Information-Seeking Behaviour of Slovenian Researchers: Implications for information services

Polona Vilar, Primož Južnič, and Tomaz Bartol; University of Ljubljana, Slovenia

Abstract

The paper present one part of a survey of information behaviour of Slovenian researchers. Results show that Slovenian researchers in most areas show usual traits of scholarly information behaviour. Exceptions are the non-use of Web 2.0 tools for research purposes and low use of open-access materials. Survey confirmed that ICT is influential in perferences regarding resource formats, access, means for information exchange, organization of resources, writing, reading, etc. The use of grey literature is quite intensive, but depending on the academic area and research field: researchers from humanities, natural sciences and other technical fields are more inclined then social science researchers to use grey literature as the source of information for their research, and business sector is of all sectors the most concerned with patents and standards.

1. INTRODUCTION

In recent years a lot of research has been dedicated to information behaviour of various user groups, among these also to scientists. With more and more resources becoming available online, there is an evident and rapid trend towards the development of different information behaviour by scientists: what information resources they are using, how and when. Recent studies of scholarly information behaviour all show significant changes in the ways researchers communicate (Maron and Smith, 2008), publish their works (Dallmeier-Tiessen et al., 2010; Muench, 2011), collaborate (Borgman, 2009), look for information and use it (Rowlands and Fieldhouse, 2007; Information Behaviour, 2008; Palmer, Teffeau and Pirmann, 2008). The origin of all these changes is undoubtedly the impact of digital technologies.

To go with this trend we have in 2011 conducted an extensive survey of information behaviour of researchers in the Republic of Slovenia. We here present part of its results. The study as a whole aims to shed more light on the patterns of their information behaviour thus facilitating the work of research organizations, information providers such as libraries, providers of publicly funded information sources such as public research agencies. The results help to better understand the research work, evaluate current offer of information sources, as well as plan the future provision.

The segment of the results presented in this paper focusses on issues of resources and media used for research purposes. We looked at use and preferences of information sources, types of information sources used (with emphasis on grey literature), and impact of information and communication technilogies on information-related activities.

2. REVIEW OF LITERATURE

2.1. Information behaviour of researchers

Among other information related activities these studies present findings regarding scholars' use of social media, use of various information sources and of various formats. It is undoubtedly becoming clear that immense impact of the digital technologies has led to certain new patterns in scientific information and communication behaviour. Researchers have noticed that although scholars still perform some 'older' activities, such as browsing or berrypicking (Bates, 1989, 2007), they also express some previously unseen behaviours, e.g. skimming (looking at one to two pages at a time), navigating (looking around at what is available, i.e. 'the electronic sweet shop'), power browsing (reading abstracts and titles, even indexing terms, rather than full text), squirrelling (downloading material to `read' later), cross-checking (collecting information from different sites) (Rowlands and Fieldhouse, 2007; Maron and Smith, 2008; Information behaviour, 2008; Palmer, Teffeau and Pirmann, 2008).

In terms of resources the fact is that researchers increasingly use different resources. For some scientific communities like High Energy Physics needs immediate access to information resources and even open access to to full text is not enough anymore. So the grey literature became the most important communication channnel (Gentil-Becot A. 2010).

For several years in the context of e-science the initiatives of data curation, reuse of data and information, have been gaining attention. By data curation we mean management of existing research data, adding value to this data, immediate sharing of it for re-use, and long-term preservation of this data for later re-use (Choudury, 2010, Lord et al., 2004; Lord and Macdonald, 2003). This issue has been tackled by OCLC, One of the questions which arises due to the changing role of libraries serving science is not, should libraries (especially academic) undertake data curation or not, but, in what way could libraries be included in these already ongoing activities? (Gold, 2010).

2.2. Slovenian research situation and infrastructure

Development and growth of research activity in Slovenia is best shown by increase of number of research groups. In 1998 in Slovenia operated 753 research groups, in the fields of natural sciences 121 research groups, in the fields of engineering 346 research groups, in the fields of medical sciences 75 research groups, in the fields of agricultural sciences and biotechnology 60 research groups, in the fields of social sciences 98 research groups and in the fields of humanities 53 research groups. Ten years later, in 2008 in Slovenia operated 1128 research groups, which means 50% increase. In the fields of natural sciences 181 research groups, in the fields of engineering 558 research groups, in the fields of medical sciences 95 research groups, in the fields of agricultural

sciences and biotechnology 80 research groups, in the fields of social sciences 142 research groups and in the fields of humanities 72 research groups.

In the year 1998 the number of registered researchers was 6971. Ten years later, this number almost doubled, with 12.182 registered researchers. The age structure of researchers was as follows: 39% of researchers were aged up to 35 years, 31% from 35 to 44 years, 19% between 45-54 years, and 11% above 55 years of age. There were 38.9% female researchers. Figure 1 shows thenumber of researchers, is number of FTE researchers (Figure 1). In the year 2009 on different programmes and projects (basic, applicative and postdoctoral), financed by Slovenian Research Agency (SRA) 4560 researchers have taken part (Peclin, Juznic, 2012).

Republic of Slovenia allocates around 1.5% of its BDP to support science and research In Slovenia investment in public sector is around 100 € per capita, which puts Slovenia, relatively low, in the middle among European union countries. The results, measured by number of ppublications look more promising. In the year 2002 Slovenia had 809 papers per million inhabitants average of EU members was 629. In the year 2005 Slovenia had 1.104 papers per million inhabitants. EU members average was 887 and in the year 2008 the ratio 1.637 vs. 1.037. In the year 2002 Slovenia was on 9 th position, in the year 2005 on 8 th and in 2008 on 5th.

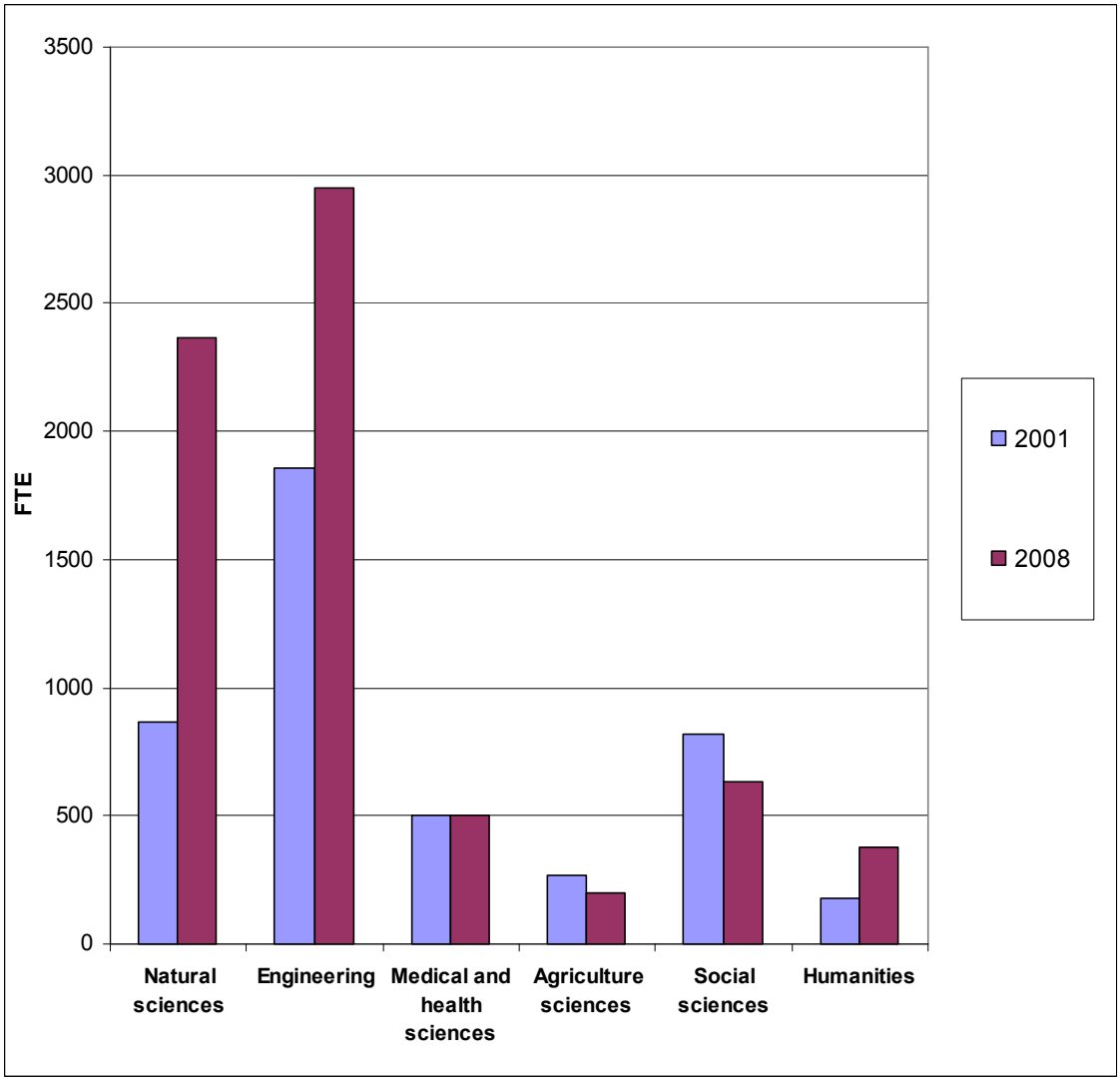

Figure 1: Number of researchers (FTE) by scientific disciplines

3. RESEARCH

3.1. Methodology

3.1.1. Sample

We used a random sample of all currently active and officially registered researchers in Slovenia. Contact details were obtained from Slovenian Research Agency (ARRS), the agency in charge of all publicly funded research in Slovenia. The agency has set up a publicly available system SICRIS (Slovenian Current Research Information System;

website: http://sicris.izum.si) to monitor the activity of every publicly funded researcher in the country. Within this system every researcher is registered with a unique research ID number. In the year 2011 there have been around 4.800 (?) active[1] researchers. The ARRS agency provided us with researchers' contact details. Sample consisted of every eighth researcher according to allocated research ID number, which meant that there were 592 researchers who received a personal email invitation to participate in the online survey (opened from September 14th to November 14th 2011). Response rate until October 24th when we finished preparation of this text (although the poll was at that time still open) was 33.1% (196 people) of which 20.1% (119) responded adequately. Although not all questions were answered by all participants, the 119 responses still allowed a fairly detailed analysis.

3.1.2. Methods of gathering data

We used an online survey consisting of 25 questions: 18 content questions (Likert scale type) and 7 demographic questions. The latter seven asked participants for their gender, age, type of their current work (research, teaching), years of experience with either research or teaching, employment status (independent researcher, working at a research organization, university, commercial organization), and research area[2].

Content of the survey (initial 18 questions) was dedicated to various aspects of information behaviour. As mentioned, they were mostly Likert scale type questions. In this study relevant were:

- preferred format of information sources (printed, electronic, either)
- opinion on the impact of information and communication technology on various aspects of research work (searching and gathering of information sources, relevance judgement, organization of acquired sources, citation checking, reading, communication, independent writing, collaborative writing)
- number of printed and electronic sources in the personal archive
- frequency of use of information sources in the personal archive
- frequency of instances when teh researcher uses electronic tools for searching for sources, but prints the sources for reading
- ratio of certain types of scientific sources which are normally cited in researcher's publications: scientific publications, electronic publications, open-source publications
- ways of acquiring scientific publications (personal subscription to printed or electronic journals, organizational subscriptions of printed or electronic journals, from e-archives or repositories, interlibrary loan or document delivery services, directly from colleagues) and the frequency of each

[1] Active means that in the current year 2011 the researcher has been allocated at least 100 publicly funded research hours.

[2] According to the classification of Slovenian research agency (ARRS): 1 – Natural Sciences,, 2 – Technical Sciences, 3 – Medicine, 4 – Biotechnical Science, 5 – Social Science, 6 – Humanistic Sciences, 7 – Interdisciplinnary Research.

- attitudes and opinions concerning various aspects of handling data curation
- types of sources used in research work (eg. formal sources like books, journals, reference material, or informal (grey) sources like project reports, dissertations, social networks, blogs, forums, websites) and frequency of each
- tools used to start search for information sources for research purposes (e-journal providers, specialized bibliographic databases, specialized information portals, web search engines, library catalogue)

As explained above, every participant received an email invitation and we used the data assembled till October 24th.

3.1.3. Data analysis

The data was analyzed using SPSS software. Besides descriptive analysis we also preformed bivariate statistics to see if any connections between demographic and content variables could be identified.

3.2. Results

3.2.1. Characteristics of respondents

There were 46,5% female researchers. The age structure of respondents was as follows: 27.6% were aged from 20-30 years, 36.7% 31-40 years, 17.3% 41-50 years, 12.2% 51-60 years and 6.1% above 60. The structure of respondents according to research area is shown in Table 2. Of the 119 respondents who are all, as explained, active researchers, 91 are involved in research, 60 in teaching and 16 in other activities (more than one current activity is possible for an individual; for example, besides being researchers some are also university teachers, medical doctors, etc).

Table 2: Structure according to research area[3]

	No.	%
Natural Sciences	30	25.2
Technical Sciences	20	16.8
Medicine	12	10.1
Biotechnology	8	6.7
Social Sciences	21	17.6
Humanistic Sciences	15	12.5
Interdisciplinary Research	13	10.9
All	119	100

[3] As explained in the introduction ,we used the classification of the Slovenian Research Agency (ARRS).

We can say that they are rather experienced both in research and in teaching. The data can be seen in Table 3. In terms of their employment status, 3.4% work as independent researchers, majority are employed either at university (52.9%) or some type of public research institute (32.7% in research organizations which are part of some institution and 5.9% in independent research organizations), 2.5% work in economy and 4.2% in other organizations, such as hospitals (again, one individual can be employed in one or more institutions). When asked about their current work tasks (multiple answers were possible), 91.9% answered that they do research, and 60.6% that they also teach – from this we can see that two thirds are actually involved in both activities.

Table 3: Experience in research and teaching.

	Research experience		**Teaching experience**	
	No.	**%**	**No.**	**%**
Less than 1 year	1	1.0	16	19.3
1-5 years	29	29.6	27	32.5
6-10 years	24	24.5	13	15.7
11-15 years	15	15.3	9	10.8
Over 15 years	29	29.6	18	21.7

3.2.2. Information behaviour

3.2.2.1. General traits of information behaviour

Generally speaking, we found that Slovenian researchers do not differ to a great extent from what has been discovered for today's scientists. In the first section we present some general traits of their information behaviour. If we look at the use of types of information sources – with this we mean the ways researchers come to information they need for research purposes – (Table 4), we see that researchers intensively use formal sources (which is, of course, understandable). However, also the use of informal sources (grey literature) is quite strong. Over one third of researchers (35.3%) use them always or often, and another fourth (24.2%) ocasionally. Research reports and dissertations are used often by one fourth (25.3) and ocasionally by half (51.5%). Over one fourth (27.5%) often or always acquire information from e-archives, if we add those who use them ocasionally (38.5%), this is more than two thirds.

Personal contacts are another strong source of information. From Table 4 it is evident that communication produces a lot of research-related information. It is evident that researchers communicate in all fields: with colleagues within their own organization, with Slovenian colleagues, and with colleagues abroad. Intense contacts with foreign colleagues indicates how aware are Slovenian scientists of importance of international

contacts and of international character of science in general. Table 4 also shows that they very often use colleagues to acquire resources (articles). 23,6% do this often or always and another 47.3% ocasionally.

Table 4: Types of information resources used and their frequency

Resource type	**Frequency of use (%)**				
	Never	**Almost never**	**Occasionally**	**Often**	**Always**
Printed books	2.0	11.1	36.4	30.3	20.2
E-books	3.0	12.1	48.5	24.2	12.1
Printed journals	0	21.2	34.3	28.3	16.2
E-journals	0	3.1	12.2	43.9	40.8
Reference sources	5.1	20.4	46.9	19.4	8.2
Patents, standards, reports	22.2	41.4	24.2	11.1	1.0
COBISS/OPAC (Slovenian union cat.)	0	13.1	33.3	34.3	19.2
Bibliographic databases	10.1	14.1	28.3	33.3	14.1
Raw data sources	39.8	26.5	15.3	15.3	3.1
Proceedings	4.0	23.2	40.4	27.3	5.1
Prepints	9.1	41.4	29.3	20.2	0
Reviews	14.1	44.4	30.3	11.1	0
Research reports, dissertations	2.0	21.2	51.5	25.3	0
Communication with colleagues in own org.	2.0	12.1	37.4	40.4	8.1
Communication with colleagues in Slovenia	4.0	22.2	48.5	19.2	6.1
Communication with colleagues abroad	4.1	20.4	46.9	20.4	8.2
Social networks	65.7	19.2	12.1	3.0	0
Forums, disc. Groups	28.3	36.4	23.2	11.1	1.0
Library	16.5	18.6	41.2	17.5	6.2
Email alerts	19.2	18.2	34.3	21.2	7.1
Blogs	51.5	31.3	10.1	6.1	1.0
Invisible college (conferences, meetings, etc.)	3.0	19.2	44.4	27.3	6.1
Web portals	30.6	29.6	24.5	12.2	3.1
Websites	5.1	14.1	41.4	32.3	7.1
E-archives	17.3	30.6	33.7	14.3	4.1

Table 5: Ways of acquiring resources and their frequency

How resources are acquired	**Frequency (%)**				
	Never	**Almost never**	**Occasionally**	**Often**	**Always**
Personal subscription of printed journal	63.3	17.4	11.9	6.4	0.9
Personal subscription of e-journal	68.8	18.3	10.1	2.8	0
Organizational subscription of printed	7.3	21.8	33.6	24.5	12.7

journal					
Organizational subscription of e-journal	5.5	1.8	16.5	45.0	31.2
E-archive, repository	13.8	20.2	38.5	23.9	3.7
Interlibrary loan	13.6	36.4	39.1	10.0	0.9
Colleagues	5.5	23.6	47.3	20.9	2.7

As for library services, we can say that researchers are not very enthusiastic about them. Table 5 shows that the use of library among researchers is poor (41.2% use it ocasionnaly, 35.1% never/almost never), as is the use of ILL for acquisition of resources (Table 5 tells us that 13.6 never use it, and 36.4 almost never use it). However, we were rather pleased to notice that some library services are rather well accepted: 53.5% use OPAC often/always; 44.8% often/always start search with OPAC (Tables 4 and 6).

Table 6: Information resources used to start research-related searches

Resource	**Frequency of use (%)**				
	Never	**Almost never**	**Occasionally**	**Often**	**Always**
E-journal sites (eg. Science Direct, Sage,…)	3.2	8.4	27.4	33.7	27.4
Specialized bibliographic databases (eg. Medline, Inspec,…)	9.4	12.5	25.0	33.3	19.8
Information portals, cross-search engines (eg. DiKUL – search portal of UL)	28.1	31.3	24.0	11.5	5.2
Web search engines (eg. Google)	2.1	9.3	11.3	45.4	32.0
COBISS/OPAC (Slovenian union cat.)	4.2	20.8	30.2	31.3	13.5

3.2.2.2. About data curation and use

Researchers were also asked to express their opinions regarding some aspects of data curation (Table 7). They are very much in favour of having the data available (71.7% agree or strongly agree) and are also prepared to provide their own research data for curation and re-use (72.8% agree or strongly agree). But, they have doubts concerning ethical dilemmas: 58.1% agree or strongly agree that it could be questionable to provide data for re-use, since it could lead to theft of results, misuse of data, etc. This is also evident when they express opinions specifically about their own research area; although they mostly think their area would benefit from this, a significant portion also thinks it would be questionable. Interesting is their opinion about libraries playing a role in data cuartion. The first question shows quite strong oposition to this idea, but the second, control question proved that they would also support it.

Table 7: About data curation

Issues of data curation	**Frequency (%)**

	I don't agree at all	I don't agree	Nor I agree nor I don't agree	I agree	I agree comple-tely
Data should be available to other researchers	3.3	9.8	15.2	40.2	31.5
I am willing to provide my research data	5.4	9.8	12.0	47.8	25.0
There are ethical dilemmas regarding data curation& use (eg. theft of results, misuse of data)	7.5	14.0	20.4	44.1	14.0
In my area data re-use is questionable	8.0	43.2	21.6	20.5	6.8
My area would benefit from data curation & re-use	0	9.7	21.5	40.9	28.0
Libraries should not be involved in data curation	4.3	10.1	18.8	31.9	34.8
Libraries should be involved in data curation	6.9	12.6	27.6	27.6	25.3

3.2.2.3. Impact of information and communication technologies

Already from the data presented earlier it is evident that ICT has had a profound influence on Slovenian researchers and on their information behaviour (which, of course, does not differentiate them from researchers elsewhere): researchers like electronic materials and use them widely. They are strong users of web search engines (77.4% use them often or always), and websites (39.4% of frequent or regular users). This on the one hand again proves that researchers in some areas behave much like general public. On the other hand, the use of e-journals clearly characterizes them as scholars (61.1% use e-journals often or always). E-preferences are also evident from other data:

- 49.6 prefer to have resources in electronic format (compared to 5% who prefer printed resources),
- 51.3% have over 200 electronic papers in their personal archive,
- 38.1% of researchers cite 81-100% e-resources in their publications.

We also asked researcers how often they print electronic materials when they want to read them: the answer was that 50.0% often and 14.0 always do that.

When asked to estimate which areas of their work were made easier or harder by ICT, results (presented in Table 8) showed that a great majority more easily searches and acquires resources (99%), organizes them (83.5%), chains citations (91.3%), writes (in collaboration (84.8%) seems to be even a little easier than alone (71.9%)) and, of course, communicates (93.9%). Areas which are more difficult for many are relevance

judgement (23.7%) and reading (25%). Very few think that ICT doesn't have any influence.

Table 8: ICT makes easier/harder

Activity	Frequency (%)				
	Much easier	Easier	No change	Harder	Much harder
Search & acquisition	8.0	19.1	0	0.9	0
Relevance judgement	22.8	40.4	13.2	19.3	4.4
Organization	48.7	34.8	13.0	3.5	0
Citation chanining	54.8	36.5	6.1	2.6	0
Reading	6.9	28.4	39.7	22.4	2.6
Communicating	61.4	32.5	5.3	0.9	0
Independent writing	26.3	45.6	22.8	2.6	2.6
Collaborative writing	45.5	39.3	12.5	1.8	0.9

3.2.2.4. Some surprising findings

In some areas of information behaviour Slovenian researchers managed to surprise us. The use of Web 2.0 tools for research purposes is almost non-existing: social networks are never or almost never used by 84.8%, weblogs are obviously not considered an information source – as 82.8% don't use them, and, similarly, web forums are never or almost never used by 64.6% of respondents (Table 4). Also, it seems that quite a significant proportion of researchers (20%) don't use (and cite) electronic resources very often when they write (Table 9).

When we look at other information resources (Table 4), we see that half never or almost never use preprints and a good third similarly never or almost never uses email alerts. Cross-search services and specialized portals (Table 5) seem to be perceived as equally unimportant (60.2% never or almost never start their search using those). Interestingly, also open-access materials don't seem to be very popular, as data shows that they are not used to a great extent – open-access materials comprise less than 20% of citations for 58.3% of researchers (Table 9). All these findings differ from the usual findings for contemporary scientists and would be worth looking into.

Table 9: Shares in citations[4]

Shares	Frequency (%)				
	Below 20%	21-40%	41-60%	61-80%	81-100%

[4] With citations we mean resources which are cited by researchers in their own publications.

Share of scientific publications	3.7	2.8	10.1	20.2	53.8
Share of open-access publications	58.3	15.6	13.5	6.3	6.3
Share of electronic sources	20.0	14.3	7.6	20.0	38.1

3.2.2.5. A closer look: Information behaviour in relation to demographic variables

We performed bi-variate statistics (Chi-Square tests) to investigate some connections between variables. A link can be identified between age of respondents and their perceptions of various aspects of digital tools, formats, ways of communicating and acquiring information, younger reserachers tend to prefer digital environment.

Gender of respondents is not an issue which would influence preference or behaviour. This is, of course, not surprising, since gender has not been identified as a factor influencing scholarly information behaviour. However, we did identify research discipline as being influential in some respects:

- Natural Sciences:
  - are keen to use research papers, dissertations,
  - don't acquire their resources by print journals or interlibrary loan,
  - use raw data,
  - cite higher proportion of scientific literature.
- Social Sciences:
  - cite higher proportion of scientific literature,
  - don't think libraries should undergo data curation.
- Technical Sciences:
  - don't use raw data,
  - use standards, patents,
  - are in favour of libraries doing data curation.
- Humanistic Sciences:
  - use research papers, dissertations,
  - prefer printed sources,
  - acquire their sources by using print journals,
  - cite higher proportion of scientific literature, lower share of e-sources and lower share of open-source materials,
  - are not keen on using ICT to organize resources.
- Interdisciplinary Research:
  - use e-archives to acquire their resources
  - are in favour of data curation from various aspects: that data should be available to others, that they would provide their own data and that libraries should deal with data curation
- Medicine:
  - use websites,
  - use colleagues to acquire their resources and information (invisible college),

    - use raw data, but are sceptical in terms of ethical dilemmas of its use,
    - think that ICT helps independent writing.
- Biotechnology:
    - use research papers, dissertations,
    - prefer e-sources,
    - support availability of raw data,
    - are keen on using ICT to communicate and organize resources.

Other influential demographic variables seem to be employment status, experience in teaching and researching, and current job tasks.

4. DISCUSSION

Our results in this preliminary analysis clearly show that Slovenian researchers in most areas don't differ significantly from what has been discovered for today's scientists. There are some areas which show some discrepancies – primarily the use of Web 2.0 tools for research purposes. While it was clearly shown that researchers strongly lean on personal contacts (i.e. social networks), this has for some reason not transferred to digital environment. Digital scholarship has in recent years been gaining importance in the professional lives of scientists, both for research and for teaching (see for example Veltsianos and Kimmons (2012), Researches of tomorrow (2011), Moran, Seaman and Tinti-Kane (2011)). Non-use of weblogs and digital social networking tools can to a large extent be contributed[5] to work overload (most researchers also teach), lack of motivation and maybe also as a reaction to popular use of social netwook tools in today Slovenia, not so much to technological issues. Last political elections that taken place and used social network tools as a political parties promotion tools. Some stated that currently they are 800.000 facebooks in Slovenia, which is a lot for two milion of Slovenians, as 60% of Slovenians have their profiles (63% are females) (RIS, 2011). Slovenia is, in fact, one of the most typical European Union (EU) countries with respect to information technology usage (Petrič et al. 2011). Some current research imply that it appears that many users are mainly using Facebook to partake in passive activities, instead of providing active social contributions (Ryan, Xenos, 2011). Such findings suggest that not all Facebook users are using the site to improve their social capital, which can also some impact on nonuse.

Another issue which has obviously not gained a lot of researchers' attention is open-access. We plan to look into these issues more deeply, to be able to shed more light on our results. One of the reasons might also be the traditionally well-organised access to academic journals in Slovenia (Juznic, 2009).

[5] At this point we can only provide anecdotical evidence, personal experience and results of ad-hoc interviews with individual scientists from various areas – but we intend to look into these issues more deeply in the future.

Otherwise there is no doubt that information and communication technologies have a big impact on the life and work of scientists, regarding many issues: resource formats, access, means for information exchange, organization of resources, writing, reading, etc. We also saw that, regardlessof the quality of infrastructure, researchers are, as always, independent, innovative and creative to find ways to acquire information which they need and to use it appropriately.

In some respects Slovenian researchers are (much like researchers in general) quite similar to general public – perhaps more than they would like (or more than providers of formal information sources would like). This is proven by e.g.:

- Intensive use of web search engines, which is much more common than the use of 'formal resources', such as e-journal providers or specialized bibliographic databases.
- Preference of e-materials and tools, immediate access to full-text,
- Dissatisfaction with existing library services and non-use of these services (with exception of OPAC).

There are, of course, areas which clearly distinguish scientists from general public. One of those is undoubtedly reference judgement. As proven also by our results, scientists are (for obvious reasons) much more than average users concerned with judging the content and quality of their information sources.

As for grey literature, we saw that it is quite intensive, but depending on academic area and sector of employment:

- Technical, natural, humanistic and biotechnological sciences are more inclined to use grey literature as the source of information for their research.
- Business sector is of all sectors the most concerned with patents and standards.

When we asked researchers what they think about data curation, the answers were positive, but careful: in principle they are in favour of it, but many have dilemmas regarding ethics. It is also quite obvious that they (with exception of medicine) don't use these resources.

5. CONCLUSION

Our research has shed more light on information behaviour, and to a certain extent, also information needs of Slovenian scientists. When the study, which is partly presented here, is finished, we hope that the picture will be even more complete. Some interesting issues arose which we intend to investigate further.

What implications could our findings have for information services to scientists? Libraries will need to further rethink the services which they offer to scientists. There is

no doubt that formal resources will still retain their value and importance, however, they will be shaped by information and communication technologies and new patterns of scientific publishing (e.g. open access, e-archives, repositories). Some library services are already less important to scientists – hence the decline of library visits – while others, like OPACs (with access to full-text) and provision of access to e-journals, retain their value. There are other interesting issues which libraries might consider taking up: setting up e-archives and repositories, approach data curation.

Undoubtedly formal information tools need further development in terms of more intuitive interface design, change of record structure - and that is potentially another big task for libraries. For this, of course, wider co-operation is needed, e.g. with search engine developers, publishers.

We must mention that our results were obtained with web survey and are thus a reflection of self-reported activities and decisions of scholars. Due to the limitations of this method the results should be crosschecked using some other methodology. For example, observation of scholars at work would probably give us more detailed insight into their activities, and follow-up interviews would certainly shed more light into the context of their work, on their decisions and on reasons for their actions. However, it would be very difficult, if not impossible, to assemble so many cases as we did using our current methodology.

6. REFERENCES

Bates, M.J. (1989), “The design of browsing and berrypicking techniques for the online search interface”, Online Review, Vol. 13 No. 5, pp. 407-24.

Bates, M.J. (2007), “What is browsing—really? A model drawing from behavioural science research”, Information Research, Vol. 12 No. 4, available at: http://InformationR.net/ir/12-4/paper330.html (accessed October 10, 2011).

Borgman, C.L. (2009) "Scholarship in the Digital Age: Blurring the Boundaries between the Sciences and the Humanities (Keynote Talk)" Digital Humanities Conference. College Park, MD. Jun. 2009. Available at: http://works.bepress.com/borgman/216 (accessed October 10, 2011)

Chowdhurry, S. (2010). "Data curation: an ecological perspective", College & Research Libraries News, vol. 71 no. 4 (April 2010), pp. 194-196.

Dallmeier-Tiessen, S., Goerner, B., Darby, R., Hyppoelae, J., Igo-Kemenes, P., Kahn, D., Lambert, S., Lengenfelder, A., Leonard, C., Mele, S., Polydoratou, P., Ross, D., Ruiz-Perez, S., Schimmer, R., Swaisland, M., van der Stelt, W. (2010). "Open Access Publishing - Models and Attributes", The SOAP Consortium, 2010. Available at

http://edoc.mpg.de/get.epl?fid=71514&did=478647&ver=0 (accessed October 10, 2011)

Gentil-Beccot, A. (2010). »The driving and evolving Role of Grey Literature in High-Energy Physics.« In D. J. Farace & J. Schöpfel (eds.). Grey Literature in Library and Information Studies. De Gruyter Saur, Berlin/New York

Gold, A. (2010). "Data Curation and Libraries: Short-Term Developments, Long-Term Prospects", available at http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1027&context=lib_dean (accessed November 11, 2011)

Information Behaviour (2008), "Information behaviour of the researcher of the future – Executive summary", available at: www.jisc.ac.uk/media/documents/programmes/reppres/gg_final_keynote_11012008.pdf (accessed October 10, 2011).

Južnič, P. (2009). "Using a decision grid process to evaluate library collections and e-journals. *New libr. world*, 110 (7/8), 341-356.

Lord, P., Macdonald, A. (2003). "E-Science Curation Report: Data curation for e-Science in the UK: an audit to establish requirements for future curation and provision", available at http://www.jisc.ac.uk/uploaded_documents/e-ScienceReportFinal.pdf (accessed 22 October 2011)

Lord, P., Macdonald, A., Lyon, L., Giaretta, D. (2004). "From Data Deluge to Data Curation", available at http://www.ukoln.ac.uk/ukoln/staff/e.j.lyon/150.pdf (accessed October 22, 2011)

Maron, N. and Smith, K.K. (2008). "Current Models of Digital Scholarly Communication: Results of an Investigation Conducted by Ithaka Strategic Services for the Association of Research Libraries", available at: http://www.arl.org/bm~doc/current-models-report.pdf (accessed October 10, 2011).

Muench, V. (2011). "Open Access shaking the basics of academic publishing", Online, Jul/Aug 2011, pp. 18-21.

Moran, M., Seaman, J., & Tinti-Kane, H. (2011). "Teaching, learning, and sharing: How today's higher education faculty use social media for work and for play", available at http://www.pearsonlearningsolutions.com/blog/2011/05/09/teaching-learning-and-sharing-how-todays-higher-education-facutlyuse-social-media/ (accessed December 22 2011).

Palmer, C.L., Teffeau, L.C. and Pirmann, C.M. (2009). "Scholarly Information Practices in the Online Environment: Themes from the Literature and Implications for Library Service Development", available at: www.oclc.org/research/publications/library/2009/2009-02.pdf (accessed October 10, 2011).

Pečlin, S. Južnič, P. (2012). »Research in the fields of medicine in Slovenia – research potentials, funding and publications." in press.

Petrič, G., Petrovčič, A., Vehovar, V., (2011) Social uses of interpersonal communication technologies in a complex media environment. European Journal of Communication. 26(2) 116–132

Researchers of Tomorrow: A three year (BL/JISC) study tracking the research behaviour of 'Generation Y' doctoral students: Second Annual Report 2010-2011. May 2011. Available at :http://www.efc.co.uk/projects/rot/Researchers%20of%20Tomorrow%20Year%202%20report%20final%20110510.pdf (accessed December 22, 2011).

Ryan, T., Xenos, S. (2011), Who uses Facebook? An investigation into the relationship between the Big Five, shyness, narcissism, loneliness, and Facebook usage. Computers in Human Behavior 27 (2011) 1658–1664

Rowlands, I. and Fieldhouse, M. (2007), "Information behaviour of the researcher of the future", Work Package I: Trends in Scholarly Information Behaviour, available at: www.jisc.ac.uk/media/documents/programmes/reppres/ggworkpackagei.pdf (accessed October 10, 2011).

Schöpfel, J., Stock, C. (2009). Grey literature in French digital repositories: a survey. In GL10 Conference Proceedings. Tenth International Conference on Grey Literature: Designing the Grey Grid for Information Society. Amsterdam. Available at: http://archivesic.ccsd.cnrs.fr/docs/00/37/92/32/PDF/GL10_Schopfel_Stock_final.pdf (accessed October 10, 2011).

Veletsianos, G. and Kimmons, R. (2012). "Networked participatory Scholarship: emergent techno-cultural pressures toward open and digital scholarship in online networks", Computers & Education, vol. 58, pp. 766-774.

Williams, P. and Rowlands, I. (2007), "Information behaviour of the researcher of the future". Work Package II: The Literature on Young People and their Information Behaviour, available at: www.jisc.ac.uk/media/documents/programmes/reppres/ggworkpackageii.pdf (accessed October 10, 2011).

Acknowledgments and funding

This research was conducted as a part of the project V5-1016, funded by the Slovenian Research Agency.