A Debate on Re-engineering the University Library System

Anca DRAGHICI
Politehnica University of Timisoara, Romania
anca.draghici@upt.ro

Agneta LOVASZ
The Central Library of Politehnica University of Timisoara, Romania
agneta.lovasz@upt.ro

Simona BURSASIU
The Central Library of Politehnica University of Timisoara, Romania
simona.bursasiu@upt.ro

Abstract. *Universities' libraries have always been playing a vital role in supporting education, research, and several other academic activities of its parent organization. However, during and after the COVID-19 pandemic period these institutions were facing organizational stress owing to the limitations of the schedule and the new rules applied to users and visitors. The current situation necessitates the universities libraries to re-think their ways on providing services through a re-engineering process. In this context, traditional methods, and tools, together with the work processes must be transform in an innovative manner to make them more productive and effective. First, the re-engineering approach is briefly presented focuses on identifying the innovative solution for fundamentally changing the process that will dramatically improve the services quality and speed the working processes, simultaneously with costs reductions. Second, there are presented best practices and cases of other university libraries that have rethink their services and their business model to generate an inventory of innovative ideas. The article debates the re-engineering process of the university library in the favourable context offer by an Erasmus+ project implementation.*

Keywords: Re-engineering, university library system, diversity, services, INNO3D project

Introduction

From their establishment and development in ancient times, libraries have been considered as "the hard" or core places of the communities, being relate to colleges, universities, or academia (supporting education, learning and generally, the knowledge creation process). Generally, libraries have been designed as spaces where a large variety of users (public)can satisfy their continuous needs for literature, for culture and accessing news related to different fields (Koehler, 2015; De la Peña McCook & Bossaller, 2017).Libraries today operate in a perpetually changing environment and many managers, staff, and board members feel overwhelmed by the pressures of rapidly expanding technologies, the changes regarding the copyright and knowledge access regulations and the limited budgets (Garnes et al., 2006; Ragon, 2019).Thus, these institutions have continuously evolved and developed their technologies of database creation, archiving and accessing resources of different types. Moreover, "librarians are expected to manage digital libraries, organize digital knowledge and information, and disseminate digital information owing to the fact that we are all have become a global village as a result of the Internet" (Okike, 2020).

In the actual Digital Age period in different are now facing organizational stress owing

to the vast increase in number of publications, especially serials, in various formats, advances in information technology and increase in the propensity to consume information by academic community (Horsfall, 2020). Furthermore, through the digitalization of their services, libraries must preserve in a re-invented way their role of being an information and learning resource centre (or more a knowledge capitalization unit in the community).According to the recent literature in the field and the libraries practices they have proved to better facilitate the users' adventure on "the avenue for bibliographic information searching, research endeavour, and other intellectual pursuits" (Corpuz, 2020).
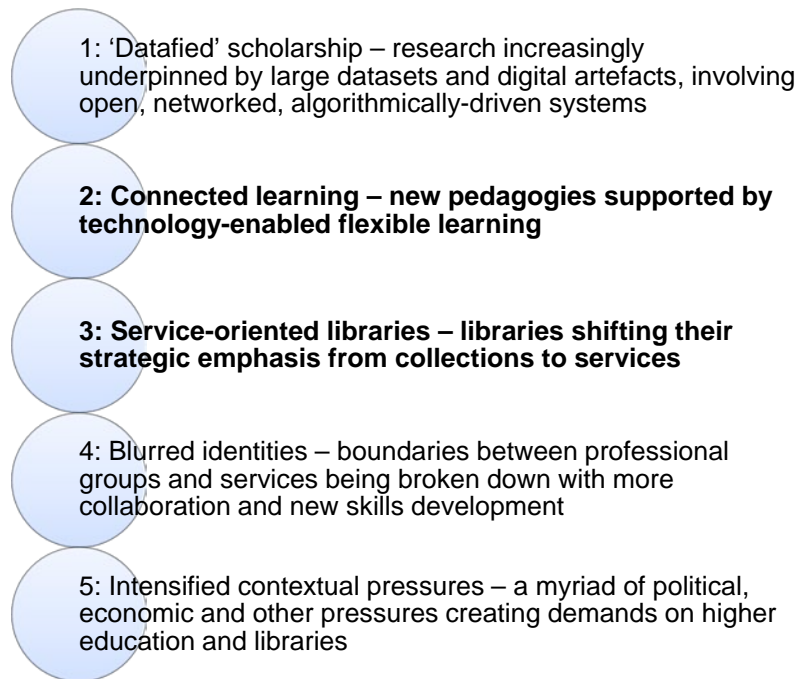
Universities' libraries have always been playing a vital role in supporting education, research, and several other academic activities of its parent organization. However, during and after the COVID-19 pandemic period these institutions were facing organizational stress owing to the limitations of the schedule and the new rules applied to users and visitors (Walsh & Rana, 2020; Mehta & Wang, 2020; Okike, 2020). On the other side, the users need were almost the same, but most students, researchers and teaching staff have been suffered by not having direct access to the shelves for in-situ documentation and for the face-to-face group studding. The current situation necessitates the universities libraries offer pick-up services most for regular loan print materials. Furthermore, researchers and occupational health and safety professionals have intensified searching about COVID-19, and"librarians have the important role of disseminatingCOVID-19related information and resources to the public through various virtual media channels available to them" (Okike, 2020).

The paper idea is also related to the well-recognized major trends (defined as nexus) that are impacting libraries and which libraries are helping to shape in the last year and nearest future (Figure no. 1) (Pinfield et al., 2017).Recently, in the study of Sucha et al. (2021) there have been re-iterated the actuality of the pre-defined nexus and the varieties of social innovations in public libraries.

Thus, the present article addresses to the second and third nexus and will present a strategic perspective of re-thinking university library services. Traditional methods, and tools, together with the work processes must be transform in an innovative manner, thus university library systems to be more productive and effective in short and medium term in the announced the "new normal" life of libraries.

The article structure includes first, the presentation of the re-engineering approach focuses on identifying the innovative solution for fundamentally changing the process that will dramatically improve the services quality and speed the working processes, simultaneously with costs reductions. Second, there will be presented best practices and cases of other university libraries that have already rethink their services and their business model to generate an inventory of innovative ideas.

The article debates the re-engineering process of the university library in the favourable context offer by the "3D Printing Support Service for Innovative Citizens "(INNO3D) project (Erasmus+, Strategic Partnerships for Higher Education, project no. 2019-1-IE02 KA203-000693). The project consortium consists of seven universities and their related libraries providing practical experiences, possible ways of implementation and barriers of library activities re-engineering.

1: 'Datafied' scholarship – research increasingly underpinned by large datasets and digital artefacts, involving open, networked, algorithmically-driven systems

2: Connected learning – new pedagogies supported by technology-enabled flexible learning

3: Service-oriented libraries – libraries shifting their strategic emphasis from collections to services

4: Blurred identities – boundaries between professional groups and services being broken down with more collaboration and new skills development

5: Intensified contextual pressures – a myriad of political, economic and other pressures creating demands on higher education and libraries

Figure no. 1. Major trends impacting libraries.
Source: (Pinfield et al., 2017).

Literature review

Brief overview of the re-engineering concept and science

In the 90', re-engineering has been flourishing as a concept, as part of the management science and as practical approach in radically changing organization and its culture. The pioneers in the filed were Davenport (1993), Hammer and Champy (1993, 2009).

The concept of re-engineering involves re-founding and re-designing the activity of an organization to obtain significant and lasting improvements in terms of costs, revenues, quality, performance, and competitiveness (Grint, 1994). The main purpose of the approach is to optimize the development of all processes involved in the organization's activity, maximizing results with optimal consumption of all the available resources. Re-engineering is associated with a process of disruption innovation (Davenport, 1993; Hammer & Champy, 1993; Hammer & Champy, 2009).

The need for designing and implementing a re-engineering process can be caused by unsatisfactory financial performance of the organization, increasing or high pressure of competition, declining market share and sales (dramatically changes of the market), identifying new business opportunities that require new business model (an aggressive strategy) etc. Furthermore, re-engineering refers to the analysis and changes in the fundamental components of the organization's activity, such as: the strategy, the processes (including the know-how, technology, capabilities, employees' competencies etc.), the organizational design, including culture and business model.

The successful implementation of a re-engineering approach is associated with the design and use of a multidisciplinary framework considering technical aspects of the processes (usually from the Business Process Management, BPM perspective so call Business Process Re-engineering, BPR), economic implications (including estimation of the investment effects through financial indicators), product/services design etc. For the implementation phase of the re-engineering project, methods, and tools of leadership, human resources management (team management, motivation, rewording etc.) and change management (crisis management) are of tremendous usefulness.

Actual organizational approaches of change are re-inventing their business model via their business process using BPR (Proxcel, 2020). In this contextual approach imposed by competitive organizations, BPR included the fundamental re-thinking and radical

re-design of BP to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service, and speed (Hammer & Champy, 2009; Consultus, 2017). BPR "is related to the analysis and design of workflows and processes within and between organisations; business activities should be more than a collection of individual or even functional tasks; they should be broken down into processes that can be designed for maximum effectiveness, in both manufacturing and service environment" (Davenport, 1993, Consultus, 2017).

As a preliminary conclusion, BPR is "a management discipline, where the design of existing processes (within an organization and between organizations) and their business components are first analysed and changed according to criteria of efficiency, economy, and value added to business objectives" (Consultus, 2017). Furthermore, BPR is related to the discovering of how BP currently operate, how to re-design these processes to eliminate the wasted or redundant effort and improve efficiency, and how to implement the process changes to gain competitiveness.

Through a re-engineering approach, organization's management need to establish a new model of organizing processes and the business using "a visionary, a motivator, and a leg breaker" (Hammer & Champy, 2009).

Re-engineering for libraries systems

The re-engineering approach has been applied in different fields as public administration, healthcare, manufacturing and production engineering, information and communication technology, for small and medium size enterprises or big companies from different cultures and countries. In the literature are less approaches of re-engineering in the library systems and thus the present approach can full this knowledge gap.

A simple search in the Clarivate Analytics database (articles indexes in the Web of Science Core Collection) for the TOPIC: (Re-engineering for library), refined by Web of Science categories: (Information Science Library Science) and considering the timespan of all years (1975 – 2021) has shown only 22 articles (h = 6, average citation per article being 3.86) from which 17 are articles and 5 are proceedings papers. Thus, the proposed approach of applying re-engineering in the case of library system could be of great interest. Some relevant studies and approaches in this domain have been identified mainly in association with the changes that should accompanying the information and communication technologies adoption.

A most cited research of Lyon (2012) has explored different ways to "re-shape libraries" to effectively and efficient satisfy users requirements and the new challenges of "data-centric research landscape"; there has been recognized that information technologies have "a potential pathways to change, which will help libraries to re-position, re-profile, and re-structure to better address research data management challenges". The added value of this research is an inventory "of ten data support services which libraries can deliver to support the research lifecycle phases" (Lyon, 2012). This research could be associated with a fragmentation approach of re-engineering.

Furthermore, re-engineering approach has been exploited for the marketing purpose and publica relation in the case of different library systems (Kumar, 2014; Ioryem, 2020).

More recent, library re-engineering has been considered in the context of the rapid evolution and adoption of information and communication technology in the education field and the solutions provided through digitization of the libraries (Chaubey, 2017; Tyagi & Sharma, 2018).

Most interesting applications refers to the librarian trainings for skills development in using the new emerging technologies (Lyon, 2016; Mattern et al., 2017).

It comes out that nowadays the concept of Smart Library is more and more present, and it is based on high technology use as started with new applications of Radiofrequency Identification (RFID), face recognition or fingerprint technologies for access and security reasons or using emergent technologies as the Internet of Things (IoT), Big data, Artificial Intelligence (AI), data mining techniques and data analytics for offering rich experience tothe users (provide right and consistent information in push or pull style, at the right moment), all facilitated by wireless connectivity, smartphones and social networking, connecting electronic devices is the next generation of the Internet (Paraschiv, 2017; Abuarqoubet al., 2017; Huang, 2020).

Another interesting and actual approach is presented by Ozeer et al. (2019) describing a traditional library system on a university campus and highlights challenges this system faced with. Their approach is focus on how processes in the traditional library could be converted into a Smart Library using Internet-of-things (IoT) to capture data in real time and BPR notation; smart library aims to efficiently perform library management and solve traditional library problems. It has been already applied in some libraries in the United States the concept of automatically authenticate users, reply to their inquiries, issue, and return books, and even locating books using location-based service, for instance, delivering location details on the use's smartphone. Other solution of using IoT based smart library system provides the luxury of fetching a book from its place by using "enabled interconnected system using a triangulation Wi-Fi based local positioning system and NearField Communication (NFC) tags" (Abuarqoubet al., 2017).

A preliminary conclusion on the literature review on the application of re-engineering approach in the case of library systems have highlighted that: (a) the approach is seen most as a way of re-thinking library services and technologies; (b) it is associated with the way libraries should applied change management for better aligned to their communities of users; (c) it is not seen as a way of planning and implementing a disruption innovation in the system; (d) the approach is less known and applied despite the actual trends and context of library functioning.

Research methodology on diversifying the library services
Brief presentation of the INNO3D project
The present study has been associated with the implementation of the INNO3D project ("3D Printing Support Service for Innovative Citizens") through the support of a European international consortium of libraries, companies, and universities. Thus, the study context is a generous one and support innovative ideas rising and exchange, and most the librarians and university staff skills development in the Digital Era. The project duration is of 36 month and it started in October 2019.

INNO3D project aims to develop tools that will define an innovative train program for librarians in using 3D printing. Thus, librarians and specialists (engineers or designers) from their own organization or collaborators (from national organizations or from the INNO3D partners) will be able to train users in using 3D printing effectively and libraries will provide a dedicated service. The project supports the extension of the classical libraries' services. The project will enhance the quality and relevance of knowledge

and skills of librarians in the field of 3Dprinting (INNO3D, 2019). Thus, the introduction of new technologies such as 3D printing is part of the mission to teach 21[st]century skills. 3D printing is an example of the type of resource that will transform today's libraries into cutting-edge learning hubs and give communities access to technologies that will have a significant impact on fields as scientific research, education, architecture, small scale manufacturing processes for entrepreneurs, engineering studies, healthcare, creative design for culture, entertainment industry (toys) and other. It is important to note that the goal of 3D printing in libraries is not to create the next artificial heart, but a library user can learn the technology and potential of digital fabrication and reinforce that learning with simpler hands-on projects. Hence, effectively introducing3D printing in Society and making it available to ordinary citizens (INNO3D, 2019).

The international partnership of the project is supported by the following organizations: Limerick Institute of Technology - Ireland (Contractor and coordinator), Transilvania University of Brasov - Romania, Panepistimio Kritis – Greece, Univerzita Konstantina Filozofa v Nitre - Slovakia, Politehnica University of Timisoara – Romania, UNIVERSITAT Politecnica de Valencia - Spain, MBThinkTank srl – Romania, Universidade Nova de Lisboa – Portugal and University of Piraeus Research Center, Greece (nine organizations) (INNO3D, 2019).

The methodology used for the project implementation is based on six core activities which will deliver the outcomes of the project, as follows: (1) Project management: this is an ongoing activity during the project's life. It ensures the smooth implementation and achieves the proposed results; (2) Mapping 3D printing education in libraries and at the university level; (3) Developing, testing, and implementing 3D printing training curriculum; (4) Elaborating 3D printing trainers' toolkit for theoretical program; (5) Validating quality assurance and improvement of 3D printing curriculum and 3D printing training materials; (6) Transferring project results and best practices. Institutionalizing 3D printing in libraries of each partner in the project to ensure ongoing training of librarians and library users for future generations (INNO3D, 2019).

Running this project within university and public libraries will lead to an increase in the number of library users in these institutions, but also to an increase in the promotion of these innovative technologies among the citizens (library users). Assimilation of these innovative technologies by librarians will lead to the personal development and lifelong learning of citizens in general and to the diversification of the services offered to users of public and university libraries, increasing their attractiveness to the younger generations for such institutions. By default, this will increase the visibility of these institutions, not only locally but on the international level. This project represents an opportunity not only for technical students, but anyone who wants to carry out various projects specific to their specialties using 3D printing. The project is expected to have immediate impact and long-term effect on improved and modernized educational processes in 3D printing across university, other libraries in the community and the whole society.
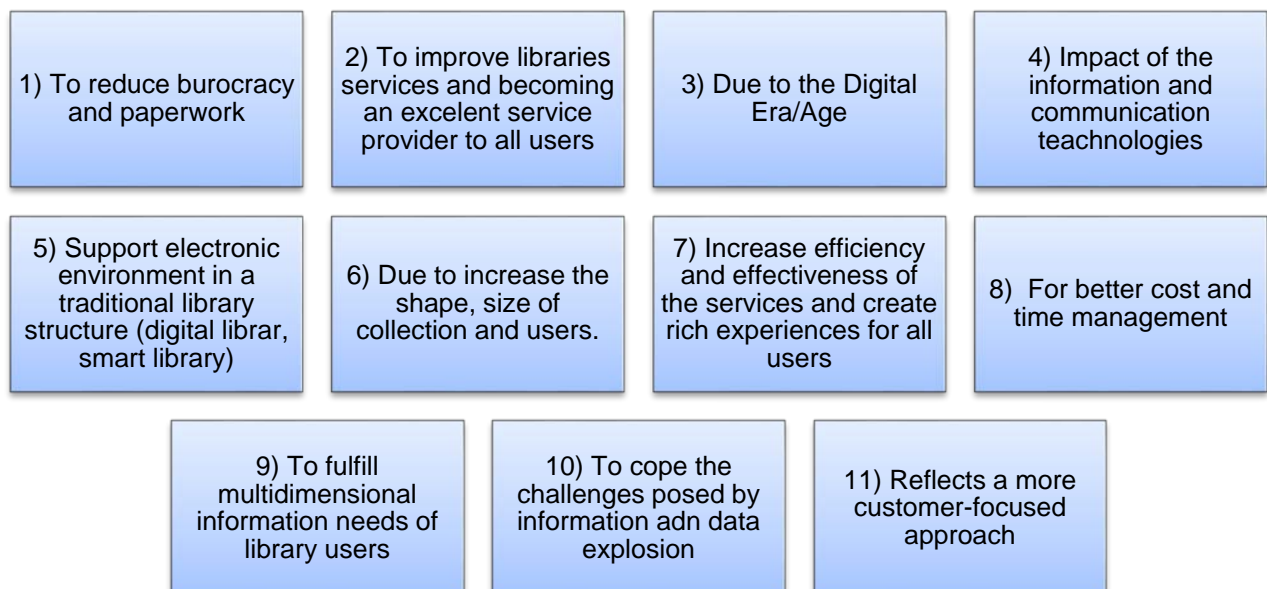
Already, the INNO3D training program has been defined based on the inventory of the skills needed in relation to the type of pieces to be process/printed, some multimedia educational resources have been created (see https://www.inno3d.eu/copy-of-resources) and currently two e-books are developed one for the trainees and the other for trainers related to the 3D printing technology.

The proposed framework for re-engineering the university library system
Before describing the proposed framework of re-engineering in the case of the

university library system, some arguments related to the changes of their activity are provided. From the practical perspective, library activity is focus most on Research Data Management (RDM) which is considered the most important service in the Research 2.0 (Science 2.0, or eScience) era; it is characterized by a data-intensive research (Koltay, 2019). Through this service, users are encouraged to develop or to take part in various forms of networking, they are supported and encourages to be open to others scientific research and most, users will report their development and discovers to other similar communities of practice or of interest.

The five trends impacting academic libraries, described by Pinfield et al. (2017) and related to Research 2.0 context (i.e., that research is increasingly based on large datasets and digital artefacts, involving open, networked systems) are still valid even within the Covid-19 pandemic period. Consequently, researchers, and practitioners support the ideas that *libraries need to shift their strategic emphasis from collections to services, because Research 2.0 depends not only on researchers' effort, but on supporting services, provided by academic libraries* (Koltay, 2019). Summarizing, Figure no. 2 presents an inventory of needs for re-engineering in university library (achieved through unformal discussions with INNO3D project consortium members during the face-to-face activities and conference participation).

1) To reduce burocracy and paperwork	2) To improve libraries services and becoming an excelent service provider to all users	3) Due to the Digital Era/Age	4) Impact of the information and communication teachnologies
5) Support electronic environment in a traditional library structure (digital librar, smart library)	6) Due to increase the shape, size of collection and users.	7) Increase efficiency and effectiveness of the services and create rich experiences for all users	8) For better cost and time management
9) To fulfill multidimensional information needs of library users	10) To cope the challenges posed by information adn data explosion	11) Reflects a more customer-focused approach	

Figure no. 2. Needs for re-engineering in university libraries.
Source: Authors own development.

Having these actions in mind, Table no. 1 presents an inventory of the library fields "affected" by re-engineering approach.

The proposed improvement of this study is given by considering RDM activities strongly supported by the re-engineering process, this being the core of the proposed framework. Despite this fact, librarians' ability to support researchers' RDM needs is influenced by a variety of factors and vice-versa researchers' view the library as a weak actor or less important one in the research process. This fact is mention even in the literature. For example, in a qualitative study(from 2018 cited by (Koltay, 2019)), using individual and focus group interviews with 36 academic librarians' on RDM experiences and the factors that influence their support, 25% of them expressed concern about researchers' unfavorable perception. Overall, some librarians considered RDM data-related work as interesting, enjoyable, satisfying, and rewarding; other librarians

perceived some benefit of learning new things, building relationships with researchers and being a source of support (Koltay, 2019).

Similar results have been achieved with samples of librarian from the European LIBER member library directors and from libraries in North America (Koltay, 2019).

Nonetheless, some librarians acknowledge that the library is not considered to be an RDM support provider, because it began to get involved into RDM too late. Consequently, researchers adopt a positive attitude about librarians in this case, because earlier they have not shown clear intention to provide RDM services (lack of advertising and communication). "By the perceived distance and isolation of the librarians from the research community, the library may also be seen as a silo" (Koltay, 2019).Furthermore, Koltay (2019) has mention that about 32% of the European academic libraries are engage in direct and cooperative participation with researchers and that there is a need for "holistic approach to academic library development" considering the complex relations between university – library – community (local, regional, national trends and specifics).

Nevertheless, transcending this status and achieving true collaboration with researchers, would require focused and intensive work of library managers, who must understand the advantages of RDM. It is crucial that managers choose appropriate services and eliminate inappropriate organizational structures and inflexible job descriptions. Last, but not least, they must acquire backing from the whole staff (re-engineering of human resources through vocational learning, international programs, participation at conferences etc.).

Table no 1. Library system's fields to be considered by the re-engineering approach

Re-engineering of:	Fields of action	Description	Methods and tool
Demand-driven acquisitions (DDA)	Acquisitions Exchanges Administration	• Assure users access to digital libraries, repositories, and databases; • Assure inter-library exchange of resources; • Participation in universities consortium of libraries; • Join consultations with library staff and users on the introduction of different kinds of resources and services; • A technical team is responsible for implementing technology and technical services, providing all-round technical solutions and technical services for librarians and users of different type;	• External exchange and cooperation (using on-line techniques, access, and the webpage); • Participation in university library fairs, conferences, exhibitions, and open days; • Applied a real feed-back collection (periodically) with all stakeholders; • Using social media to collect feed-back; • Adoption of new technologies (e.g., develop of digital library, smart library); • Introducing 3D printing, augment and virtual reality services in the library (AR/VR).
Research Data Management (RDM)	Education	• Providing educational resources (university publications); • This service aimed to raise awareness among researchers and other stakeholders of the importance and necessity of	• Digitalization of the educational resources and continuous update of this repository; • Connecting library digital repository to the university Learning Management System (LMS);

		responsibly managing their data and arranging for its long-term curation; • Providing Data Management Plans (DMP) for researchers.	• Develop webinars, trainings and on-line networking.
	Expertise	• Offer decision support and customized solutions for solving specific data management problems encountered by researchers.	• Interactive web solutions; • Access to digital repositories; • RFID technology; • Software solutions for data mining, semantic analysis of the documents;
	Curation	• Include persistent storage, assignment of unique identifiers, or metadata creation and management; • Provide technical infrastructure that supports data management throughout the research cycle.	• Web solutions (web page); • Social-media solutions; • Active involvement in university trainings for master and PhD Students (bibliometric research demonstrations and on demand);
Marketing	Advertising and public relation	• Defining library's services portfolio; • Defining the distribution of these services; • Defining which services could be subject to payment (e.g., room, offices or conference facilities rent); • Introducing innovative services as: 3D printing services and trainings.	• Internet for public use and several workstations • Support and promote Open Access, Open Education, and Open Science; • Using digital marketing techniques and social media • Develop innovative marketing content • A business development group must be responsible for external publicity and operation of resources and assets; • The system operation division is specifically responsible for guiding the operation and safeguarding sharing system, and commissioning service management.
Administration	Administrative activities Human resources management	• Use of modern management methods and tools (delegation, leadership); • Re-engineering of human resources management (library staff education through lifelong learning programs).	• Applying talent management technique and creating rich experiences for librarians. • Develop librarian technical/technological skills, related to metadata standards, knowledge of data resources, the use of HTML and XML are needed, nontechnical skills, i.e. communication and project management also are necessary

Source: Authors own development.
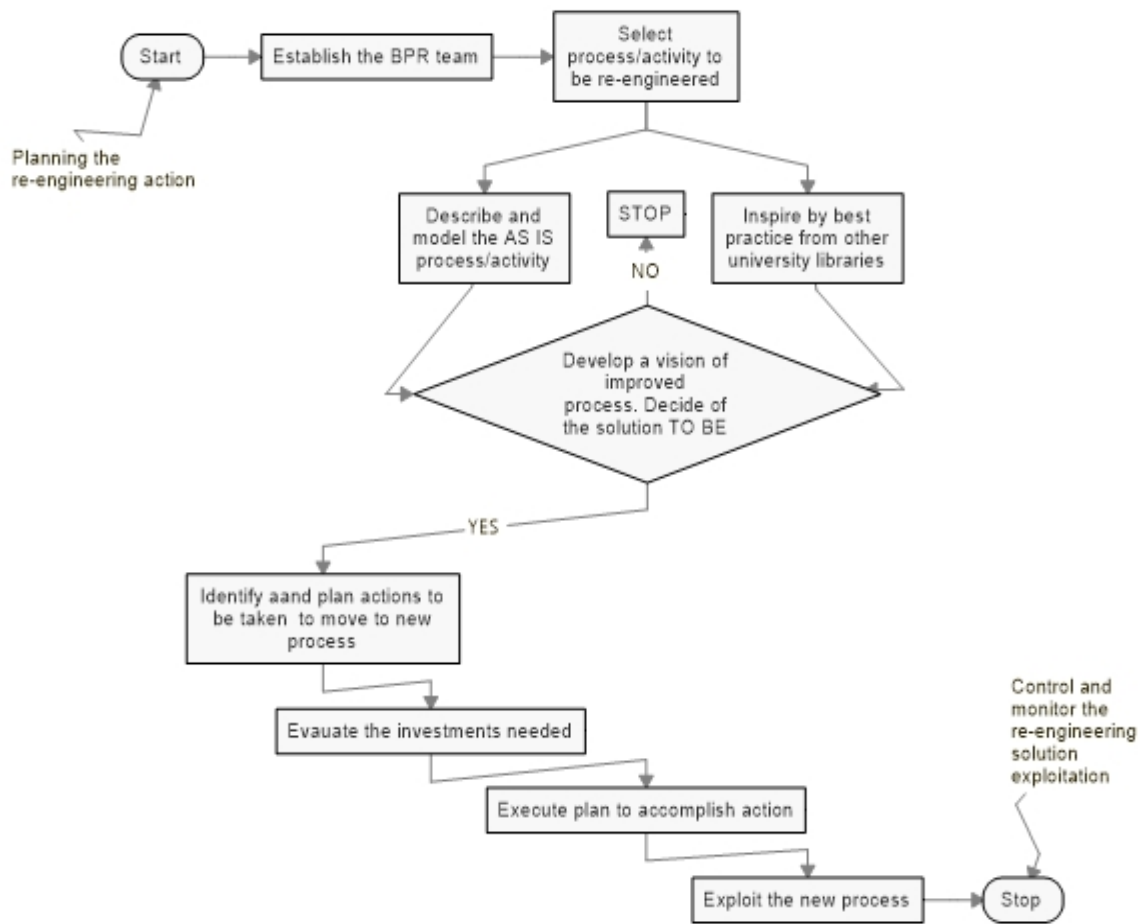
Figure no. 3. Methodology for the re-engineering approach in university library system
Source: Authors own development.

Giving the details of how the re-engineering process will impact different sectors of the university library system in Table no 1, Figure no. 3 present the steps of the methodology for implementation. The difficulties and barriers in applying the described methodology are most described in the research of Chaubey (2017).

Conclusions and recommendations

The present article addressed the challenges that academic library systems meet in achieving their service goals, considering both the trends (nexus of Pinfield et al. (2017)) and the conditions imposes by the pandemic period (even by imagine the post-pandemic restrictions), proposing a framework based on re-engineering.

University library system should adopt BPR to better support their organization's change management (adopt the paradigm of library process oriented) strategies to lead them into the present and the future of Digital Era. This will support continuing increasing of their efficient in user satisfaction (satisfy their expectations in an effective manner). Considering the proposed feasible approach of re-engineering in university library and their associated digital services (that should be representative and dominant in present and the nearest future), it is necessary to re-think on this serious issue and how it will be applied for providing better services to fulfil multidimensional needs of the users.

The paper main contributions are the fulfilment of the knowledge gap identified in the

literature related to the re-engineering approach in university library system and by proposing a feasible way to implement it. In the future work there will be extend the implementation phase with the modelling and simulation of a real process in a university library. The limitation of the present research is determined by the limited number of the university librarian that were consulted for designing of the presented re-engineering approach (related to the INNO3D consortium members).

Acknowledgement

References

Abuarqoub, A., Abusaimeh, H., Hammoudeh, M., Uliyan, D., Abu-Hashem, M. A., Murad, S., & Al-Fayez, F. (2017, July). A survey on Internet of Things enabled smart campus applications. In *Proceedings of the International Conference on Future Networks and Distributed Systems* (pp. 1-7).

Chaubey A.K. (2017). Re-engineering of academic library system: challenges and opportunity. In: Mukhyalal, B.G, Sonawane,S.S., & Khandare R.B. (Eds.), Modern Library Services: Shifting from Print to Virtual, Ess Ess Publications. Retrieved from: https://www.researchgate.net/profile/Ajay_Chaubey4/publication/329209107_RE-ENGINEERING_OF_ACADEMIC_LIBRARY_SYSTEM_CHALLENGES_AND_OPPORTUNITY/links/5bfd0030458515b41d1087c6/RE-ENGINEERING-OF-ACADEMIC-LIBRARY-SYSTEM-CHALLENGES-AND-OPPORTUNITY.pdf (Access 29-12-2020)

Consultus (2017). Business Process Re-engineering, Retrieved from: http://consultus.hr/business-process-reingeneering/ (Access 04-01-2021)

Corpuz, D. A. (2020). Library resources and functional effectiveness of an academic library: meeting the challenges of the digital age. *Humanities & Social Sciences Reviews, 8*(4), 2020, 238-245. Retrieved from: https://core.ac.uk/download/pdf/327122622.pdf (Access 20-12-2020).

De la Peña McCook, K., & Bossaller, J. S. (2017). *Introduction to public librarianship*. American Library Association.

Davenport T. H (1993). Process innovation: Re-engineering work through information technology. Boston, MA: Harvard Business School Press.

Garnes, K., Landøy, A., Repanovici, A., Bagge, B. A., Åsmul, A. B., Kongshavn, H, & Stangeland, E. (2006). *Aspects of the digital library*. Alvheim & Eide.

Grint, K. (1994). Reengineering history: social resonances and business process reengineering. *Organization, 1*(1), 179-201.

Hammer M, & Champy J. (1993). Re-engineering the corporation: A manifesto for business revolution. London: Nicholas Brealy Publishing

Hammer, M., & Champy, J. (2009). *Reengineering the Corporation: Manifesto for Business Revolution, A*. Zondervan.

Horsfall, M. N. (2020). Marketing of Library and Information Services in the Digital Age: Challenges, Strategies and Implications. *Information Impact: Journal of Information and Knowledge Management*, *11*(2), 13-20.

Huang, W. (2020, September). Design of Intelligent Recommendation System of Smart Library under Big Data Environment and Its Application Research in Applied University. In *International Conference on Intelligent and Interactive Systems and Applications* (pp. 628-634). Springer, Cham.

INNO3D (2019). 3D Printing Support Service for Innovative Citizens, an ERASMUS+ KA203 project description, grant no. 2019-1-IE02 KA203-000693. Retrieved from: https://www.inno3d.eu/ (Access 28-12-2020).

Ioryem, T. N. (2020). Public Relations Activities in Academic Libraries: An Image Re-engineering Survey of Francis Sulemanu Idachaba Library, University of Agriculture Makurdi, Nigeria: Public Relations Activities in Academic Libraries: An Image Re-engineering Survey of Francis Sulemanu Idachaba Library. *International Journal of Knowledge Dissemination*, *1*(2), 99-106.

Koehler, W. (2015). *Ethics and values in librarianship: A history*. Rowman & Littlefield.

Koltay, T. (2019). Accepted and emerging roles of academic libraries in supporting research 2.0. *The Journal of Academic Librarianship*, *45*(2), 75-80.

Kumar, B. (2014). Re-Engineering of Academic Library Services in Context of its Marketing and Promotion. *International Journal of Innovative Research & Development*, *3*(12), 87-90.

Lyon, L. (2012). The informatics transform: Re-engineering libraries for the data decade. *International Journal of Digital Curation*, *7*(1), 126-138.

Lyon, L. (2016). Librarians in the lab: Toward radically re-engineering data curation services at the research coalface. *New Review of Academic Librarianship*, *22*(4), 391-409.

Mattern, E., Brenner, A., & Lyon, L. (2017). Learning by teaching about RDM: an active learning model for internal library education. *International journal of digital curation*, *11*(2), 27-38.

Mehta, D., & Wang, X. (2020). COVID-19 and digital library services–a case study of a university library. *Digital Library Perspectives*.

Okike, B. I. (2020). Information dissemination in an era of a pandemic (COVID-19): librarians' role. *Library Hi Tech News*. Retrieved from: http://palevel.unza.zm/bitstream/handle/123456789/6573/10-1108_LHTN-04-2020-0040.pdf?sequence=1&isAllowed=y (Acceess 21-12-2020).

Ozeer, A., Sungkur, Y., & Nagowah, S. D. (2019, December). Turning a Traditional Library into a Smart Library. In *2019 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)* (pp. 352-358). IEEE.

Paraschiv P. (2017). 10 innovative technologies to implement at the library of the future. Retrieved from: https://princh.com/8-technologies-to-implement-at-the-library-of-the-future/#.YB23ougzbDc (Access 07-01-2021).

Pinfield, S., Cox, A., & Rutter, S. (2017). Mapping the future of academic libraries: a report for SCONUL. Etrived from: http://eprints.whiterose.ac.uk/125508/1/SCONUL%20Report%20Mapping (Access 07-01-2021)

Proxcel (2020). Business Process Reengineering | Let's Improve. Retrieved from: https://www.proxcel.in/blog/business-process-reengineering-lets-improve/ (Access 04-01-2021).

Ragon, B. (2019). Alignment of library services with the research lifecycle. *Journal of the Medical Library Association: JMLA*, *107*(3), 384.

Tyagi, S., & Sharma, S. K. (2018). Re-engineering of Library in Digital Environment. *Library Progress (International)*, *38*(2), 325-331.

Walsh, B., & Rana, H. (2020). Continuity of Academic Library Services during the Pandemic. The University of Toronto Libraries' Response. *Journal of Scholarly Publishing*, *51*(4), 237-245.