LIBRARY RESOURCES AND SERVICES AND PUBLICATION PRODUCTIVITY

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ABSTRACT

Present the results of a study that compares the perceived adequacy of library resources for research, the formal channels found to be useful in providing information needed for research, the methods used to keep abreast with current research literature, the problems faced when obtaining information required for research with publication productivity of 83 academic engineers and 239 academic scientists from the University of Malaya and National University of Malaysia. Respondents' views were sought on how libraries can improve their services to support research activities. The feedback from interviewing 56 academic scientists and engineers about the results obtained from the survey is also presented. The services that correlate positively are inter-library loans and help from library staff in searching online databases. The sources, which correlate with high total publication scores are research reports, conference proceedings and library accession lists. Scientists who used varied methods to keep themselves up-to-date with current research literature are highly productive. The highly productive scientists indicated the following situations as problematic for them when searching information needed for research: no help in finding information, not knowing where to look for information, not finding relevant information, receiving information too late, and not knowing how to choose relevant databases. This indicates that the productive scientists do need help in obtaining information. The respondents also gave useful suggestions on how library services could be improved to support research effectively.

INTRODUCTION

There is an assumed inter-dependence between information collections in libraries and the services of the university and the faculty, which are both the producers and consumers of that information. The outputs of research, such as the publishing activity of academics or the number of doctorates produced, have been compared with certain key library-related variables. These include the total number of volumes held by the university libraries, the libraries' total expenditures, materials expenditure and the number of professional staff

employed (Budd, 1995). Since these variables benefit the academic staff, they are considered as inputs in the research process. Budd compared the above library variables with the total number of doctorates produced by selected American universities in 1992. Data from the 1991-1992 Association of Research Libraries statistics were used. The rank order correlation was employed to make comparisons. The results indicated that the total raw publication counts of the universities were related to the number of volumes held in libraries (.678); total library expenditure (.803); total material expenditure (.717); and total number of professional staff employed (.746). Budd, however, cautioned about the danger of taking the results too seriously, since there is no evidence that any causal relationship exist between the variables. In fact, an increase in total number of doctorates may be the result of other inputs such as better-qualified research students or research active professors who are well funded.

When an academic institution boasts of its ability to provide academic excellence, the quality and extensiveness of its library service and resources to support teaching, learning and research, are among the situations often highlighted. It is, however, difficult to indicate how the library actually helps to further student, courses and academic progress. The exact nature of the relationship between usage of libraries and academic performance is not clear. Previous studies in the 1970s have indicated attempts by major research libraries to analyse the extent to which their collection and services supported research. Among the methods used were monitoring circulation patterns, user population, academic staff's time expended on the various library activities, and library space utilization. It was assumed that academic staff make heavier use of library resources than undergraduate students (SPEC kit 64, 1980). Soper (1976) observed that academic researchers used documents, which were most convenient, and therefore, gave high rating to the use of their personal collection. Hernon (1979) reported that the social scientists made heavy use of research and technical reports. White (1975) revealed that academic economists needed to gather more information sources during the "methodology stage" (second stage) rather than the "problem stage" (first stage) or "presentation stage" (third stage) of research. Baughman (1983) also observed that academics reported heaviest use of library resources during the "project research stage" not at the "proposal development stage". The former stage was augmented with the use of other research libraries, purchasing items that were important and taking advantage of the inter-library loan services. This dependence on neighbouring research collections and inter-library loans was also indicated by Startup (1979) who interviewed academics from four universities in Wales. Startup observed that academics in the arts discipline found that their university library could not meet their research needs adequately, and proposed that good inter-library loan services would make-up for these deficiencies. Studies on information usage behaviour of engineers indicated that they used bibliographic databases mainly

to define or redefine research problems (Shuchman, 1981; Kaufman, 1983; Pinelli, Kennedy and Barclay, 1990). In an Australian study, Hiscock (1986) found that previous experience in the use of library bibliographic tools and the catalogue helped undergraduates to obtain relevant texts that have not been recommended by their lecturers. These factors bear significant relationship to the students' academic performances. It is unclear, however, whether this relationship also exists for academics who are adept at using the library services and sources for their research information needs.

Previous studies have highlighted the types of material academics used for their research information needs. Lonnqvist (1990), studied the information seeking behaviour of scholars in the humanities, and observed that journals were used to supply research news, present new literature, read book reviews and obtain related articles needed in the chaining process. Lorenz (1973) found that users of the University of Nebraska library perceived a high need for photocopying services in the periodical Library. Academics generally perceived the library services as essential but often admitted that they used them infrequently. This low usage could be due to ignorance, as academics might be aware of only half of the services actually available.

The use of libraries is foreseen to change in future, especially in the provision of access to online databases, both bibliographic and full-text, right to the academicians' desks. There are evidences, which indicate that academics are readily using online databases made available by their libraries. Curtis, Weller and Hurd (1997) found that academic staff preferred to access electronic databases from their offices to doing so from the library. Zhang (1998) surveyed the use of electronic resources by academic staff at Rollins College in the United States and observed that 69% of academics sampled used the online catalogue, 53% used UMI's *ProQuest* direct online databases, 35% used the OCLC *First Search* package and 35% used the *ProQuest* CD-ROM databases made available through the campus network. Bonzi (1992) indicated that access to databases and computer support facilitated academic staff's research productivity. Babu and Singh (1998) observed that eminent Indian scientists regarded access to the relevant literature and adequate library resources as important, in order to keep abreast with current literature in their research areas.

Published literature in library and information science revealed that numerous studies have been conducted on academic's use of library resources and services to enhance research performance. Very few studies however, have investigated how library use has improved academic performance and specifically how it has contributed to faculty publication productivity. A number of early studies indicated that library use did not influence the work of various professional groups (Friendlander, 1973; Nicholar, Erbach and Poalman, 1987). Contrary to that, Baldwin and Rice (1997) found that heavier library use was related to work

productivity among security analysts. Hughes (1999) also found a correlation between access to research resources, supportive telecommunication environment and information professionals with high academic publishing productivity. Generally, most scholars who are involved in studies on academic research performances have not considered resource support and availability, as possible variables. This paper presents the results of a study that compares the perceived adequacy of library resources for research as well as the type of resources used, with publication productivity of selected Malaysian academic engineers and scientists.

METHODS

The study uses two methods to collect data. The survey instrument provides information related to library services or resources: (a) perceived adequacy of library materials for research needs; (b) ratings on library services found to be useful in connection with research; (c) the formal channels used in providing information needed for research; (d) the methods used to keep abreast of current research literature; (e) the problems faced when obtaining information required for research; and (e) the ways that library services could be improved to fulfill research needs. The sample population comprises 322 academic staff members from two universities, National University of Malaysia (UKM) and University of Malaya (UM). Of the 322 academic staff, 83 are academic engineers from the departments of civil, chemical, electrical and mechanical engineering, and 239 scientists from the departments of botany, chemistry, genetics, geology, mathematics, physics, and zoology. The engineers comprised 66.4% (83 out of 125) and the scientists 76.8% (239 out of 311) of total population from the engineering and science faculties at the two universities. The second approach uses the interview method where 56 selected productive academics were asked regarding their opinion on how libraries contribute to research productivity. In this study, total publication is the simplest measure of output, and is used as an indication of research productivity. Total publication is taken as results, which appear in print and are usually embodied in research communications in the formal sense. It comprises research papers and reports, books, journal article, papers presented at conferences, sections of a book, consultation report, translations, edited works, patents, standards and preprints. The publications used in this study were published between 1990 and 1995. For the purpose of cross-tabulations, total publication counts were collapsed into 5 categories, low (1-5), minimum (6-10), average (11-20), high (21-30) and very high (equals or more than 31).

RESULTS AND DISCUSSION

(a) Adequacy of Library Resources and Research Productivity
Respondents' ratings on the adequacy of library resources to support their research are given in Table 1. The mean scores obtained by both groups indicate

that between 46-55% of the respondents felt their library resources to be fairly adequate for their research needs. Among the scientists, only one indicated not using the library and six regarded that their library resources as not adequate at all times when they needed them.

Table 1: Ratings on the Adequacy of Library Resources

Adequacy of library resources	Adequacy of library resources			
	Engineers		Scientists	
	Count	%	Count	%
Never used/Inadequate	15	18.1%	7	2.9%
Fairly adequate	46	55.4%	169	70.7%
Adequate/V. Adequate	22	26.5%	63	26.4%
Total	83	100.0%	239	100.0%

Mean=2.08   Mean=2.23

Cross-tabulating the ratings on the adequacy of library resources for research needs with respondents' total publication scores indicates no relationship for both academic groups.

(b) Ratings on the Different Types of Library Services
All respondents rated 7 types of services based on a 5-point scale (1=not used to 5=very useful) (Table 2).

Table 2: Ratings on the Usefulness of Library Services for Research Information

ENGINEERS	Useful, V. useful			Fairly useful		Not useful, not used			
Library services	Freq.	%	Ranked useful	Freq.	%	Freq.	%	Ranked not useful	Mean
Photocopying services	60	72.3%	1	17	20.5%	6	7.2%	7	3.78
Book loan	52	62.7%	2	22	26.5%	9	10.8%	6	3.64
Book reservation	34	41.0%	3	35	42.2%	14	16.8%	5	3.24
Inter-library loans	29	34.0%	4	19	22.9%	35	42.1%	4	2.70
Library staff search online db	15	18.0%	5	30	36.0%	38	46.0%	3	2.35
Library staff help locate sources	18	21.7%	6	24	28.9%	41	49.6%	2	2.31
Borrowing periodicals	26	31.0%	7	9	11.0%	48	58.0%	1	2.29
SCIENTISTS	Useful, V.useful			Fairly useful		Not useful, not used			
Library services	Freq.	%	Ranked useful	Freq.	%	Freq.	%	Ranked not useful	Mean
Book loan	229	95.8%	1	64	26.8%	10	4.2%	6	3.91
Photocopying	230	96.3%	2	74	31.0%	9	3.8%	7	3.86
Inter-library loans	111	46.5%	3	93	38.9%	35	14.7%	5	3.38
Book reservations	100	41.8%	4	102	42.7%	37	15.5%	4	3.27
Library staff search online db	80	33.5%	5	61	25.5%	98	41.0%	2	2.74
Library staff help locate sources	75	31.4%	6	86	36.0%	78	32.6%	3	2.91
Borrowing periodicals	2	.8%	7	2	.8%	235	98.3%	1	1.44

The services can be grouped into two types; loans (which comprise book loans, inter-library loans, book reservations, periodicals loans), and search and retrieval (includes photocopying, help with database searching, help with locating

resources). On the whole, the distribution of mean scores does not show great variations. A higher number of academic staff from both groups rated photocopying services, book loan services, book reservations, and inter-library loan services as "fairly useful". The services offered by library staff have been found to be fairly useful or not fully used. The low ratings given provide some indications to the libraries from both institutions on the need to promote higher usage of the services available.

Ratings on "inter-library loans" correlate with total publication scores for academic engineers (*p*=.224, sig.<0.05) and scientists (*p*=.140, sig.<0.05), where more than half of the high /very high publishers rated this service as useful or very useful. The highly productive academic scientists also tended to rate library staff's help in searching online databases as useful or very useful (*p*=.140, sig.<0.05).

A number of relationships were observed when the ratings on the seven types of library services were cross-tabulated with selected personal and departmental variables. For the academic engineers:

(i) The percentage of academic engineers from UKM and UM who never sought professional staff's help was quite high. However, a higher proportion of respondents from UM (31.8%) indicated seeking professional librarians' help as useful/very useful for their research compared to those from UKM (10.3%)) (x^2= 8.170, df.2, p<0.017).

(ii) The mechanical engineers constituted the largest group who considered book loans (x^2=14.010, df.6, p<0.030) and book reservations (x^2=19.447, df.6, p<0.003) as useful or very useful. The civil engineers were the largest group that never used or do not find the above two services useful.

For the academic scientists:

(i) More respondents from UM (74.8%) rated photocopying services as useful/very useful than those from UKM (53.7%) (p<0.01).

(ii) There were differences in the ratings among the seven science departments on the usefulness of book loan services, book reservation, inter-library loan services, library staff's help to locate sources needed for research, and the usefulness of the library staff's help with online database searches. A total of 98 respondents indicated that they never sought help from the library staff or found their help "not useful" and most of them were from the departments of chemistry, geology or zoology.

(iii) Academic scientists who are older (41 years or above) are more likely to rate professional help in locating resources for research needs as either useful or very useful (*p*=.221, sig.<0.01). The younger respondents

(aged 40 or below) are more likely to not approach library staff for help or to find their help useful. This could be an indication that the older academic staff are more confident and aware of their rights to library facilities and services, making them more likely to approach professional librarians when they need help. The more experienced lecturers (11 or more years) indicated book loan services, as either not useful or fairly useful for their research needs (p=-.173, sig.<0.01), while the contrary was indicated by those with 10 or less years of working experience. A positive relationship is indicated between those with 11 or more years of experience with inter-library loan services (p=.201, sig.<0.01), library staff's help in locating sources (p=.163, sig.<0.05), and library staff's help in searching online databases (p=.163, sig.<0.05). The younger respondents (with 10 or less number of years of working experience) are more likely to "never use" or find these services not useful. These situations indicate that the more experienced academic scientists are more likely to utilise their library resources and services. Libraries, therefore, need to make known to younger academics, who have fewer years of working experience and who may not be aware of the availability of professional help in obtaining needed information for research.

(iv)   The associate professors, and more so the professors, were very satisfied with inter-library loan services (p=.246, sig.<0.01), library staff's help in locating sources (p=.281, sig.<0.01), and library staff's help in searching online databases (p=.291, sig.<0.01).

(c) Use of Formal Channels for Research

It is assumed that academic staff knows which formal channels are most useful in meeting their research information needs. Formal channels are institutional based resources such as journals, books, conference proceedings, library catalogues, indexes, abstracts, the Internet and bookstores. This information was sought from respondents to find out whether library-based resources were useful for research needs. Table 3 indicates the respondents' ratings on the thirteen formal channels.

Academic engineers and scientists both unanimously agree that journals are useful for research information. Conference proceedings and research reports follow this. Slightly above average mean scores (3) were indicated for sources such as books, the Internet, online or CD-ROM databases, and indexes/abstracts/ bibliographies. Standards/specifications, library catalogues, patents, bookstores, reference librarian, and the library's accession lists were considered not useful or not used. Among the scientists, only 19 respondents rated the library catalogue as useful or very useful. The reference librarian also performs poorly as only 12 engineers and 83 scientists rated this channel as useful or very useful. The results indicate that the engineering academic staff do not find the services provided by their libraries or the intermediary information provider (the reference librarians)

useful for their research needs. However, they did indicate the sources that they might have used in the library or subscribed to themselves. These include

indicate that there is a need to provide both commercially available indexes as

ENGINEERS (83)	Useful,V. useful				Not useful, not used		
Formal channels	Count	%	Count	%	Count	%	Mean
Journals	83	100.0	-	-	-	-	4.90
Conference proceedings	76	91.6	7	8.4	-	-	4.43
Research reports	66	79.5	17	20.5	-	-	4.31
Books	52	62.7	31	37.3	-	-	3.84
Internet	46	55.4	34	41.0	3	3.6	3.61
Online/CD-ROM databases	46	55.5	29	34.9	8	9.6	3.53
Indexes/abstr./bibs	44	53.0	28	34.0	11	13.0	3.41
Standards	24	28.9	39	47	20	24.1	2.96
Library catalogues	19	22.9	38	45.8	26	31.3	2.76
Patents	12	14.4	37	44.6	34	41.0	2.59
Bookstores	11	13.0	18	22.0	50	60.2	2.20
Reference librarian	12	14.4	21	25.4	54	65.0	2.07
Library's accession lists	9	11.0	20	24.0	54	65.0	1.92
SCIENTISTS (239)	Useful, V. useful		Fairly useful		Not useful, not used		
Formal channels	Count	%	Count	%	Count	%	Mean
Journals	237	99.2	1	0.4	1	0.4	4.85
Conference proceedings	200	83.6	35	17.1	4	1.6	4.02
Research reports	190	79.5	41	14.6	8	3.3	4.10
Books	163	70.8	74	30.9	2	0.8	3.94
Indexes/abstracts/bibs.	159	66.5	66	27.6	14	5.8	3.86
Online/CD-ROM databases	155	64.8	63	26.3	21	8.7	3.77
Internet	140	58.5	71	29.7	28	11.7	3.70
Library catalogues	83	34.7	113	49.1	43	17.9	3.22
Reference librarian	54	23.4	107	44.7	78	32.6	2.77
Library's accessions list	55	23.0	78	32.6	106	44.3	2.66
Standards/specifications	40	16.7	96	40.1	103	43.0	2.55
Bookstores	38	15.8	68	28.4	133	55.6	2.44
Patents	26	10.8	54	22.5	159	66.5	2.10

Cross-tabulating total publication scores and the ratings on types of resources used indicated the following.

(i)   The highly productive academic engineers, rated research reports ($p=.253$, sig. <0.05 level) and conference proceedings ($p=.271$, sig. <0.05 level) as either "useful" or "very useful" channel. For the scientists, the very productive are more likely to use the library accession lists compared to those in the other productive groups ($p=.289$, sig. <0.01 level).

(ii)   Among the engineers, there are variations in departmental ratings on 5 formal channels: journals ($x^2=7.847$, df. 3,<0.05), accession lists

(iii)   published by libraries (x^2=26.430, df.12,sig.<0.01), standards and specifications (x^2=45.329, df.12, sig.<0.01), and patents (x^2=27.854, df12, sig.<0.05). In all cases, the chemical and electrical engineers gave more positive ratings compared with those in the other engineering groups. Significant differences (<0.01) in departmental rating were also indicated for these channels by the academic scientists: the reference librarian, online CD-ROM databases, library accessions list, standards/specifications, the Internet, bookstores, and patents. In most cases, those from the chemistry, mathematics, genetics, and geology departments rated more on the "very useful" scale.

(iv)   The academic engineers who are above 40 years of age, who are higher in academic rank, who possess Ph.D., and are experienced, perceived formal channels such as journals, research reports, conference proceedings, and indexes/abstracts as useful.

(v)   Those who indicated that reference librarians are useful, are also those who are in the older age group ((p=-.191, sig. <0.01), have longer working experience (p=-.171, sig. <0.01), and possess Ph.D. (p=-.199, sig. <0.01). This could imply that the more experienced researcher needs a more specialised and personalised service.

(d) Methods Used to Keep Abreast of Research Information

The methods used to keep abreast of research information should reflect the ability of respondents to effectively identify useful sources. This factor should indirectly stimulate research and result in better publication productivity. This information was sought out to ascertain the extent academics use library resources to keep abreast. Table 4 presents the rating of respondents to 11 methods used to keep abreast of research information. Academic staff from both groups generally keeps abreast by attending conferences, professional meetings and browsing the current periodical shelves.

Other methods rated highly by academic engineers are subscribing to journals, browsing abstracts and indexes in their field of research, talking to colleagues within their department, and contacting others working in the same field. Scientists, however, found browsing through abstracts/indexes in the field, browsing through the Internet, talking to colleagues within their departments, and browsing through special bibliographies in their own subject areas fairly useful. Academics from both groups indicated browsing the library's online catalogue and publishers' catalogues, not useful or not used.

Table 4: Ratings Given to the Methods Used to Keep Abreast

ENGINEERS	V.useful		Fairly useful		Not useful,		
Methods used to keep abreast	Count	%	Count	%	Count	%	Mean
Attend conferences /meetings	72	86.7	11	13.3			4.24
Browse current periodical shelves	68	81.9	11	13.3	4	4.8	4.02
Subscribe to journals	63	76.0	9	10.8	11	13.2	3.90
Browse abstracts/ indexes in field	44	53.0	37	44.6	2	2.4	3.52
Contact with those in the same field	30	36.1	37	44.6	16	19.3	3.08
Talk to colleagues within dept.	29	35.0	46	55.4	8	9.6	3.18
Browse special bibs in subject area	18	22.0	40	48.0	25	30.0	2.61
Browse Internet for information	14	16.9	56	67.5	13	15.6	2.90
Publishers' catalogues	10	12.0	19	23.0	54	65.0	1.89
Browse online catalogues	2	2.4	20	24.1	61	73.5	1.60
Browse library's accessions lists	2	2.4	10	12.0	7.1	85.6	1.31
SCIENTISTS	Useful, Very useful		Fairly useful,		Not useful, Fairly useful		
Methods used to keep abreast	Count	%	Count	%	Count	%	Mean
Browse current periodical shelves	212	88.7	23	9.6	4	1.7	4.36
Attend conferences/meetings	203	85.0	35	14.6	1	0.4	4.29
Contact with those in the same field	177	74.0	60	25.1	2	0.8	3.93
Browse abstracts/ indexes in field	155	64.8	82	34.3	2	0.8	3.68
Browse the Internet	156	65.3	69	28.9	14	5.8	3.74
Browse abstracts/ indexes in field	155	64.8	82	34.3	2	0.8	3.68
Talk to colleagues within the dept.	103	43.1	130	54.4	6	2.6	3.48
Browse special bibs in subject area	93	38.9	138	57.8	8	3.3	3.39
Browse library's accessions list	11	4.6	63	26.4	165	69.0	2.19
Subscribe to journals	36	15.1	21	8.8	182	76.1	2.07
Publishers' catalogues	5	2.1	43	18.0	191	79.9	1.83
Browse library's online catalogues	4	1.7	33	13.8	202	84.5	1.81

Further analysis indicated that the methods academic engineers used to keep abreast were not related to total publication productivity. Although engineers unanimously rated attending conferences/professional meetings, browsing current periodicals shelves and subscribing to journals as important means of keeping abreast of current research, these methods are not related to their publication productivity. For the academic scientists, the situation is different. Seven (7) out of the 11 channels correlate positively with total publications. Those who achieved high publication productivity, indicated keeping abreast by subscribing to journals (p=.157, sig.<0.05); browsing through the library accessions list (p=.167, sig.<0.01); browsing special bibliographies in their field of research (p=.173, sig.<0.01); browsing the library's online catalogue (p=.156, sig.<0.05); looking at publishers' catalogues (p=.136, sig.<0.05 level); contacting researchers in the same field (p=.136, sig.<0.05) and talking to colleagues within the respective departments (p=.158, sig.<0.05). The results indicate that the productive academic scientists use several methods in tandem to

keep themselves abreast and the methods tend to be library-related sources, even though the ratings by other respondents show these sources to be less useful. The results also indicate that the more experienced and higher ranking academic engineers keep abreast by subscribing to journals on their own (r =258, sig. <0.05, r =258, sig. <0.05 respectively). For the academic scientists, those who are older, with longer working experience, and who are associate or full professors, keep abreast by subscribing to journals, browsing through the library accession lists, browsing special bibliographies, use the library's online catalogues, attend conferences and talk to colleagues within their own departments, to keep abreast (Table 5).

Table 5: Methods Scientists Used to Keep Abreast and Demographic Variables

Spearman rho (p)	Age	Work experience	Highest qualification	Academic Rank
Subscribe journals	**.155***	**.172***	**.165***	**.190***
Sig. (2 tailed)	**.017**	**.008**	**.010**	**.003**
Browse library's accessions lists	**.135***	**.149***	262**	**.258****
Sig. (2 tailed)	**.036**	**.021**	**.001**	**.001**
Browse abstracts/ indexes/ bibliographies	**.138***	.077	.041	.023
Sig. (2 tailed)	**.033**			
Browse special bibliographies	**.181****	.120	**.181****	**.140***
Sig. (2 tailed)	**.005**		**.005**	**.030**
Browse library's online catalogue	**.163***	.075	**.160***	.091
Sig. (2 tailed)	**.012**		**.014**	
Attend conference/ meetings	.105	.094	.096	**.175****
Sig. (2 tailed)				**.007**
Talk to colleagues within department Sig.	**.171****	.087	.098	**.172****
(2 tailed)	**.008**			**.008**

* significant at the 0.05 level (2-tailed) ** significant at the 0.01 level (2-tailed)

The findings have implications for library service providers. Firstly, scientists need services to cater for their "browsing" behaviour. Secondly, cutbacks on periodical subscriptions must be considered cautiously. If the mission of the library is to provide resources for research needs, then the subscription to mainstream as well as relevant periodicals must be maintained either in print or electronic versions, as research information needs are heavily dependent on the use of periodicals literature. There is also the need to provide relevant abstracts and indexes in the engineering field which respondents find useful in keeping themselves abreast of current research. Focus should perhaps be given to provide special bibliographies in areas of engineering and science, which faculty members are researching, supplemented with current content services of engineering and scientific journals subscribed by the library.

(e) Problems in Obtaining Information Needed for Research
During research, the need for information may vary depending on the stage of the research. Gupta (1993) identified six information need situations, ranging from the initial stage of searching for literature to making the results public. At

all stages, not obtaining the right and relevant information at the right time is detrimental to the success of the research. Respondents from this study were also asked about the problems that they faced when trying to obtain information needed for their research. This is done to ascertain whether academics find obtaining information from library-related services problematic. Table 6 presents the responses on 15 problem situations.

Table 6: Ratings on Problem Situations in Obtaining Information for Research

ENGINEERS	Not applicable	Most of the time	Occa-sionally	Rarely/ never	Mean
Don't know where to look for information	8	4	29	42	3.27
Cannot find relevant Information	6	7	43	27	3.10
Don't know how to search CD/ROM online databases	20	1	16	46	3.06
Don't know how to choose relevant databases	17	3	22	41	3.05
Inadequate photocopying services	4	9	52	18	3.01
Receive information too late	10	6	59	8	2.78
No help in finding information	11	9	51	12	2.77
Colleagues not helpful in providing information	21	11	40	11	2.49
Library books are outdated	4	37	42	-	2.46
No time to look for information	3	47	25	7	2.44
Too much irrelevant information from librarian	36	4	24	19	2.31
Cannot find wanted books on the shelves	3	54	24	2	2.30
Delay in journal arrivals	3	57	23	-	2.24
Insufficient funds to order articles from abroad	6	53	21	2	2.23
Professional librarian not willing to perform searches	40	8	24	10	2.05
SCIENTISTS	**Not applicable**	**Most of the time**	**Occa-ionally**	**Rarely / never**	**Mean**
Inadequate photocopying services	13	49	125	52	2.91
Don't know how to choose relevant databases	50	16	86	87	2.88
Don't know how to search CD/ROM online databases	55	20	63	101	2.88
Cannot find relevant information	33	20	151	35	2.79
Receive information too late	34	38	129	38	2.72
Don't know where to look for information	62	21	109	46	2.71
Library books are outdated	11	66	150	12	2.68
No help in finding information	30	60	119	30	2.62
Colleagues not helpful in providing information	61	16	125	37	2.58
No time to look for information	33	70	114	22	2.52
Cannot find wanted items on the shelves	23	93	103	20	2.51
Delay in journals arrival	6	133	81	19	2.47
Professional librarian not willing to perform searches	86	15	79	59	2.47
Too much irrelevant information from librarian	85	15	100	39	2.39
Insufficient funds to order articles from abroad	36	122	51	30	2.32

The five most problematic situations expressed by both groups are in the following order: delay in journal arrival, insufficient funds to order articles from abroad, cannot find items on the shelves, no time to look for information and outdated library books. The common occasional problems faced by both groups of respondents are: cannot find relevant information, inadequate photocopying services, received information too late, colleagues are not helpful in providing information, and too much irrelevant information from librarians. The engineers indicated that the lack of help in finding information is an occasional problem.

Academics from both groups indicated having little problem with searching CD/ROM or online databases, choosing relevant databases, and know where to look for information. The ratings have a number of implications. Firstly, journals are the main concern of the academics. They want current information and, hence, find delay in journal arrivals, an irritant. For titles not found in the library, allocations or subsidies to obtain articles from abroad should be provided. Both groups of academics are confident in their ability to search and find information, but do need help occasionally when items required cannot be located. They also need help to perform searches when they do not have time to conduct the searches themselves.

The ratings on the 15 problem situations were cross-tabulated with respondents' categorised publication scores and the following results were observed.

(i)　　The highly productive academic engineers rarely found their colleagues helpful. On the other hand, a higher proportion of those who are in the low and minimum productive group, rated this situation as not problematic (r=-.242., sig. < 0.05). In general, respondents' ratings on the other 14 variables are independent of their achieved publication scores.

(ii)　　For the scientists, the scores on total number of publications are correlated to 7 of the 15 problem statements. The highly productive scientists indicated that outdated library books (ρ=.124, sig. <0.05), and the librarian's assistance in bibliographic searches (ρ=.144, sig. <0.05) are not problematic for them. However, they rated as problematic: no help in finding information (ρ=-.189., sig. < 0.01), do not know where to look for information (ρ=-.222., sig.<0.01), cannot find relevant information (ρ=-.132., sig. < 0.05l), receive information too late (ρ=-.204., sig. < 0.01), and do not know how to choose relevant databases (ρ=-.141., sig. < 0.05) occasionally or at most times. This implies the special needs of the productive scientists who need guidance to find the relevant resources, and to be given help or information promptly.

(iii)　　Table 7 indicated that age, years of working experience, highest academic qualifications obtained and academic rank are significantly related to academic engineers ability in finding relevant information and knowing where to look for information. The older academic engineers indicated significantly (r =427, sig.< 0.01) having no problem to find relevant information or in looking for information (r =254, sig.< 0.05). The highly experienced engineers indicated they have no problems in finding relevant information. Those with 10 or less years of working experience tend to find this situation problematic occasionally and 7 academics from this group rated this situation as giving them problems most of the time. Engineers, who are lecturers, and especially those with Masters degrees, indicated not knowing where to look for information (r

=240, sig.< 0.05) and not finding relevant information (r =498, sig.< 0.01) (r =332, sig.< 0.01), as problematic situations most of the time.

Table 7: Demographic Variables and Engineers' Ratings on Problem Situations

Spearman's rho (p)	Age	Working experience	Highest qualification	Academic Rank
Don't know where to look for information Sig (2-tailed)	**.254*** **.021**	.069	.038	**.240*** **.029**
Cannot find relevant information Sig (2-tailed)	**.427**** **.001**	**.387**** **.001**	**.332**** **.002**	**.498**** **.001**

*Correlation is significant at the 0.05 level (2-tailed)   **Correlation is significant at the 0.01 level (2-tailed)

(iv)   The highly productive scientists rarely found "professional librarian not willing to perform searches" as problematic (Table 8). In general, the results indicate that academic scientists do need help in terms of locating, searching and retrieving information needed for research. This is especially so in the case of the older and more experienced scientists who may be tied up with administrative and consultation commitments.

Table 8: Demographic Variables and Scientists' Ratings on Problem Situations

Spearman's rho (p)	Age	Working experience	Academic Rank
Delays in journal's arrival Sig. (2-tailed)	.014	-.109	**-.181**** **.005**
No help in finding information Sig. (2-tailed)	-.083	-.105	**-.148*** **.022**
Don't know where to look for information Sig. (2-tailed)	**-.142*** **.028**	**-.163*** **.012**	**-.169**** **.009**
Received information too late Sig. (2-tailed)	-.093	-.094	**-.177**** **.006**
No time to look for information Sig. (2-tailed)	**.131*** **.043**	.008	-.011
Don't know how to choose relevant databases Sig. (2-tailed)	**-.130*** **.045**	**-.223**** **.001**	**-.160*** **.013**
Don't know how to search CD-ROM, online databases Sig. (2-tailed)	**-.148*** **.022**	**-.194**** **.003**	**-.188**** **.004**
Prof librarian not willing to perform searches Sig.. (2-tailed)	**.152*** **.019**	**.208**** **.001**	**.240**** **.001**

*Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

(f) How Can Library Services be Improved to Support Research?

A section in the distributed questionnaire sought respondents' comments on library services that should be improved and below is a summary of their responses.

Academic Engineers. A total of 50 respondents (60%) gave their comments. The comments are grouped into 5 categories: (1) access to other libraries; (2) acquisition of reprints from other libraries; (3) need to acquire new titles and

full-text databases; (4) photocopying facilities, and (5) others. Most of the comments (46%) expressed the need for newer journal titles, especially in the form of full-text databases. The other two most expressed needs are for more self-operating photocopying machines, exclusively for lecturers' use (30%), and the need for better handling of request for reprints of journal articles not available in the library (19%). From the comments, a pattern of information source needs seems to emerge. There is much emphasis on the need of periodicals for research. Monographs are very rarely mentioned even though respondents were asked to comment generally on how they feel library services could be improved.

Academic Scientists. A total of 166 respondents (61.5%) gave comments on the type of library services that they would like to see improved. Similar to the engineering sample, a majority of the comments concern the acquisition of new books or periodical titles (31.9%), and the inclusion of sources in the form of full-text databases. The acquisition of recent and relevant periodical titles is mentioned repeatedly, with some giving specific areas of their research that need specific periodical titles. The second most expressed need is for better access to CD-ROM databases that libraries should make accessible on the campus network so that searches could be carried out from the faculties and departments. There is also a suggestion that the library should offer foreign online database services equivalent to BIDS at Bath University. Academic scientists are also concerned with the need to increase the efficiency of the inter-library loan services, and this should include cooperation with other universities abroad so that articles "from obscure journals" could be obtained. There were 11 suggestions to improve the processing, shelving of new titles and re-shelving of used journal titles to ease the locating of the titles needed. There were 5 to 6 suggestions to speed up the binding process of journals, provide for current contents service of scientific periodicals subscribed by the library, and allow the borrowing of periodicals. Some academic scientists suggested that staff-user relationships could be improved by the librarian's being more sensitive to client's needs, providing search services, and being more "pro-active".

From the comments, the general resource needs of the academic scientists can be identified. The importance of journals to satisfy research needs has been much emphasized. The respondents consistently suggested on the need to have journal coverage, especially in their area of research. They repeatedly stressed their opposition to budget cuts for periodical subscriptions, and the cancellation of journal titles. They would like the journals to be processed, bound and shelved more efficiently. They want easy access to articles needed for their literature search stage with an efficient inter-library loan system (nationally and internationally), and to be permitted to borrow journals, even only on an "overnight" basis. Other resources, which are important for academic scientists,

are the CD-ROM and online scientific databases, that they want to access from their own desks.

(g) Responses from the Productive Academics Who Were Interviewed

The survey results indicated that about 55.4% (46) of academic engineers and 70.7% (169) of scientists regarded their library resources as fairly sufficient, yet the ratings did not correlate to their publication productivity. When the results were put forward to those interviewed, differences in respondents' views of their library are indicated.

The majority of academic engineers and scientists agreed that library facilities and publication productivity are not related factors. Those who agreed provided several reasons such as: "Library provides information about research done by others, but the shaping of the actual publication is totally self-driven"; "The resources are there, but it depends on how one maximizes the sources"; "Library search can provide the researcher with literature but cannot directly make him write good papers"; and "A good library collection helps in the literature searching process, but whether the research results get written or reported still depends on individual self-discipline and motivation". Although the academic staff surveyed accepted the importance of library facilities, they felt that these do not affect their research because there are alternative channels. One academic commented, "I have always requested reprints directly from the paper writers or obtained the information I need from the Internet, and good library resources are accessible through the Net".

Those who felt that the library facilities have an effect on publication output, also gave several reasons for their opinions, such as: "It does affect the initial phase of the research", "Quality and quantity of reading materials are important in good research", "Library is important in the initial stages (literature view) of research", "It is impossible to research properly without the support of the library", and "All scientific research starts with the literature review – this would help in problem formulation, choice of methodology and approach to analysis".

To understand how the library can help to improve publication productivity, the academic engineers interviewed gave four possible methods (Table 9).

Table 9: Ways in Which the Library Can Assist in Research

	Engineers		Scientists	
	Count	Row %	Count	Row %
Better access to electronic databases	13	40.6	4	16.6
Continue journal subscription & maintain currency	13	40.6	8	33.3
Speedy inter-library loan services	9	28.1	2	8.3
Other support services	4	12.5	5	20.8

A high number of academic engineers (40.6%) wanted the library to improve services to electronic databases. Academic engineers felt that the library could help by increasing access to databases in relevant research areas, which should be made available over the campus network (6 engineers mentioned this). They felt that the library should provide online links to libraries throughout the world and notify users of useful web sites and forthcoming conferences.

Both academic engineers and scientists stressed the importance of continuing subscriptions to up-to-date journals, which must be currently received and supported by a current contents service. Nine (9) engineers wanted free or subsidised inter-library loan services in order to "expedite getting papers requested at a reasonable cost". The academic engineers and scientists wanted help in locating journals required, searching databases, and stressed on the provision of good photocopying services.

CONCLUSION

This study highlights the groups of academic staff who are finding problems with library services or facilities, and the improvement academics feel that libraries can make to add quality to their research environment. The study reveals that the academics higher in rank and longer in experience, have fewer problems in using and seeking professional help. This is especially so among the scientists who depend more on published formal sources such as periodicals, special bibliographies and accession lists produced or kept by the library. The highly productive scientists also seem adept at keeping current with research information through varied means. A number of actions are open to the library to accommodate itself to these situations. Firstly, the marketing of services and facilities must be aimed towards creating awareness among the less experienced lecturers who may lack the confidence to seek professional help or advice, and who may not be aware of the facilities available to them, such as, getting articles from abroad through the inter-library loan services, and help in identifying relevant databases. Lorenz (1973) observed that academics at the University of Nebraska perceived the importance of the library, but admitted to infrequent use, and postulated that this might be the result of ignorance of the services available to them. In the present study, this is implied in the academics rating on the usefulness of library services. The ratings given seemed random and did not indicate any significant pattern of use. It is suspected that academic engineers rated randomly for services they were not very acquainted with, but gave high ratings to familiar services such as photocopying, book loans and book reservation services. New approaches need to be adopted to ascertain whether academic engineers are aware that they can 'request' for help from library professionals to search for information and resources. This might be the reason why library services such as obtaining professional library's help to locate sources, and help in searching online databases are rated poorly, especially by

the engineers. As suggested by Garvey (1979), the library must realize that there are two groups of academics, that is, the major and minor scientists. Major scientists are few and involved in mainstream research, and are members of the elite group who maintains a high degree of informal communication for the dissemination or in obtaining information for research. These scientists usually have access to many information resources, being editors or referees of prestigious journals, reviewers of research proposals and are members of committees that determine priorities of research at the front. The minor scientists are those who supply the major scientists with the content of the information. "It is with the 'minor' scientists that librarians will probably have the most successful interactions and be of greatest service … The information needs of the 'minor' scientists are great because they do not have the resources of the major scientists"(Garvey, 1979, p.12).

The library's role in providing bibliographic information for research was highlighted by Vieira and Faraino (1997). As library professionals are equipped with the skills of bibliographic searching, it is natural that these skills be included when advertising the library services, be it for free or fee-based. Most research projects receive funding, and thus, allocation for bibliographic searches and the acquisition of needed materials could be worked into the proposed budgets. Such services are not aggressively marketed in academic libraries, and academics are expected to visit the library to perform their own searches. Matarazzo and Prusak (1995) suggested that libraries change their roles, and highlight their competency in searching and locating information for users. What libraries must accept is that engineers depend heavily on their own personal collection and informal discussion with colleagues for research information (Herner, 1954; Allen, 1977; Kremer, 1980; Kaufman; 1983; Pinelli, Kennedy and Barclay, 1990). Only when they have exhausted their personal sources, would they turn to other sources, such as the library. Libraries and librarians were often ranked low in priority of sources used. Even when in the library, Shuchman (1981) found that engineers would attempt to find the information themselves first before soliciting help from library professionals. In this situation, the librarian that handles such queries should be the subject specialist or those experienced in handling enquiries. For those who opt not to use professional help, the issue of access becomes detrimental. Access refers to not only access to web sites, e-resources and online catalogues, but also to obtaining full-text resources and knowledge portals.

The highly productive academics are already using the library but their needs are different. From the interviews and responses to the open-ended questions in the questionnaire, it is observed that the productive academics are active users but want facilities to be better managed and services efficiently dispensed. In these circumstances, the "horses are already at the well and are drinking", but libraries have to ensure that the "drinking process and water content is trouble free" and

of the "best concoction" so that information is obtained comfortably, easily, current, yet maintaining the independence of the "drinker" if they so wishes.

Possible help sought after by the academics are the provision of a reasonably priced inter-library service (subsidising the cost of articles obtained from abroad), making available CD-ROM or online databases via the campus network so that searches can be conducted from their desks, and managing the periodicals collection more effectively (speedy shelving of used periodicals, processing of new titles for the shelves, binding of loose periodicals and allowing the borrowing of bound journals for short periods of time). Access to literature is crucial to research performance and lack of access may reduce successes (Srichandra, 1970; Babu and Singh, 1998). Poland (1993) pointed out that librarians are in the business of providing information and need to change strategies in dealing with academics. One strategy Poland suggested was to identify the information gatekeepers in faculties and utilize them to disseminate current and relevant information. The improvements in communication network have made it possible to improve access to resources and services. An automated inter-library loan service, which allows academic staff to submit requests and receive feedback online would reduce time in walking to the library to fill in forms for every items requested. Current awareness portals could be linked to the library home pages and online catalogues, which contain special subject bibliographies that are current, or content pages of journals subscribed by the library in the discipline of science and engineering. This was suggested by Hughes and Lee (1998) who declared a marked increase in the usage of full text databases compared with the citation versions, when access to journal databases was made available at the Pennsylvania State University in 1995. Such systems should be designed for the heavy, as well as the average users, with functions that minimize the client's effort when obtaining information. The system should empower academics to browse contents of scholarly works, order needed information and receive feedback online from their workplace at any time. This would place the library as a dynamic content provider for the promotion and advancement of a knowledge rich scholarly environment.

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