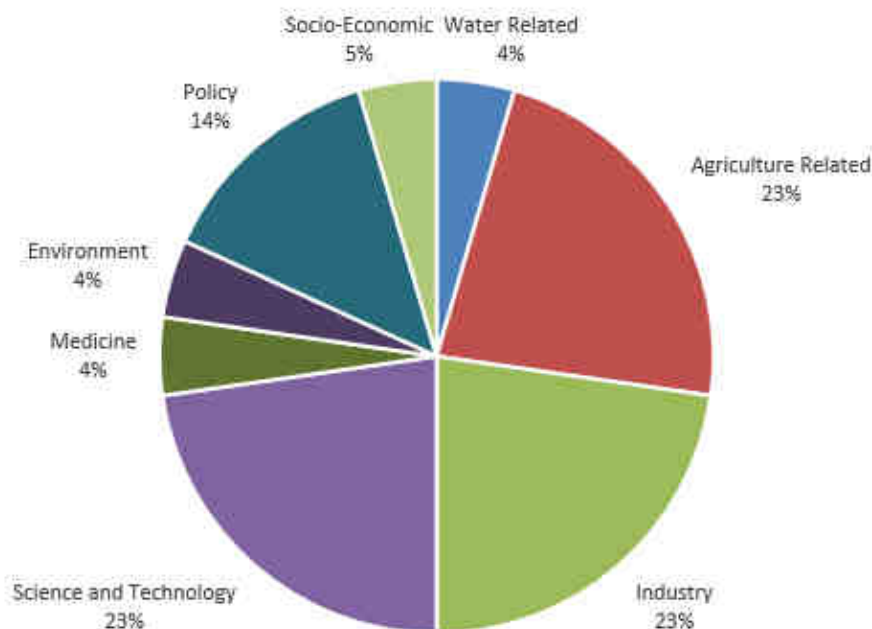
Figure 1: Types of Information Produced by Water Research Institute



Amongst the types of information produced by the Science and Technology Policy Research Institute (CSIR-STEPRI), Figure 2 shows that agriculture-related information (5; 22.7%); information on industry (5; 22.7%); and information on science and technology (5; 22.7%) ranked the most produced types of information. Being an institute that spreads its operations across many disciplines, it was not surprising that information

produced by CSIR-STEPRI cuts across multi-disciplines, and with equal proportion of focus on three (3) of these; agriculture, industry and science and technology.

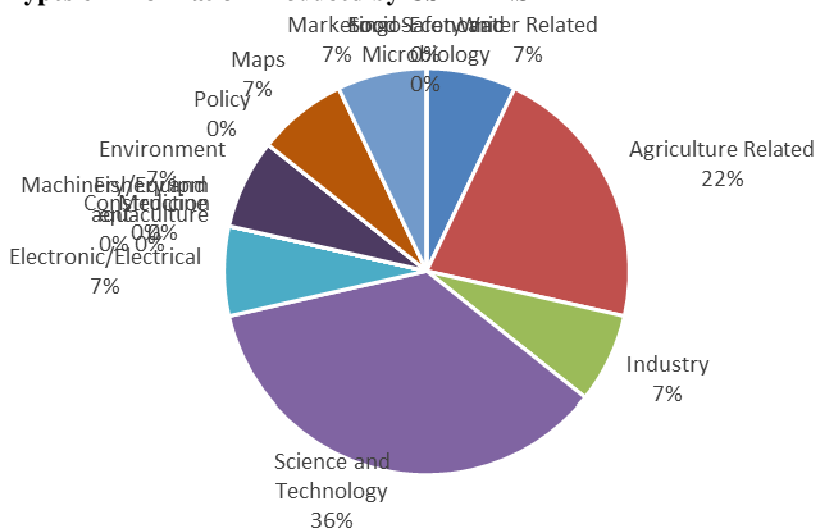
Figure 2: Types of Information Produced by CSIR-STEPRI



Other types of information produced by STEPRI include water-related information (1; 4.5%); information on medicine (1; 4.5%); environment (1; 4.5%); policy (3; 13.6%); and socio-economic information (1; 4.5%).

Figure 3 depicts the types of information produced by CSIR-INSTI, which presents information on science and technology (5; 35.7%) as the most produced information. This is also not surprising as CSIR-INSTI is the main repository for all scientific and technological information produced within the CSIR.

Figure 3: Types of Information Produced by CSIR- INSTI

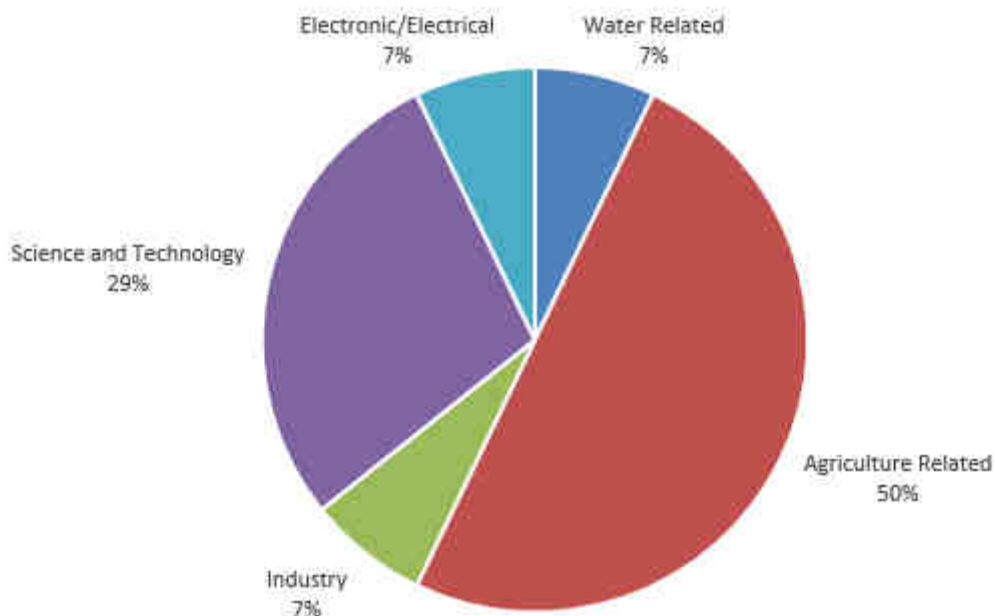


In figure 3, Agriculture-related information (3; 21.4%) ranked next for CSIR-INSTI, probably because of projects like the Ghana Agricultural Information Network System (GAINS) being executed by the institute. This notwithstanding, information is produced on other subjects such as water (1; 7.1%); industry (1; 7.1%); electronics/electricity (1; 7.1%); environment (1; 7.1%); maps (1; 7.1%); and marketing.

It was not surprising that the study (as presented in Figure 4) identified agriculture-related information

(7; 50.0%) as the most produced type of information by the Animal Research Institute (CSIR-ARI). Other information produced by the institute are water-related (1; 7.1%) as well as concerning industry (1; 7.1%); and electronic/electricity (1; 7.1%).

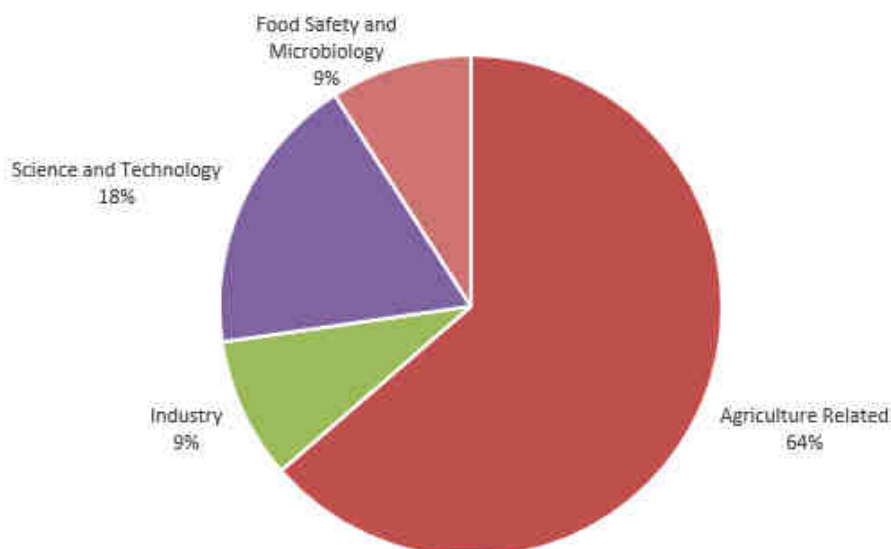
Figure 4: Types of Information Produced by Animal Research Institute



The study gathered also that Animal Research Institute, being an agriculture-based research institute, does produce agriculture-related information (7; 50.0%) as the bulk of its information products. The institute produces, however, other types of information including science and technology (4; 28.6%); information on industry (1; 7.1%); electronics/electrical information (1; 7.1%); and water-related information (1; 7.1%).

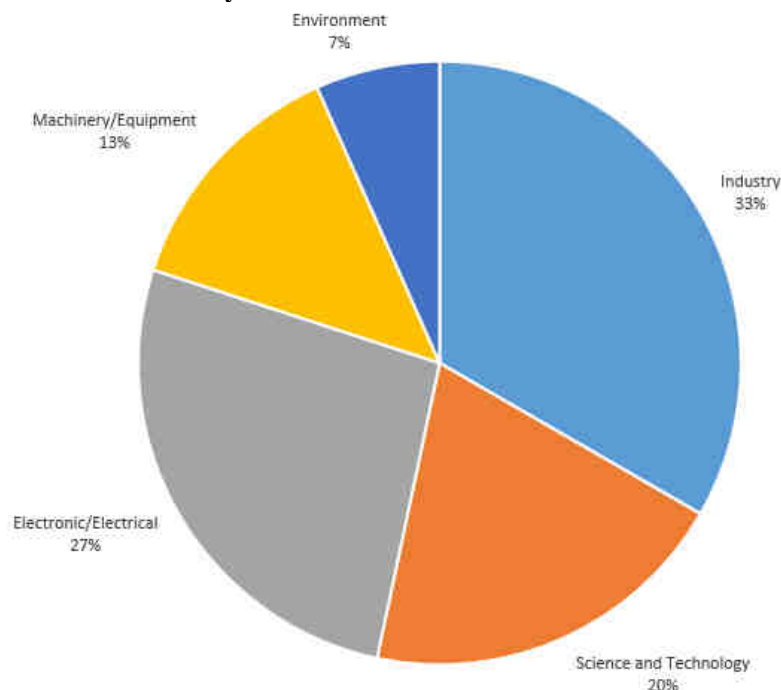
The Food Research Institute (CSIR-FRI), as it was gathered, goes beyond the production of agriculture-related information (7; 63.6%) to include the production of information on food safety and microbiology (1; 9.1%) in bouquet its information products. Other types of information produced by the institute include information on industry (1; 9.1%) and science and technology (1; 9.1%).

Figure 5: Types of Information Produced by Food Research Institute



The Institute of Industrial Research (CSIR-IIR) was found by the study to produce different types of information, but most dominant in the list was industry-related information (5; 33.3%); information on science and technology (3; 20.0%); and electronic/electrical information (4; 26.7%).

6: Types of Information Produced by Institute of Industrial Research



Apart from the dominant types of information, the Institute of Industrial Research (CSIR-IIR) also produces information on environment (2; 13.3%) and information on machinery and equipment (1; 6.7%).

To conclude on this section, the study revealed that different kinds of scientific and technological information (STI) are produced by the different institutes of the CSIR, which is indicative of their coverage in disciplines. While all institutes produce common types of information, such as those on science and technology and industry, there are some types of information that are unique to some institutes.

4 Duration for The Dissemination of STI

In assessing the dissemination of scientific and technological information (STI) at the CSIR, the duration for the dissemination was also considered, to ascertain the differences if any among the different institutes studied. Table 4 presents results gathered across the different institutes, which shows that generally, none of the institutes of the CSIR uses two years for the communication of STIs. The Water Research Institute (CSIR-WRI) was found to use a minimum of one week (3; 10.3%) and a maximum of one year (3; 10.3%) for the communication of STIs. Generally however, the institute disseminates its STIs in six months.

Table 4: Duration for the Dissemination of STI at CSIR Institutions

Institute	Timeframe						Total	Mean	Median	Mode	Standard Deviation
	One Week	One Month	Three Months	Six Months	One Year	Two Years					
Water Research Institute	3 (10.3%)	2 (6.9%)	6 (20.7%)	15 (51.7%)	3 (10.3%)	-	29 (100%)	3.4483	4.0000	4.00	1.12078
STEPRI	-	3 (42.9%)	-	3 (42.9%)	1 (14.3%)	-	7 (100%)	3.2857	4.0000	2.00; 4.00	1.25357
CSIR- INSTI	1 (12.5%)	2 (25.0%)	1 (12.5%)	4 (50.0%)	-	-	8 (100%)	3.0000	3.5000	4.00	1.19523
Animal Research Institute	-	-	1 (12.5%)	4 (50.0%)	3 (37.5%)	-	8 (100%)	4.2500	4.0000	4.00	0.70711
Food Research Institute	-	-	2 (40.0%)	2 (40.0%)	1 (40.0%)	-	5 (100%)	3.8000	4.0000	3.00; 4.00	0.83666
Institute of Industrial Research	-	-	-	6 (100%)	-	-	6 (100%)	4.0000	4.0000	4.00	0.00000

The Science and Technology Policy Research Institute (CSIR-STEPRI) however disseminates its STIs within a minimum of one month and a maximum of one year. On the average therefore, STIs take six months to be disseminated. It was gathered also that while it takes a minimum of one week (1; 12.5%) to disseminate STIs at the Institute for Scientific and Technological Information (CSIR-INSTI), a maximum of six months (4; 50.0%) is used to disseminate these kinds of information. On the average however, STIs are disseminated within six months at CSIR-INSTI.

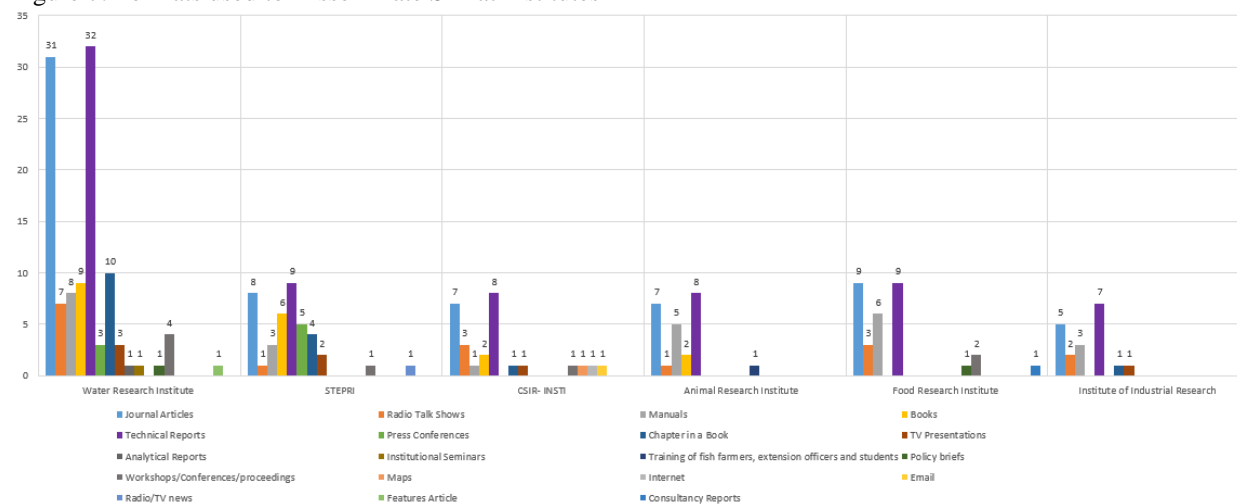
A common trend was recorded for the Animal Research Institute (CSIR-ARI) and Food Research Institute (CSIR-FRI), where STIs are disseminated within a minimum of three months ([1; 12.5%] & [2; 40.0%] respectively), and ([3; 37.5%] & [1; 40.0%] respectively) maximum. Generally, however, STIs were found to be disseminated at these two institutes within a period of six months. The case for the Institute of Industrial Research (CSIR-IIR) showed a unanimous response 6 (100%) that all STIs are disseminated within a period of six months.

On the whole, the study revealed that the different institutes of the CSIR have different timeframes for communicating scientific and technological information (STI). While some institutes disseminate information within one week minimum, others spend as much as one year for STI dissemination. On the average however, it was gathered that the different institutes of the CSIR use a period of six months for STI dissemination.

4.2 Formats Used to Disseminate STI

In assessing the dissemination of Scientific and Technological Information (STIs) within the CSIR, it was worth discussing the different information products (or formats) within which these STIs are communicated. Results are presented in Figure 7. The study revealed that journal articles and technical reports are amongst the mostly used information dissemination formats within the CSIR, with high ratings at the Water Research Institute (CSIR-WRI) ([31; 88.6%] & [32; 91.4%] respectively), Science and Technology Policy Research Institute (CSIR-STEPRI) ([8; 88.9%] & [9; 100.0%] respectively), the Institute for Scientific and Technological Information (CSIR-INSTI) ([7; 63.6%] & [8; 72.7%] respectively), Animal Research Institute (CSIR-ARI) ([7; 87.5%] & [8; 100.0%] respectively), Food Research Institute (CSIR-FRI) ([9; 100.0%] & [9; 100.0%] respectively) and the Institute for Industrial Research (CSIR-IIR) ([5; 71.4%] & [7; 100.0%] respectively).

Figure 7: Formats used to Disseminate STI at Institutes



Other formats for STI dissemination mostly used at the Water Research Institute (CSIR-WRI) include radio talk-shows (7; 20.0%), manuals (8; 22.9%), books (9; 25.9%) and book chapters (10; 28.6%). At the Science and Technology Policy Research Institute (CSIR-STEPRI), manuals (3; 33.3%), books (6; 66.7%), book chapters (4; 44.4%), press conferences (5; 55.6%), television presentations (2; 22.2%), radio programmes (1; 1.1%) and conference & workshop proceedings (1; 1.1%) are used to complement its traditional information dissemination formats.

The Institute for Scientific and Technological Information (CSIR-INSTI) considers using other formats such as radio talk-shows (3; 27.3%), manuals (1; 9.1%), books (2; 18.9%), book chapters (1; 9.1%), television presentations (1; 9.1%), conference & workshop proceedings (1; 9.1%), maps (1; 9.1%), internet (1; 9.1%) and email (1; 9.1%). And among other dissemination formats used by the Animal Research Institute (CSIR-ARI) are radio talk-shows (1; 12.5%), manuals (5; 62.5%), books (2; 25.0%), and training of fish farmers, extension officers and students (1; 12.5%).

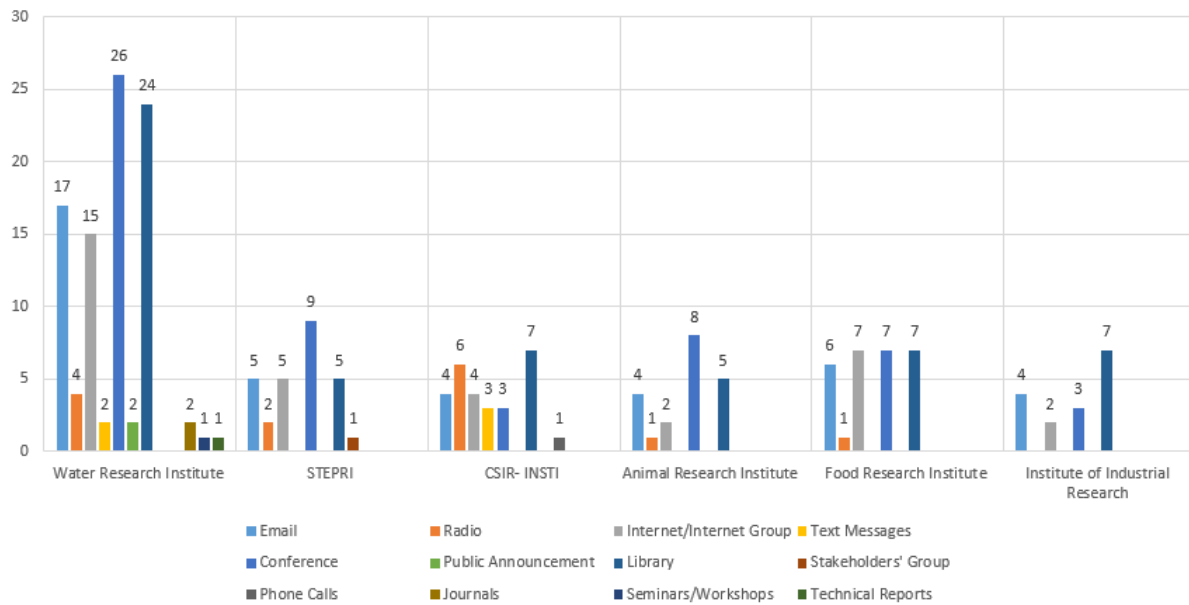
At the Food Research Institute (CSIR-FRI), radio talk-shows (3; 33.3%), manuals (6; 66.7%), policy briefs (1; 11.1%), conference & workshop proceedings (2; 22.2%), and consultancy reports (1; 11.1%) are used to complement traditional STI dissemination formats; while the Institute for Industrial Research (CSIR-IIR) has among alternative information dissemination formats such as radio talk-shows (2; 28.6%), manuals (3; 42.9%), book chapters (1; 14.3%) and television presentations (1; 14.3%).

Altogether, this section discovered general formats used to disseminate scientific and technological information (STI) at institutes within the CSIR. These included journal articles and technical reports, which were considered paramount among the bouquet available to these institutes, as well as radio talk-shows, manuals, books and/or book chapters. There were some other formats that were unique to these institutes, but were

generally employed to reach out to their audiences.

4.3 Mediums Used to Disseminate STI

In this section, the study discusses findings with respect to scientific and technological information (STI) dissemination mediums/media used at the various institutes of the CSIR studied. These are presented in Figure 8. Figure 8: Mediums used to Disseminate STI at Institutes

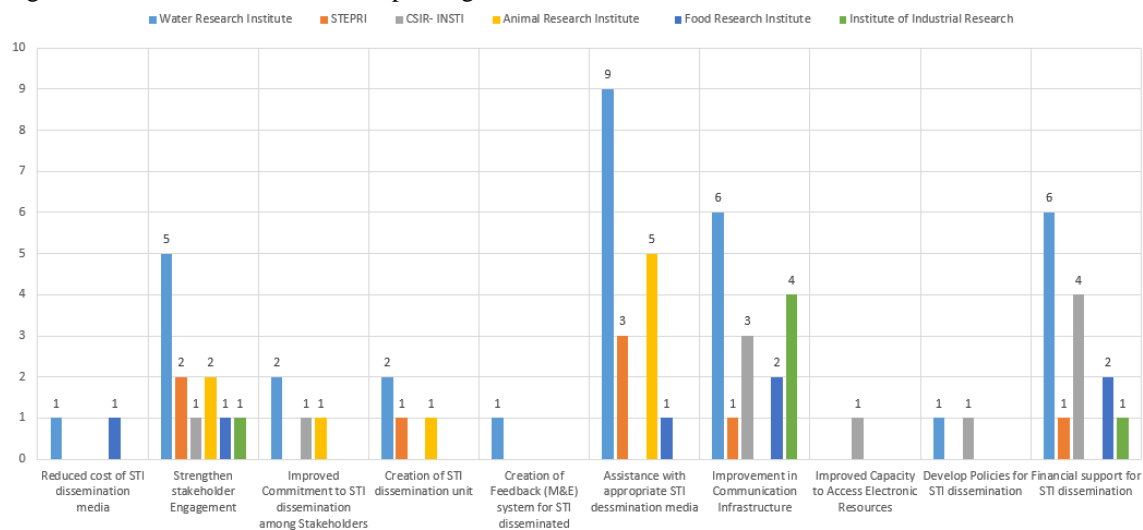


While observing a unique set of STI dissemination media among the institutes studied, some formats seemed to be cross-cutting and highly rated for the purpose of disseminating STIs. Among these were electronic mail (e-mail) communication, internet/internet group platforms, conference platforms, and libraries.

4.2.7 Recommendations For Improving STI Dissemination Systems

There was an opportunity for respondents to identify limitations of the prevailing systems, and these are presented in Figure 11. Two (2.8%) responses called for a reduction in the cost of STI dissemination media; and these calls were from the Water Research Institute and Food Research Institute. Another recommendation was for the strengthening of stakeholder engagement, and this call was made by all six institutes studied. Specifically, some comments were stakeholder relationship should be strengthened; strengthen research-extension interaction; STI dissemination should involve the District Assembly; establish strong linkage between industry and scientific community; and the media should be sensitized and encouraged to specialize in scientific and technology reporting just like media men and women specializing in sports.

Figure 11: Recommendations for improving STI dissemination in the CSIR



Four (5.6%) other recommendations called for an improved commitment by all stakeholders to STI dissemination; and another 4 (5.6%) consider the creation of an STI dissemination unit within the CSIR. One

(1.4%) respondent from Water research Institute recommended the creation of a feedback mechanism to gather reactions from for STI communicated. There were 18 (25.4%) responses that called for assistance with appropriate STI dissemination media. Specifically, such recommendations include institutional review committees should fast track review processes; use policy briefs instead of lengthy/long reports and workshops instead of TV/radio for dissemination; and organize basic transfer of STI to the farmers through more seminars via their associations.

Other recommendations called for an improvement in existing information communication infrastructure, and in particular with comments like internet access should be improved in all educational institutions especially via wireless connectivity; I think some of the technical reports must be sent to all the universities for easy access by the public; there is the need for networking of the database; more PCs are needed at the library to facilitate easy access and dissemination of information; and only few local journals are available which is not encouraging enough.

One (1.4%) respondent suggested capacity building to improve access to electronic resources; and another 2 (2.8%) called for the development of policies for STI dissemination within the CSIR; and a final 14 (19.7%) of them called for improved financial support for STI dissemination.

5. Conclusions and Recommendations

5.1 Conclusions

The objective of this study was to:

- Examine the present processes of disseminating STI in the CSIR.
- Assess the effectiveness of the present system of disseminating STI.
- Develop and recommend strategies for disseminating STI.

The findings of this study revealed that the STI generated by the CSIR vary from one institute to another, for instance, WRI generated STI on water related subjects including information on fishing and aquaculture. STEPRI generated STI on science and technology policy and industry. ARI generated agriculture related STI especially in relation to animal sciences and technology.

FRI also generated STI on food science and technology, while IIR and BRRI generated STI on industry, science and technology and building and road technology respectively.

The study also established that, it takes between 6 months to 2 years to disseminate research findings to the general public; a situation which is not acceptable.

The results further revealed that the CSIR disseminates STI in various formats ranging from journal articles, technical reports, radio and television talk shows, manuals, books and conference proceedings.

The findings also established that there is a limited use of emerging technologies namely, emails, internet based group discussions to communicate STI to the general public.

5.2 Recommendations

In view of this study, we recommend the following:

- Adoption of electronic information dissemination methods such as email, social media platforms, group discussions lists, etc. to target groups who are computer literates.
- STI dissemination policy. The CSIR must develop a policy for STI dissemination; this will help the various institutes to follow the acceptable standards in STI dissemination.
- Repackaging of STI. The CSIR should repackage STI and use the appropriate format, media to disseminate the information to the various targeted groups
- Information needs Assessment
- The various institutes should conduct frequent STI needs assessment/analysis to determine the STI needs of the users, this will help in determining which STI will be relevant and in what format.
- Issuing of press releases which attracts a lot of attention.
- Periodic evaluation of STI dissemination processes and policies
- Establishment of CSIR repository, where an electronic database will be created to assess STI. The Institute for Scientific and Technical Information is expected to play the co-ordinating role
- Adequate funding should be provided for STI dissemination.

REFERENCES

- Addy, M.E. (2003), "Training the Next Generation of Scientists", *The J.B. Danquah Memorial Lectures Series* 36.
- Akibile, L.A.& Otitolaye, O.O. (2008), "Assessment of Extension agents' knowledge in the use of communication channels for agricultural information dissemination in Ogun state, Nigeria", *Journal of Agricultural and Food information* 9(4).

- Anasi, S. (2012), "Access to and dissemination of health information in Africa: The patient and the public", *Journal of Hospital Librarianship* **12**(2), 120-134
- Anasi, S. (2004), "Audio-visual media capabilities and the dissemination of health information", *Library Focus* **22**, 50-59.
- Council for Scientific and Industrial Research (2001) –Annual Report 2000
- Entsuaah-Mensah, M. (2005), "The Future of the Youth in Science and Technology in Ghana. In: Harnessing Research, Science, and Technology for Sustainable Development in Ghana", *Proceedings of the First National Forum on Research, Science and Technology* held in Accra, 15-19 March 2004. NCTE, Accra 2005. pp77-109
- Hines, J. M., Hungerford, H. R. & Tomera, A.N. (1987), "Analysis and synthesis of research on responsible environmental behavior: A meta-analysis of case studies on education within conservation across the WWF network", *Applied Environmental Education and Communication* **1**, 153-162.
- Horsey, S. (2006), "Case studies aimed at reducing diffuse water pollution from agriculture in England".
- Howard, J. & McGregor, D. (2000), "Reducing nutrient enrichment of waterways through public education: A tale of two cities", *Environmental Conservation* **27**, 351-358
- Janse, G. & Konijnendijk, C.C. (2007), "Communication between science, policy and forestry. Experiences from the neighbor woods project". *Urban Forestry and Urban Greening* **6**, 23 -40.
- King, H (2003) Disseminating educational developments. In: Khan, P. & Bawne, D (Eds) A guide to staff and educational development. London: Kogan, pp96-115
- Marchionini, G. (1995) Information seeking in electronic environments, Cambridge: Cambridge University Press.
- M'jamitu-Sie, N. (2003), "Disseminating health information in Sierra Leone: The challenges", *Information Development* **19**, 250 -259.
- Moxen, J. & McCulloch, A. (2010), "Organizing the dissemination of environmental Information: Lessons from Scotland", *Journal of Environments & Planning* **1**(2), 155-165.
- Rasmussen, A.M. (2001), "Information and development: the information effect", *Information Development* **17**, 250 -259.
- Ryan, R & Rudland, S. (2002). *Effective environmental education campaigns: Campaigns Report*. New South Wales: Elton Consulting
- Udall R & Udall S. (1979). *People and Communication*. Amersham Bucks: Hutton Education Press.
- Welstead, J., Aitchison, K & Savage, B (2006) Effective provision of environmental information and advice: A scoping study. Scottish Government: Scottish Executive Social Research