Library service design based on the needs of chemistry research data management and sharing survey

Ming Wu
National Science Library,
Chinese Academy of Sciences,
No.33 Beisihuan Xilu, Haidian District,
Beijing, China, 100190
wum@mail.las.ac.cn

Xiujuan Chen
National Science Library,
Chinese Academy of Sciences,
No.33 Beisihuan Xilu, Haidian District,
Beijing, China, 100190
chenxiujuan@mail.las.ac.cn

ABSTRACT
This paper aims to survey five perspectives of research data in chemistry research process, which including data generation and collection, data recording and processing, data preservation and backup, data management and sharing, needs for data sharing services. By means of questionnaires survey, 119 researchers and graduate students of Chinese Academy of Science in chemistry disciplines provided us with insights in research data management and sharing. The outputs of statistical analytical results help us have a better understanding on their currency attitudes and needs of researchers about their data management and sharing in chemistry disciplines. Although the survey in chemistry discipline, it could be provide us some insights for designing a range of library service, particularly in promotion, consulting and training of research data management and sharing.

Keywords
Chemistry discipline, Data management and sharing, Needs survey, Library data service.

INTRODUCTION
As we all know research data are very important component of scientific findings. In the context of e-science and open data, in recent years the governments, international organizations, the funding agencies and the periodical publishers have issued a series of research data management and sharing policies. Researchers are encouraged or required to sharing research data with their research outputs. These open data policies are actively promoted research data sharing and reused during research data lifecycle. But in realities researchers not only have different attitudes and expectancies to manage and share research data(Tenopir et al., 2011; Carlson and Stowell-Bracke, 2013; Huang et al., 2012; Hall, 2013), but also meet many challenges in management data especially for different disciplinary of small science(Borgman, 2012; Borgman et al., 2007; Gray et al., 2005). Therefore some studies are conducted survey in the current state and needs of research data management and sharing(Peters and Dryden, 2011; Anderson et al., 2007; Carlson, 2012), others are increasing engaged in understanding practices and developing new services to meet research data management requirement, particularly within academic library(Bardyn et al., 2012; Kim, 2015; Williams, 2013).

National Science Library (NSL) is an academic library attached to Chinese Academy of Sciences (CAS). In recent year, NSL was initiated subject librarian system and set up full time subject librarian’s team with diverse subject background. One important aspect of subject librarians is to provide subject information services for the researchers and graduates of the institutes CAS in different research fields. Since research data management and sharing become more and more important, many researchers also show much concern about the issue. So in this studies, we conducted the survey of chemistry researchers and graduates in Chemistry Institute of CAS, which including five perspectives of research data in chemistry research process, e.g. data generation and collection, data recording and processing, data preservation and backup, data management and sharing, needs for data sharing services. By means of questionnaires survey, respondents provided us with insights in research data management and sharing in chemistry disciplines. Based on the outputs of statistical analytical results, we have a better understanding on their currency attitudes and needs of researchers about their data management and sharing. Although the survey in chemistry discipline, it could be helpful for us to design a range of library service to meet researchers’ needs for data management and sharing around data lifecycle, particularly in promotion, consulting and training of research data.

METHODOLOGY
Questionnaire design
Preliminary preparation of the questionnaire began in July, 2015. After several revisions, the second draft of the questionnaire was formed in early September. Then the pre-test of questionnaire was carried out. Ten graduates of
Shanghai Institute of Organic Chemistry (SIOC), CAS had filled out the questionnaire to test whether the questionnaire was easy to understand. Based on the feedback of the graduates, we adjusted the questionnaire and forming the final questionnaire draft of “needs of chemistry research data management and sharing survey”.

The questionnaire includes five perspectives of research data in chemistry research process which show in table1.

| No. | Questionnaire design                | No. questions |
|-----|-----------------------------------|---------------|
| 1.  | Data Generation and Collection    | Q1—Q4         |
| 2.  | Data Recording and Processing     | Q5—Q6         |
| 3.  | Data Preservation and Backup      | Q7—Q10        |
| 4.  | Data Publication and Sharing      | Q11—Q15       |
| 5.  | Need of data management and sharing services | Q16—Q20 |

**Respondents**
The survey was conducted in September, 2015 to January, 2016. 129 respondents who are from Changchun Institute of Applied Chemistry (CIAC), Chinese Academy of Sciences (CAS) and Institute of Chemistry Chinese Academy of Sciences (ICCAS) participated in the survey. We acquired 129 questionnaires distribution and return ratio was 100%. Eliminating some invalid and blank questionnaires, we acquired 119 effective questionnaires.

**Statistical method**
We use excel for statistical analysis of each questions. The percentage is the number proportion of total respondents.

**RESULTS AND DISCUSSION**

**Data Generation and Collection**

Q1. Types of data generated during research

Q2. Formats of data generated during research

Q3. Frequency of data generated during research

Q4. Size of each year data generated during research

**Data Recording and Processing**

Q5. Ways of recording research data

**Data Preservation and Backup**

Q7. Ways of research team for data management

Q8. Data lost situation

Q9. Research team data management requirements

Q10. Ways of research team data management
Data Publication and Sharing

Q11. Meet the data requirement of journals

Q12. Knowledge of the data requirement of journals

Q13. Willing of submit data to journals

Q14. Knowledge of chemical research data repository

Q15. Cognition of chemical research data repository

Q16. Needs degree for research data management services

Q17. Main problems of research data management

Q18. Learn content of research data management

Q19. Ways to improve research data management

Q20. Functions for research team data repository

DISCUSSION

By means of the statistical analysis of questionnaires survey, the current status of researchers and graduate students in chemistry disciplines about their data management and sharing of researchers are summarized. And the results help us have a better understanding on their needs for research data management and sharing in chemistry disciplines.

| Survey contents                        | Survey results                                                                 |
|----------------------------------------|-------------------------------------------------------------------------------|
| Data Generation and Collection         | Research data generated is valuable, rich in formats, frequent and the amount is general. |
| Data Recording and Processing          | Using traditional ways for data recording and processing.                     |
| Data Preservation and Backup           | Losing data frequently is the main shortcoming. There are no mandatory requirements and many research teams carry out the management of data separately by the researchers. |
| Data Publication and Sharing           | Most of researchers have a strong will to submit their data. There are obvious lacks of cognitive for data policies of journals and data repositories. |
| Demand for data management and sharing services | The main problems researchers are issues about storage, security, intellectual property and so on. Researchers express a strong desire for the data management and sharing services. |
A workflow of research data for library service is designed as shown in Figure.

Promotion research data management and sharing
Based on the survey results, the majority of the chemistry research teams’ data management and sharing consciousness is weakly. Firstly, libraries should raise chemistry researchers’ awareness of data sharing by promotion services, which including research data management and sharing policies, data management plan policies, data publication requirements etc.

Consulting for research data management
When the researches meet the problems, including data management and sharing policies, data retrieval, data management, journal and repository selection etc., librarians can consult through reference platform, phone, e-mail, QQ etc.

Training on chemistry research data management
The survey results have shown that researchers have strong needs for training service. Libraries can provide special training related to research data management with their rich experience, including data management and sharing policies; data discovery, retrieval and access; chemistry journal or repository research data type, format, size; chemistry journal or repository requirements etc.

CONCLUSION
In this study, based on survey five perspectives of research data in chemistry research process, researchers and graduate students of Chinese Academy of Science in chemistry disciplines provided us with insights in research data management and sharing. The outputs of statistical analytical results help us have a better understanding on their currency attitudes and needs of researchers about their data management and sharing in chemistry disciplines. A series of library service are designed around research data lifecycle, particularly in promotion, consulting and training of research data. We hope that it would give beneficial assistance on a better understanding on researcher needs of data management and sharing, and would be significant for librarians to design of embedding library service.

REFERENCES
Anderson NR, Lee ES, Brockenbrough JS, et al. (2007) Issues in biomedical research data management and analysis; needs and barriers. J Am Med Inform Assoc 14: 478-488.

Bardyn TP, Resnick T and Camina SK. (2012) Translational Researchers’ Perceptions of Data Management Practices and Data Curation Needs: Findings from a Focus Group in an Academic Health Sciences Library. Journal of Web Librarianship 6: 274-287.

Borgman CL. (2012) The conundrum of sharing research data. Journal of the American Society for Information Science and Technology 63: 1059-1078.

Borgman CL, Wallis JC and Enyedy N. (2007) Little science confronts the data deluge: habitat ecology, embedded sensor networks, and digital libraries. International Journal on Digital Libraries 7: 17-30.

Carlson J. (2012) Demystifying the data interview. Reference Services Review 40: 7-23.

Carlson J and Stowell-Bracke M. (2013) Data Management and Sharing from the Perspective of Graduate Students: An Examination of the Culture and Practice at the Water Quality Field Station. portal: Libraries and the Academy 13: 343-361.

Gray J, Liu DT, Nieto-Santistebeban M, et al. (2005) Scientific data management in the coming decade. SIGMOD Rec. 34: 34-41.

Hall NF. (2013) Environmental studies faculty attitudes towards sharing of research data. Proceedings of the 13th ACM/IEEE-CS joint conference on Digital libraries. Indianapolis, Indiana, USA: ACM, 383-384.

Huang X, Hawkins BA, Lei F, et al. (2012) Willing or unwilling to share primary biodiversity data: results and implications of an international survey. Conservation Letters 5: 399-406.

Kim J. (2015) A Study on the Perceptions of University Researchers on Data Management and Sharing. Journal of the Korean Society for Library and Information Science 49: 413-436.

Peters C and Dryden AR. (2011) Assessing the Academic Library’s Role in Campus-Wide Research Data Management: A First Step at the University of Houston. Science & Technology Libraries 30: 387-403.

Tenopir C, Allard S, Douglass K, et al. (2011) Data sharing by scientists: practices and perceptions. PLoS One 6: e21101.

Williams SC. (2013) Using a Bibliographic Study to Identify Faculty Candidates for Data Services. Science & Technology Libraries 32: 202-209.