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Use of Scientific Information Sources by Policy Makers in the Science and Technology Sector of Nigeria

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Abstract

This study investigated how policy makers in Nigerian public agencies that have mandates for policy making and implementation in the science and technology sector access and use information sources in their activities. A questionnaire was used to collect data from 121 of the policy makers to find out the sources and types of information they use and their perceptions of the availability and accessibility of the sources. The policy makers reported that the most available sources were newspapers (88.6% of the respondents) and colleagues/ superiors (82.9%), while the most accessible sources were colleagues/superiors (70.0%). The most inaccessible information sources were student theses and dissertations (40%), reports from research institutes (37.1%) and books of abstract (35.7%). The results imply that soft information sources and personal contact are the most available and accessible information sources. The policy makers suggested that improved availability and accessibility of information produced in the research institutes and universities could help strengthen their policy making activities. This could be achieved through the building of local institutional repositories and databases of scientific research and publications, as well as joint conferences and workshops involving policy makers and scientists/researchers in the research institutes and universities.

Keywords

Science and technology, information sources, policy makers, information access, information use, Nigeria

Introduction

Making information sources readily available and accessible to policy makers in public institutions could significantly increase the effectiveness of public policies, such policies being vital elements in development efforts. Well thought out policies are central to achieving key national goals such as alleviating poverty, raising living standards, creating good jobs, ensuring security, strengthening education, as well as improving public health and protecting the environment (Aiyepeku, 1983). Nevertheless, the utilisation and impact of information in policy making are universally often difficult to measure objectively. Moreover, policy-relevant research seldom has an immediate or direct impact on government decisions, especially in most developing countries (Porter and Hicks, 1996).

About a decade ago, Adeya (2000) noted that the use of scientific and other information sources by policy makers in Africa was very low despite increasing global consciousness that information is a *sine qua non* for socio-economic development. In Nigeria, Olembo (2002) has shown that there is a gap between the worlds of policy makers and researchers because research outputs from research institutes and universities are either

not available or not accessible to policy makers. Onatola (2004) has also noted that the resultant low integration of relevant locally produced scientific information sources into national policies could be considered one of the limiting factors in most development plans.

Olomola (2005) showed that in Nigeria, although the role of research in policy decision process seems to have been recognised, research input into policy making processes is rather limited. He observed that Nigerian policy makers take several decisions without research input while several research studies that have no policy relevance are being conducted in the universities and research institutions. Policy makers in the public service generally rely so much on consensus information such as in-house memoranda and committee reports (Aiyepeku, 1983), just as they often use information that comes in the form of directives from the government. Colleagues or superiors also constitute veritable sources of scientific information to workers. These sources have the advantages of reliability, availability and relative ease of accessibility; and they provide information that could be readily used without much further processing. Personal contacts with researchers, research institutes or universities with whom policy makers have established either personal or formal relationship also provide useful information.

Information sources exhibit different attributes that make them desired or avoided by policy makers. In-house memoranda or colleagues, for instance, may serve as quick sources of information for the policy makers. Meta information sources, such as abstracts and indexes, usually serve window-shopping purposes, and policy makers might not be keen to use them either due to lack of the ability of time to use them or the means to acquire the relevant sources listed in the indexes and abstracts. Moreover, the dwindling library acquisition and subscription budgets often mean that most of the sources listed in meta sources might not even be available from the institutional or local libraries.

Science and technology policies in Nigeria are made in the Federal Ministry of Science and Technology, which is also the supervising ministry in the sector, as well as in two research institutes affiliated to the Ministry, namely: National Information Technology Development Agency (NITDA) and National Agency for Engineering Infrastructure (NACENI). In addition, there are about eighteen research institutes mandated to carry out research and provide research and development information and products to the decision-makers in both the public and the private sectors.

Djenchuraev (2003) described scientific and technical information (STI) broadly as information derived primarily from research or researchers, and from the development and monitoring activities of scientists and engineers. Hard research -based sources such as reports from research institutes, learned journals, students' theses and dissertations, as well as books, monographs and conference proceedings constitute sources from which the policy makers could extract STI. Meta sources such as abstracts, indexes, subject specialists or authorities also provide information that could guide policy makers. Some of these sources could be obtained from the institutional libraries in the ministry and science and technology institutes and agencies. In the digital era, it is expected that some of the required STI would become accessible through the Internet.

The availability and accessibility of information sources might not be considered relevant research issues in developed countries where the information resources required to perform various policy making tasks are available and where infrastructure for accessing the resources is available. The same does not apply to Nigeria and probably many other developing countries, and these differences underlie the concepts of information rich and poor, and the digital divide. In the developing countries, factors such as location of the facilities, ability to use the sources, time and organisational regulations, and forms of the sources, among others may pose obstacles to using available information sources. In the specific context of Nigeria, Aguolu and Aguolu (2002) have shown that the existence of information sources does not guarantee that they will be accessible to particular users.

Literature Review

Science and Technology (S&T), Science and Technology Information (STI) Policies

Science is defined as generalisable and replicable knowledge of nature, usually resulting from basic science performed in universities or institutions of near status, and reproduced in refereed and published papers (UNECA, 1997). Science also refers to any body of knowledge created through formal processes of research. Technology, on its own part, refers to the knowledge of (products, processes, services) usually resulting from applied research, development and related activities in business firms and other institutions, and embodied in the production of the artefacts themselves. In other words, technology refers to the application of science with the aim of making a difference to the world around us (UNECA, 1997). Musoke (2002) suggests that technology is everything – equipment, knowledge, including information about all kinds of skills, processes and products, plus institutional and organisational know-how. This means that science and technology (S&T) are sometimes inseparable concepts-new scientific knowledge may lead to technological development, while a technological need also may prompt scientific investigation. Science and technology help humans to understand and conceptualise their world and fashion out tools and means by which humans go about their daily lives and satisfy basic needs.

Scientific information derives primarily from research, development, and monitoring of the activities of scientists and engineers and other individuals supporting their work (Djenchuraev, 2003). Nwagwu's (2006) definition of STI as "all information developed from research undertakings in all science and technology fields" somewhat broadens this definition. This broad view of science and technology information permits an expanded understanding of sources of information that are useful to the policy makers.

A policy could be defined as a specific decision or set of decisions designed to carry out a course of action (Mudenda, 1989). It could also be viewed as an official statement with a specific purpose, a set of objectives, defined goals and outcomes, and a set of criteria for choosing among competing alternatives (Abdalla, 2003). Policy making involves those in positions of authority making choices on behalf of their patrons within the sector they supervise. The outcomes of policy making are in many forms, ranging from national policies made by the government to professional guidelines by professional bodies. Although, this usage of the terms, policy and policy making, appears very broad, but it has advantages in the study of knowledge utilisation, and has also informed a series of such studies (Buxton and Hanney, 2000; Hanney and Packwood 2000).

Evolution of S&T and STI in Nigeria

The development of science and technology sector in Nigeria can be elucidated by an overview of the evolution of the supervising ministry- the Federal Ministry of Science and Technology. The Ministry in its present form started as the Nigerian Council for Science and Technology (NCST) in 1970, and became the National Science and Technology Development Agency (NSTDA) in 1977. In 1980, the civilian government of Shehu Shagari (1979-1983) created the Federal Ministry of Science and Technology (FMS&T), which absorbed the functions of NSTDA. However, a change in government through a military *coup d'etat* in 1983 brought in the General Muhammadu Buhari (1983-1984) government which merged the Federal Ministry of Science and Technology with the Federal Ministry of Education to form the newly created Federal Ministry of Education, Science and Technology. The General Ibrahim Babaginda government (1984-1993) restored the independent status of Ministry of Science and Technology in 1985, a status the Ministry enjoys till date.

The mandate and functions of the FMS&T have been outlined by Chidi (2007) as follows: initiation, formulation, monitoring, and review of the national policy on science and technology issues, including harvesting research and other information from all stakeholders. Nigeria's first National Science and Technology Policy was formulated in 1986 on the realisation that overall national development could only be sustained through the effective application of scientific and technological skills for the production of goods and services. The FMS&T has recorded some achievements in the past few years, including investment in the launching of Nigeria Sat-1, launched in September 2003. The Ministry has also recently initiated a linkage framework with research institutions and stakeholders, which arises from a growing realisation

that research information is critical to science and technology policies and that increased access and utilisation of information will definitely strengthen the sector's activities.

Sources and Uses of Scientific Information to Policy Makers

There are many sources of information to policy makers. Adams and Hairston (1995) identified textbooks, published scientific papers, conference proceedings, computer models, position papers from professional or advocacy groups, government agency staff, industry employees, consultants, or people with practical experience and "conventional wisdom" as common sources of information for policy makers. Aiyepeku (1983) studied the perception and utilisation of information by policy makers in Nigeria, and discovered that the most important source of information for the Nigerian policy maker is the confidential file where the well-known in-house memoranda are contained. According to him, more than 90% of the respondents used 'personal sources', suggesting a heavy dependence on 'opinion leaders' and 'colleagues'. The study also showed that policy makers identified timeliness and availability as two most important factors that enhanced their utilisation of information.

There are diverse factors that affect the use or non-use of information sources by policy makers. Schwartz (1983) has shown that finding information that is relevant to solve a problem in developing countries is not easy, because of the difficulty in identifying, locating, retrieving and understanding the information. Glover (2000) pointed out that factors such as the design and dissemination of research, quality of the research, including the reliability of its methodology, have an important bearing on research report credibility and impact. According to Narcise *et al* (2002), use of information is limited by factors like inadequate technical capacity with regard to human, equipment and financial resources resulting to significant gaps in scientific knowledge; profusion of data that is not evaluated optimally; incomparable and/or unreliable data; lack of mechanisms for information sharing and integration and reluctance of institutions to share data. Others are failure to package information into understandable forms for managers and decision-makers, failure to translate information to management actions and decisions, and limited understanding of the value of information by some local leaders.

An interesting finding was also made by Abdalla (2003) when he showed that factors like cultural values, attitudes, tradition-bound behaviour, and fear of ostracisation, power relations and vested interests may negatively influence policy makers, causing them to stick to existing routines of actions rather than make informed but risky decisions. Recently, Chandrika (2007) showed that factors such as relevance of research findings, timeliness, quality and accuracy, objectivity of research documentation and simplicity of language of research findings encourage, to a great extent, the use of research reports by policy makers for decision-making.

Methodology

A sample survey research design was used to collect data from the senior staff of the Federal Ministry of Science and Technology (FMS&T) and the two policy making agencies under the ministry, namely: National Information Technology Development Agency (NITDA), and the National Agency for Science and Engineering Infrastructure (NASENI). From the staff records which were obtained from the directors of personnel in the three organisations, a sample frame of policy makers who had at least a first degree or its equivalent numbering 221 was constructed and a random sample of 121 was selected. Data was collected using a questionnaire and an oral interview. The questionnaire was administered personally by the second author and her assistants, while the oral interviews were conducted by the first author.

The questionnaire was aimed at eliciting information on (i) personal background of the respondents, (ii) types of sources used (iii) perceptions about availability, accessibility and uses of information sources and (iv) the associated constraints.

The questionnaire was subjected to face validation among scholars at the Africa Regional Centre for Information Science, University of Ibadan. The scholars noted the possibility of

respondents confusing the constructs of availability and accessibility, which led to operational definition of the two terms being provided in the final questionnaire. Moreover, the administration of the questionnaire by the researchers themselves enabled them to clarify information about some of the variables, as needed.

Regression analysis was employed to gauge whether the availability or accessibility of information sources was a significant predictor of their use, as well as whether perception about availability and accessibility can be explained by the demographic characteristics of the respondents, placing our significance level at $p<0.05$.

Results

Background Information

One hundred and twenty-one copies of the questionnaire were distributed, and all were returned. This complete return rate was made possible by the readiness of the policy makers to participate in the study, as well as personal follow up mounted by the authors.

Table 1 summarises the demographic and organisational characteristics of the respondents. The respondents included personnel from the following departments: Administration and Supply (10.0%), Finance and Accounts (15.7%), Planning, Research and Statistics (8.6%), Physical and Life Sciences (17.1%) and Chemical Technology and Energy Research (11.4%). Others are Technology Acquisition Assessment (8.6%), Science and Technology Promotion (17.1%) and Information and Communication Technologies (7.1%).

The sample also included mainly persons above 50 years (55.7%), followed by those who are less than 40 years (37.2%). Majority of the policy makers had spent less than 10 years in employment. More than half possessed first degree; about 25% possessed master's degrees while less 7% had doctoral degree. Finally, out of every ten policy makers, as many as eight were males.

Table 1: Organisational and Demographic Characteristics of Respondents (N=121)

Variable	Measurement	Frequency	%	Mean
Department	Administration and Supply	12	10.0	
	Finance and Accounts	19	15.7	
	Planning Research & Policy Analysis	10	8.6	
	Physical and Life Science	21	17.1	
	Chemical Technology & Energy Research	14	11.4	
	Technology Acquisition & Assessment	10	8.6	
	Science and Technology Promotion	21	17.1	
	ICT	9	7.1	
	Not indicated	5	4.4	
Age	Above 60 years	0	0.0	42.19
	50-60 years	67	55.7	
	40-50 years	10	7.1	
	Less than 40 years	44	37.2	
Working experience	Below 10 years	64	52.9	14.5
	10-15 years	9	7.1	
	15-20 years	21	17.1	
	20-25 years	16	12.9	
	Above 25 years	11	10.0	
Education qualification	Bachelor's degree	73	60.0	
	Master's degree	30	25.7	
	Doctoral degree	9	7.1	
	Diploma	5	4.3	
	Others	4	2.9	
Gender	Male	117	81.4	
	Female	4	8.6	

Types/Forms of Information Sources Consulted

Almost all of the policy makers (95.7%) affirmed that they consulted information sources during policy decision making.

The policy makers were then asked to indicate which of seventeen listed information sources they consulted. The result is shown in Table 2. Each of the sources received affirmative responses from at least 55% of the respondents, although colleagues/ superiors were reportedly the most consulted (92.6%). The next three sources of information, namely: in-house memoranda, government opinions, and committee were either job-related, forms of government opinions or information arising from consensus, and each was reportedly used by not less than 76% of the respondents. Information developed from formal research institutions or research-related activities and institutions constituted the next seven sources, and they were reportedly used by not less than 60% of the respondents. The Internet, student theses and dissertations, and meta-information sources such as subject specialists and indexes are the least used each by less than 60% of the respondents.

Table 2: Types of Information Sources Consulted (N=121)

Information Sources	Yes	%
Colleagues or superiors	112	92.6
In-house memoranda	97	80.2
Government opinions	94	77.7
Committee	92	76.0
Newspapers	89	73.6
Report from research institutes	87	71.9
Books and monographs	85	70.2
Research libraries	81	66.9
Conference proceedings	79	65.3
Researchers	78	64.5
Learned journals	75	62.0
Internet	72	59.5
Books of abstract	72	59.5
Subject specialists or authorities	70	57.9
Students thesis and dissertation	70	57.9
Indexes	67	55.4

Frequency of Use of Information Sources

The study inquired from the respondents the frequency of use of the different sources, and they selected from a list of the seventeen sources whose frequency of use was measured with very often, often, not often or not at all. Table 3 shows the result. Colleagues or superiors retained the first position with about 79.0% reporting that they consulted them very often. The Internet moved up many ranks ahead of other items in the list reportedly consulted very often by 72.9% of the respondents, followed by in-house memoranda (68.6%) and government opinions (62.9%).

Use of reports from research institutes and researchers came relatively very low in the list, with 58.6% and 55.7% reporting consulting them respectively. Books and monographs (47.2%), committees (47.1%) and research libraries (41.4%), each constituted sources of information used very often by less than half of the policy makers. Learned journals, subject specialists and periodicals also shared this position. Among the sources used the least were indexes (14.3%) and students' theses and dissertations (15.7%). Following this response, the perception about availability and accessibility of the information sources was investigated.

Table 3: Frequency of Consultation of Information Sources (N=121)

Information Sources	Very Often	Often	Not Often
Colleagues or superiors	78.6	4.3	2.9
Internet	72.9	14.3	1.4
In-house memoranda	68.6	18.6	1.4
Government opinions	62.9	15.7	2.9
Newspaper	62.8	24.3	2.9
Report from research Institutes	58.6	12.9	7.1
Researchers	55.7	17.1	2.9
Books and monographs	47.2	22.9	4.3
Committee	47.1	18.6	2.9
Research libraries	41.4	14.3	8.6
Conference proceedings	40.0	20.0	8.6
Learned journals	40.0	11.4	8.6
Subject specialists or authorities	40.0	10.0	7.1
Books of abstract	31.5	20.0	10.0
Students thesis and dissertation	15.7	25.7	20.0
Indexes	14.3	18.6	14.3

Availability and Accessibility of Information Sources

Table 4 revealed that the most available source was newspapers (88.6%), followed by colleagues or superiors (82.9%) and the Internet (81.4%). At least 50% of the respondents reported that government opinions, in-house memoranda, and reports from research institutes, conference proceedings, researchers and learned journals were also available. The least reportedly available sources were books of abstract (30.0%), indexes (28.6%) and students' theses and dissertations (20.0%).

Table 4: Availability of Information Sources (%)

Sources Consulted	Available	Not available	Don't Know	No Response
Newspapers	88.6	11.4	0.0	0.0
Colleagues or superiors	82.9	10.0	1.4	5.7
Internet	81.4	5.7	0.0	12.9
Government opinions (publications)	74.3	25.7	0.0	0.0
In-house memoranda	72.9	5.7	1.4	20.0
Reports from research institutes	71.4	28.6	0.0	0.0
Conference proceedings	61.4	28.6	1.4	8.6
Researchers	52.9	18.6	11.5	17.0
Learned journals	51.4	21.4	11.4	15.8
Committee	48.6	14.3	11.4	25.7
Books and monographs	47.1	2.9	31.4	18.6
Research libraries	47.1	11.4	0.0	41.5
Subject specialists or authorities	44.3	7.1	22.9	25.7
Books of abstract	30.0	38.6	1.4	30.0
Indexes	28.6	30.0	21.2	20.2
Students theses and dissertations	22.9	29.9	25.8	20.0

Exploring further, the perception of the respondents about the accessibility of these information sources was also examined, i.e., whether the respondents considered the sources as accessible to a large extent, low extent or not accessible. Table 5 shows that the sources that were reportedly most accessible to a large extent were colleagues or superiors, followed by newspapers and in-house memoranda (55.7%) each, and then the Internet (54.3%). The least accessible information sources were student theses and dissertations (40.0%), reports from research institutes (37.1%), and government opinions and books of abstract (35.7%) each. Others were learned journals (25.7%), indexes and books\monographs (22.9%) each

Table 5: Accessibility of Information Sources (%) (N=121)

Information sources	Large extent	Low Extent	Not Accessible	Don't Know
Colleagues or superiors	70.0	11.4	2.9	15.7
Newspapers	55.7	34.3	0.0	10.0
In-house memoranda	55.7	12.9	8.6	22.8
Internet	54.3	31.4	2.9	11.4
Government opinions (Publications)	40.0	35.7	2.9	21.4
Committee Reports	37.1	20.0	4.3	38.6
Researchers	35.7	22.9	5.7	35.7
Report from research Institutes	34.3	37.1	8.6	20.0
Conference proceedings	31.4	24.3	21.4	22.9
Subject specialists or authorities	25.7	31.4	10.0	32.9
Books and monographs	24.3	25.7	22.9	27.1
Learned journals	21.4	28.6	25.7	24.3
Research libraries	18.6	45.7	12.9	22.8
Indexes	17.1	27.1	22.9	32.9
Students thesis and dissertation	10.0	22.9	40.0	27.1
Books of abstract	7.1	35.7	15.7	41.5

Constraints on the Use of Science and Technology Information

What are the factors the policy makers perceive as constraints to their use of these information sources? Table 6 shows that the most frequently indicated constraint was inadequate packaging of the information (54.5%), information not being timely (53.7%), inadequate sharing and integration of information (53.7%), and problems of locating (51.3%) and retrieving the information materials (51.1%). The least frequently indicated problem was inadequate understanding of received information (39.7%) and problems with identifying information materials (43.0%). As many as two-thirds of the policy makers reported having problems with the relevance of the S&T reports to their policy needs.

Table 6: Constraints of Use of Scientific Information

	Frequency (Yes)	Percentage
Identifying	52	43.0
Locating	62	51.3
Retrieving	62	51.2
Understanding the information received	48	39.7
Quality of the research	59	48.8
Lack of sharing and integration	65	53.7
Information packaging	66	54.5
Relevance of research findings	55	45.4
Timeliness	65	53.7

Table 7 is the result of a regression analysis showing how each of the demographic characteristics of the respondents predicted the frequency of use of the sources. The table shows that only use of books of abstracts could be significantly predicted by the age of the respondents. The table also shows that neither age nor working experience was a significant predictor of use of any of the sources, although educational qualification predicted the frequency of use of books and monographs, learned journals, colleagues and superiors and Internet.

Table 7: Regression Analysis of Frequency of Use of Information Sources by Age and Working Experience

	Age			*Working Experience*			*Educational Qualification*		
	B	**SE**	**p**	**B**	**SE**	***P***	**B**	**SE**	**p**
Newspaper	0.071	0.065	0.279		0.027	0.325	-0.006	0.024	0.811
Books and monographs	-0.148	0.195	0.450		0.077	0.140	-0.071	0.069	0.303
Conference proceeding	-0.100	0.151	0.513		0.062	0.125	0.149	0.059	0.015
Learned journals	-0.611	0.537	0.263		0.234	0.214	0.578	0.217	0.011
Colleagues and superiors	-0.110	0.109	0.318		0.044	0.296	0.165	0.039	0.000
Government opinion	-0.087	0.095	0.361		0.038	0.645	0.64	0.033	0.059
Students	0.200	0.230	0.391		0.100	0.166	0.066	0.088	0.455
thesis/dissertation	-0.264	0.163	0.115		0.064	0.680	0.189	0.063	0.005
Committee reports	0.082	0.229	0.721		0.099	0.390	0.029	0.065	0.657
Libraries	-0.149	0.255	0.563		0.112	0.992	-0.083	0.080	0.309
Indexes	-0.623	0.270	0.026		0.125	0.297	-0.081	0.078	0.307
Books of abstracts	0.002	0.115	0.988		0.050	0.644	0.044	0.047	0.351
Researchers	-0.253	0.165	0.132		0.064	0.826	0.130	0.054	0.021
Books and monographs	0.066	0.106	0.534		0.044	0.343	0.008	0.035	0.826
Research reports	-0.110	0.215	0.613		0.094	0.973	0.004	0.064	0.949
Subject specialists	-0.051	0.087	0.561		0.036	0.128	0.134	0.034	0.000
Internet									

Table 8 provides further information on how the reported use of each of the information sources by the policy makers is predicted by the policy makers' perception of the availability or accessibility of the sources. The table shows that there is a significant relationship among the perceived availability of newspapers, colleagues, research libraries and research reports from research institutes and use of the sources ($p < 0.025$). Furthermore, the accessibility of almost all of the seventeen sources had significant relationships with their frequencies of use. The exceptions were books and monographs, colleagues/superiors, research libraries, indexes, books of abstract and reports from research institutes.

Table 8: Availability and Accessibility of Sources as Predictors of the Use of the Sources(N=121)

Sources	**Availability**			**Accessibility**		
	B	**Se**	**P**	**B**	**Se**	**P**
Newspapers	1.409	0.606	0.024	1.213	0.160	0.000
Books and monographs	0.246	0.461	0.597	0.351	0.286	0.227
Conference proceedings	0.314	0.270	0.253	0.575	0.156	0.001
Learned journals	4.495E-2	0.065	0.492	0.680	0.145	0.000
Colleagues or superiors	1.4	0.29	0.00	4.545E	0.1	0.816
Students thesis and dissertation	-1.128E	0.375	0.976	0.835	0.259	0.003
Government opinions (p)	1.590E	0.373	0.966	0.849	0.163	0.000
Committee	-0.298	0.200	0.145	1.556	0.141	0.000
In-house memoranda	-0.115	0.363	0.725	0.757	0.202	0.000
Research libraries	2.021	0.294	0.000	-0.194	0.234	0.413
Indexes	1.427	0.337	0.000	5.4E-2	0.215	0.803
Books of abstract	-0.275	0.316	0.391	0.648	0.281	0.028
Report from research institutes	1.357	0.416	0.002	0.376	0.190	0.053
Subject specialists or authorities	0.346	0.299	0.256	0.821	0.184	0.000
Researchers	-0.118	0.327	0.720	0.965	0.158	0.000
Internet	1.121	0.333	0.043	0.102	0.113	0.001

Discussion

Colleagues, superiors and personal contact sources were reportedly used more than other sources, a finding that is in consonance with Aiyepeku (1983). This is probably because policy making often requires information that is easily available and accessible, as well as information that may not require further processing or validation to use. Information reported in academic sources is not as heavily used as personal contacts, a finding that is popular in the literature (Oh, 1996). Internet sources are also not often used for policy making purposes, probably due to its information authentication weaknesses. Moreover, it might be speculated that the Internet might have a low policy-relevant content from Nigeria, a situation that could make the resource less useful to the policy makers. In the Nigerian public service, much of the policy-relevant content is created or stored offline and Web-driven networks are not popular. Meta sources such as indexes and books of abstract, which refer the information seeker to other information sources that might either not be available or not be accessible, are also not very much used. Mcharazo (2008) observed that meta sources sometimes merely serve window shopping purposes, and that targeted users might not have the requisite skill to use them. Practically, meta resources are not popular information resources in Nigeria, and the observed poor state of libraries in the ministries and poor collection management and literature control at the national level support this result. Existing indexes might be pointing to information materials that do not exist in the local libraries.

The heavy reliance on colleagues as sources of information by policy makers is understandable. A director in the Ministry of Science and Technology said during an interview that those who had worked in the ministry for long periods, or served in sensitive positions, or have access to privileged connections are crucial in getting the work done, and that the younger policy makers must often depend on the wealth of knowledge of these senior ones. However, it is not unexpected that personal contacts could provide uncritical and non-verified information, although they are easy to access, available, and yield ready-to-use information that might not require further processing before use. Reliance on personal contacts might also highlight the possible strong influence of some influential individuals in government, business or politics in matters of public policy.

The findings of the study show that the research institutes supervised by the MS&T do not seem to constitute major sources of information for the policy makers. A director in NASENI observed that policy makers prefer research information developed from the projects they commissioned themselves, which may be carried out by their own staff or in collaboration with personal contacts in the universities and research institutes. He also observed that research scientists often embark upon research not necessarily because they want to produce information relevant for policy making, but rather because the nature of their job requires that they do research. Even when the research results from the research institutes and universities are very relevant to an issue of national concern, such results might not be pertinent to national priorities at the time they are published. He noted further that most research reports also do not incorporate the wide range of social, legal, institutional and economic concerns which might be critical in integrating research findings into public policies. The reports are often too technical or quantitative, and are usually evaluated by academics and not by policy makers. All these factors, which provide support for two-communities hypothesis (Caplan, 1979), likely explained the very low use of the research from research institutes and universities by the policy makers.

The frequency of use of newspapers in this study is lower than expected. Newspaper content could rightly be considered a reflection of the pulse of the public and other stakeholders and interest groups and could be a great source of awareness information for policy makers. Hanney and Packwood (2000) have suggested that newspapers should report latest scientific findings from both local and global research before they could be good sources of policy information. Further studies are required to examine the relevance of the content of Nigerian newspapers to public policy. For instance, do they contain syntheses of scientific findings from universities and research institutes in Nigeria?

The study also found that the Internet is readily available and is frequently used in the ministry. However, the policy makers reported consulting Internet-based sources less than they did personal contacts. This might imply that the Internet is not necessarily being used to search for policy making information, but for other purposes. In the recent years, there has been some concern about the need to monitor the use of Internet in the workplace to avoid the possible negative effect of the misuse of the Internet on productivity (Wagner, 2008). Further studies are required to examine the purposes that the Internet serves for public servants, given the increasing implementation of the infrastructure in Nigerian public organisations.

Finally, of all the information sources, committee reports, books and monographs, research libraries, subject specialists or authorities, books of abstract, indexes, and students' theses and dissertations were the least reportedly available. This is related to Ochai's (1987) study which reported on the ailing state and low level of use of special libraries in the country. Nwagwu (2006) has also reported a lack of bibliographic control services in the country, highlighting the adverse consequences of this on access to information.

Conclusion and Recommendations

The information sources used by public policy makers in the science and technology are wide ranging, although information from institutional and personal contact sources appear to be used more often than information from other sources. Information from scientific research in research institutes and universities is in low use. Policy makers reported inadequate packaging, lack of information sharing and integration, and difficulty in locating and retrieving information items as the most very frequently experienced serious constraints to their use of S&T information. These findings suggest that policy makers in the S&T sector have some ideas about the information needed to coordinate the sector, but have difficulty in finding the most appropriate information materials for policy making purposes. These findings also underscore the need for meta information sources, such as indexes and books of abstract, as well as access to adequately packaged and relevant information for the policy makers.

The FMS&T has already formulated a policy on linkage between stakeholders and information producers in the sector which, if implemented successfully, will help solve the problem of identifying and locating information. The findings of this study also highlight the need for institutional repositories in the ministry, research institutes and universities, which can be networked and made accessible to policy makers and other users. Also needed are joint conferences and workshops that bring together and stimulate greater interactions among stakeholders in the sector.

The National Planning Commission also has a role to play in collating research studies from different ministries periodically, identifying suitable research components, and together with the relevant ministries, design mechanisms for joint implementation. There is also need for increased access to computers and the Internet across the rank and file of the officers in the Ministry in order to increase options for information searching and dissemination among policy making members of staff.

Finally, as a follow up on this study, more studies are required to establish, among others, the potential value of each of the information sources for policy making purposes in the sector. In particular, there is a clear need for studies that investigate the nature of research activities that go on in the research institutes as well as strategies to synchronise activities within the information needs of policy makers. In the same policy direction,an evaluative content analysis of Nigerian newspapers might provide useful insight on the relevance, quality and authoritativeness of their contents for science and technology policy making purposes.

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