

# THE IMPACT OF INFORMATION ON RESEARCH AND DEVELOPMENT ACTIVITIES OF NUCLEAR SCIENTISTS IN GHANA

---

**E. A. Agyeman** and **C. O. Kisiedu**,

Librarian, Ghana Atomic Energy Commission, Accra Ghana  
Department of Information Studies, University of Ghana, Legon

## Abstract

*This paper considers the relationship between information use and the professional development of nuclear scientists in Ghana. The assumption is that, frequent use of library and information services results in higher productivity and achievement. Consequently, a national survey of nuclear scientists was conducted using the questionnaire method. The results indicate that information use leads to increase in the volume and quality of work output of nuclear scientists. Evidence is also found to support the claim that information use enhances contributions of scientists to their organizations.*

KEYWORDS: INFORMATION USE, PROFESSIONAL DEVELOPMENT, NUCLEAR SCIENTISTS, GHANA

## Introduction

It is widely accepted that scientific and technological information plays a vital role in the socio-economic development of all nations, especially those of the third world. Unfortunately information is accorded a low ranking when it comes to the allocation of resources by decision-makers (Mchombu, 1992). The rationale for this investigation is the need to provide policy and decision-makers in the nuclear sector with empirical evidence that information is crucial to the work of nuclear scientists. Such evidence should ensure adequate and sustained funding for library and information services in developing countries.

A survey of the literature shows a positive correlation between information use and the professional development of scientists and other professionals. However, most of these studies were undertaken in the corporate, energy and health sectors in the United States of America and the United Kingdom (Marshall, 1993; Smith, Winterman and Abell, 1998; King, 1982, 1985; Marshall, 1992; King, 1987; Parsons, 1994; Urquhart and Hepworth, 1995; Urquhart and Davies, 1997; Wood and Wright, 1998).

In the field of nuclear science and technology, there is a dearth of literature on the value of nuclear information on research and development. Past work on nuclear information use have generally focused on the establishment, development and the operation of the International Nuclear Information System (INIS) in various countries (Bree, 1975; Zheludev and Groenewegen, 1978; Breiffeld, 1979; Stanik, 1979; Zamora, 1986 and Pecinka, 1997). However, the few empirical studies undertaken have been limited to information use by nuclear scientists as well as user satisfaction with INIS output products and services (Komatsubara and Shimizu, 1978; Stanik, 1979)

The only previous study in the nuclear sector identified that is directly related to this study is that of Amaral (1998) who evaluated the impact of document delivery and selective dissemination services derived from the INIS database in Brazil. Therefore, it will be worthwhile investigating the value of information to nuclear scientists from an African perspective.

The study tried to answer the following questions:

1. Why do nuclear scientists use nuclear information in Ghana?
2. Where do nuclear scientists look for nuclear information in Ghana?
3. What is the relationship between information use and the productivity of Ghanaian nuclear scientists; and
4. What is the relationship between information use and the achievements of Ghanaian nuclear scientists?

## **Methodology**

Subjects for the survey were scientists and engineers, university lecturers and post-graduate students involved in nuclear research and using nuclear information in Ghana. The total population was 100 nuclear scientists. Table 1 below provides an overview of the background characteristics of the subjects. Majority of the subjects are research scientists (75%). Majority of them (85%) are males and relatively young, with about 70% below 51 years. The level of education of the subjects is generally high, with 90% of them holding a second degree. Over a quarter of them (26%) are engaged in the agricultural sector of the economy. There was no sampling considering the relatively small size of the population. Data were collected in 2004 using a semi-structured questionnaire with a response rate of 92 percent.

The analytical framework proposed by Griffiths and King (1993) and later by the International Development Research Centre (IDRC) (Stone, 1993; Menou, 1993) on impact of information guided this study. Impact of information related "Usage" and "Outcomes" variables. Usage was considered in terms of reasons for use and frequency of use of information. Outcomes were determined by the increase in productivity and achievements of the nuclear scientists. Since productivity and achievements are difficult to determine, indicators were used to measure

them. In this work, productivity was assessed in terms of the number of publications, formal oral presentations and number of consultations. Achievement was assessed in terms of promotions earned, awards, and membership of special committees or projects. Such a technique was used by Griffiths and King (1993).

**Table 1: Background Characteristics of the Nuclear Scientists**

Characteristic	Male		Female		Total N = 92	
	No.	%	No.	%	No.	%
<b>AGE GROUP</b>						
< 30	6	7.7	2	14.3	8	8.7
30 - 50	48	61.5	9	64.3	57	62.0
51 - 60	17	21.8	3	21.4	20	7.6
> 60	7	9.0	0	0.0	7	7.6
<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>92</b>	<b>100.0</b>
<b>Profession</b>						
Research Scientist	57	73.0	12	86.0	69	75.0
Engineer	1	1.3	0	0.0	1	1.1
Student	3	3.9	0	0.0	1	1.1
University Lecturer	15	19.2	1	7.0	16	16.3
Retired	1	1.1	0	0.0	1	1.1
Consultant	1	1.3	0	0.0	1	1.1
Radiation Oncologist	0	0.0	1	7.0	1	1.1
<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>92</b>	<b>100.0</b>
<b>QUALIFICATION</b>						
B.Sc.	6	7.7	3	21.4	9	9.8
Msc./M Phil.	41	52.6	7	50.0	48	52.2
PhD.	31	39.7	4	28.6	35	38.0
<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>92</b>	<b>100.0</b>
<b>SECTOR OF ACTIVITY</b>						
Agriculture	17	21.7	7	46.7	24	26.1
Energy	16	20.5	2	13.3	18	19.6
Health	14	17.9	2	20.0	16	17.4
Industry	17	21.7	1	6.7	18	19.6
Science/Tech.	7	8.9	0	6.7	8	8.7
Environment	5	6.4	1	0.0	5	5.4
Education	2	2.5	1	6.7	3	3.3
<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>14</b>	<b>100.0</b>	<b>92</b>	<b>100.0</b>

## **Results**

### **Reasons for using Nuclear Information**

Griffiths and King (1993) believe that one indicator of the value of information is the purpose for seeking it. Therefore, in analysing the value of information, it is necessary to know the factors that motivate people to use information. Consequently, the respondents were asked to recall the reason why they sought information on one occasion recently. They assigned three main reasons. These are: research (55%), publication (20%) and teaching (12%). The figures reflect the nature of the study population; majority being research scientists and university lecturers whose work involve research, teaching and publication. Indeed the latter is crucial to their career advancement.

### **Sources of Nuclear Information**

The respondents were asked to indicate information sources they frequently consulted. The most frequently used source mentioned was reference book or handbook (25%), followed by colleagues (22%) and organisational libraries (22%). Other sources of information mentioned by respondents were their personal resources and departmental files (15%), the Internet (4%) and others (12%) comprising libraries such as the Ghana Medical School Library, the Noguchi Medical Research Institute in Ghana, the International Atomic Energy Agency in Austria, university libraries, the Ghana Atomic Energy Commission Library, the Centre for Agriculture and Biosciences International (CABI) Library Service.

With regard to reasons for preference for the afore-mentioned sources of information, 82% indicated that these were readily accessible sources; 15% said information from these sources could be accessed at no cost, while 3% considered the source as being more reliable. From the results, one can deduce that accessibility of information is very important to respondents. This suggests that, perhaps the less frequently used sources such as the Internet would be utilised more if they were made available in the offices or laboratories of nuclear scientists. A look at the infrastructure base of nuclear related institutions and universities in Ghana indicate low accessibility of such facilities.

### **The relationship between Information Use and Productivity**

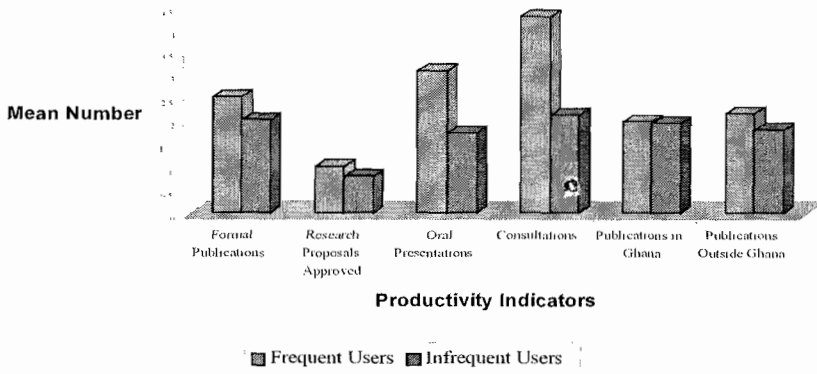
Several factors can be used to measure the productivity of scientists among which are the number of publications and citations, approved research proposals and grants, consultations and oral presentations (Griffiths and King, 1993). Therefore to assess the relationship between information use and the productivity of respondents, frequency of library use was quantified and used as a proxy of the time spent in performing the information related activities. Thus, frequency of library use served as input, which was cross-tabulated with the identified productivity indicators that served as the output of the respondents, on the assumption that, those who use the library frequently gain more in terms of their

professional development than less frequent library users. In this work, productivity indicators are divided into two. The first set of indicators comprises mainly written or paper-based outputs such as technical reports written, research proposals approved, journal articles published within and outside Ghana. The second set is related to some form of expression or oral presentation (Oral presentations and advice/consultations given). Table 2 and Fig.1 below show the relationship between frequency of use of library and information services and some productivity indicators.

**Table 2. Relationship between frequency of Library Use and the Productivity of respondents**

INDICATORS	Frequent Library Users N=65		Infrequent Library Users N=27	
	Mean	Standard Deviation	Mean	Standard Deviation
Productivity				
Journal Articles in Ghana	2.000	1.987	1.951	1.975
Journal Articles Outside Ghana	2.190	2.861	1.817	3.076
Formal Publications	2.542	2.836	2.042	2.458
Research Proposals Approved	1.034	1.189	0.792	0.833
Oral Presentations	3.119	3.922	1.750	1.359
Consultations / Advice	4.288	9.248	2.125	2.740

**FIG. 1. Relationship between frequency of Library Use and the Productivity of respondents**



No doubt, frequency of library use has effect on almost all the productivity indicators of users. The mean values recorded for frequent library users were higher, compared to the infrequent library users. The highest mean value was recorded for consultations or advice (4.288 for frequent library users against 2.125 for infrequent library users), followed by oral presentations (3.119 for frequent users against 1.750 for infrequent users), and formal publications (2.542 for frequent users and 2.042 for infrequent users). The least mean value was observed for research proposals approved (1.034 for frequent users against 0.792 for infrequent users). Thus, frequency of library and information services use has profound effects on almost all the productivity indicators especially the oral productivity indicators. It is, therefore, apparent that the most direct impact of library use has to do with some form of expression or oral presentation, perhaps with written or paper-based productivity impacts becoming more visible in the medium or long-term. It can generally be concluded that frequent library and information services users are more likely to be productive than infrequent users, as was also observed by Griffiths and King (1993).

### The relationship between Information Use and Achievement

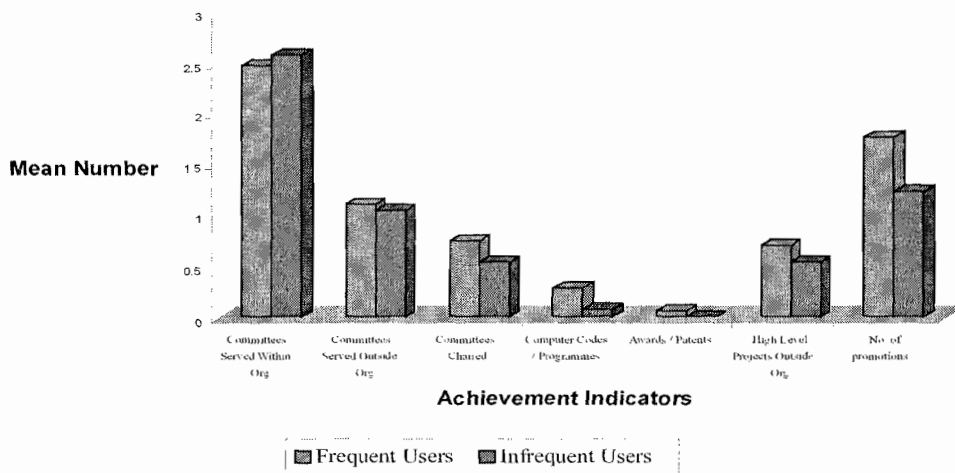
The following achievement indicators were used to assess the value of information: committees served on within and outside the parent organization; computer codes or programmes written; patents and technical awards received; and promotions earned within the last ten years. The impact of library use on achievements of respondents was less apparent (see fig. 2), compared to impact on productivity (see fig.1).

**Table 3. Relationship between frequency of Library Use and the Achievements of respondents**

INDICATORS	Frequent Library Users		Infrequent Library Users	
	Mean	Standard Deviation	Mean	Standard Deviation
Achievements				
Committees Served in Organisations	2.475	2.438	2.583	1.767
Committees served Outside Organisations	1.102	1.435	1.042	1.546
Committees Chaired	0.746	1.397	0.542	0.721
Computer Codes / Programmes Written	0.288	0.872	0.083	0.408
Awards / Patents	0.070	0.320	0.000	0.000
High Level Committees/Projects	0.695	1.004	0.542	0.932
Promotions	1.76	7.456	1.24	1.123

However, frequency of library use also affected the achievement indicators considered in this work, such as the number of promotions obtained within the last 10 years, number of high-level projects that respondents have participated in outside their organization and the number of committees chaired. The mean number of awards/patents produced for frequent and infrequent library users are 0.07 and 0.00 respectively. The trend was similar for the number of computer codes/programmes written, where frequent and infrequent users produced 0.288 and 0.083 codes/programmes respectively. Though there are clear differences between the achievements of frequent and infrequent library users with respect to number of awards/patents and computer codes/programmes, the mean number per respondent is very low. Therefore, any attempt to attribute these achievements exclusively to library use may not be appropriate.

**FIG. 2. Relationship between frequency of library use and some achievement indicators**



## Conclusion

This study focuses on the impact of information on the research and development activities of nuclear scientists in Ghana. Before tackling the actual benefits of information, the study addressed among others, respondents' reasons for using information, their sources of information and the effects of use of information.

The results show that in Ghana, nuclear scientists seek information mainly for research, publication and teaching. Most of the nuclear scientists seem to prefer information sources that are readily available and free of charge such as reference materials and handbooks, colleagues, organisational libraries, personal resources and departmental files. Some nuclear scientists do not use library services mainly because the libraries lack current, specialised journals and books.

The main problems nuclear scientists face with regard to information are lack of access to the Internet, lack of current journals and books and poorly equipped libraries.

An important finding of this survey is that frequent library use has effects on the productivity as well as the achievement of nuclear scientists in terms of their research output and their contribution to the work of their organisation.

It is hoped that, the results of this study will convince policy and decision-makers in the nuclear sector that library and information services play a significant role in the research process, hence the need to pay more attention to information, if we are to fully enjoy the benefits of nuclear science and technology in this part of the world.

## References

- Amaral, S. (1998) **Impact of the marketing activities related to services offered at the Nuclear Information Centre of the Brazilian National Nuclear Energy Commission**, PhD Thesis, Brasilia Univ.(Unpublished)
- Bree, R. (1975) Significance and influence of information in the field of nuclear engineering. In: **Nuclear energy and international politics. On the peaceful use of nuclear energy**, pp. 377-387
- Breitfeld, B. (1979) **INIS: International Nuclear Information System, Vol. 22, No. 5**, pp. 170- 172.
- Griffiths, J. M., King, D.W. (1993). **Special libraries: Increasing the information edge**. Washington, D.C. : Special Libraries Association
- INTERNATIONAL ATOMIC ENERGY AGENCY. (1987). Covering the world's nuclear literature, **IAEA Bulletin**, Vol. 29, No. 3, pp. 65-66.
- King, D. N., (1987) The contribution of hospital library information services to clinical care: A study in eight hospitals, **Bulletin of the Medical Library Association**, Vol 75, No. 4, pp. 291-301.
- King, D. W. et al. (1985) **A study of the value of information and the effect on value of intermediary organizations, timeliness of services & products, and comprehensiveness of the EDB**. United States Department of Energy, Office of Scientific and Technical Information, Oak Ridge Laboratory, Tennessee (summary).
- King, D. W., et al. (1985) **The value of the Energy Database**. United States Department of Energy, Office of Scientific and Technical Information, Oak Ridge Laboratory, Tennessee (1982) (summary).
- Komatsubara, Y.; Shimizu, A. (1978) **INIS SDI system at JAERI, Joho-Kanri-Japan**, Vol.21 No. 8, pp. 573-585.
- Marshall, J. G. (1992) The impact of the hospital library on clinical decision-making: The Rochester study, **Bulletin of the Medical Library Association**, Vol. 80 No. 2, pp. 169-78.



- Marshall, J.G. (1993). **The impact of special libraries on corporate decision-making**, Washington, D.C.: Special Libraries Association
- McConnel, P. (ed). (1995). Measuring the impact of information on Development: Overview of an international research program. In: P. McConnel, (ed). **Making a difference. Measuring the impact of information on development: Proceedings of a workshop held in Ottawa, Canada, 10-12 July 1995**. Ottawa: IDRC.
- Mchombu, Kingo (1995) Impact of information on rural development: background, methodology and progress. In: P. McConnel, (ed). **Making a difference. Measuring the impact of information on development. Proceedings of a workshop held in Ottawa, Canada, 10 – 12 July 1995**. Ottawa : IDRC.
- Menou, M.J. (Ed.), (1993). **Measuring the impact of information on development**, Ottawa.: IDRC
- Parsons, D. F., The impact of information technology on health care: A practitioner's perspective, **Telematics and Informatics**, Vol. 11, No. 2, pp. 127-145.
- Pecinka, K., (1997) Nuclear Information Centre, **Uechnicka-Knihova-Czechoslovakia**, Vol. 21, No.1, pp. 18-23.
- Smith, C., Winterman, V., Abell, A. (1998) Impact of information on corporate decision-making in the insurance sector, **Library Management**, Vol. 19, No. 3, pp. 154-173.
- Stanik, Z. (1979). **INIS user needs survey: Evaluation report**, Vienna: IAEA.
- Stanik, Z. (1979) INIS: International Nuclear Information System, **Ceskoslovakia Informatica** Vol. 21 No. 3, pp. 79 – 87.
- Stone, M.B. (1993) Assessment indicators and the impact of information on development, **Canadian Journal of Information and Library Science**, Vol. 18, No. 4, pp. 50-64.
- Urquhart, C., Davies, R. (1997) EVINCE: The value of information in developing nursing Knowledge and competence, **Health Libraries Review**, Vol. 14 No. 2, pp. 61-72.
- Urquhart, C., Hepworth, J. (1995). The value to clinical decision making of information supplied by NHS library and information services. **British Library R&D Report 6205** London: BLR&DD
- Wood, F., Wright, P. (1998). The impact of information on clinical decision-making by general medical practitioners [http://Information.net/ir/2\\_1/paper11.htm](http://Information.net/ir/2_1/paper11.htm).
- Zamora, P., Ibarra, O. (1986). INIS and its impact on nuclear power development, **International Atomic Energy Agency Bulletin**, Vol 28, No. 4, pp. 14-16.
- Zheludev, I .S., Groenewegen, H.W. (1978) INIS: The International Nuclear Information System, **International Atomic Energy Agency Bulletin**, Vol. 20, No. 4, pp. 7-17.