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TEKNOLOGI
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Cawangan Kedah
Kampus Sungai Petani

Voice of Academia

Academic Series of Universiti Teknologi MARA Kedah

VoA 2021
Volume 17 Issue 2

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e-ISSN: 2682-7840



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INDUSTRIAL REVOLUTION 4.0 & ACADEMIC LIBRARIANS: WHERE ARE WE NOW?

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ARTICLE INFO

Article history:

Received Dec 2020
Accepted Mac 2021
Published June 2021

Keywords:

Attitudes, competencies, IR
4.0, knowledge, skill,

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ABSTRACT

Competencies that comprised of knowledge, skills and attitudes are widely changing especially in the era of IR 4.0. Malaysians nowadays are trying to be parallel with the existence and transformation of sophisticated and challenging technology particularly in academic library's environment. These technologies will help the academic librarians to enhance the library's service for the users' needs. Managing academic librarians is not an easy task as to ensure users can get access to the library's services and materials with comfort and successfully especially in IR 4.0 era. This conceptual paper comprises how academic librarian presenting the knowledge, skills and attitudes in Industrial Revolution 4.0 (IR4.0).

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1. Introduction

A profession of academic librarian has a job scope that requires them to have a special set of competency to work in the academic library. In general, there are many types of library with different terms of services, products and users and each is not only performing the same duties but depends on the type of library they employed. For example, an academic librarian, usually entertains students, gives lectures and does research focusing on fulfilling the needs of teaching, learning and research activities. The extremely changes of information and information technology (ICT) and services require a certain level of competency from academic librarians in facing challenges at different levels of technologies in their surrounding.

The emergence of Industrial Revolution (IR 4.0) in the industries has changed various aspects of work processes and job practices. Changes and added value in the structure of information and communication technology (ICT) have also affected professional competencies in various fields including academic librarian. In addition, the challenging information and research landscape of

universities require diverse competencies in information professionals, especially academic librarian. The academician has great expectations from academic librarians in providing proactive services to support their research, teaching and training programs. Such expectations generate a need for academic librarians to enhance their competencies.

2. Literature Review

The term IR 4.0 was first mentioned in 2011 in Germany as a suggestion for the betterment of the new economic policy of Germany, which was based on high technological strategies (Mosconi, 2015). The most significant clarification of IR 4.0 is from Roblek et al., (2016) which assumed that data and information will be shared among the machines. The new concept of IR 4.0 includes technology based tools such as cyber-physical systems (CPSs), cloud storage and Internet of Things (IoT). Moreover, continuous communication via the internet enables sharing and exchange of data and information not only among humans but also between humans and machines and among machines themselves. Similarly, Shahroom and Hussin (2018) also believed that IR 4.0 is controlled by artificial intelligence and digital physical frameworks that make human-machine interface more universal and has changed the landscape of educational innovation.

Competencies which comprised knowledge, skills and attitudes can also be defined in more terms of skill-oriented behavior and observable actions measured against quantitative standards as the competence is judged on the basis of whether or not learned mental and physical tasks can be performed (Mohanty & Dass, 2014). Based on Hirsh (2012), academic librarian should have an ability to adapt every changing environment with library. In the same way, each academic librarian is required to equip themselves with the applicable competencies that will assist them in designing and creating the information and producing resources which can help the library's users meet their needs especially for students and academicians in the university environment. This is relevant with the statement by Okoye (2013) which urged academic librarian should always reflect on their acquired competencies and reflect actively with new changes in the library.

In doing so, there are too many levels of skills, knowledge and behavior that need to be learned by academic librarians. They should also have a knowledge and understand the administration of managing virtual and digital library. In the same light, they should understand the concept of the technology and application that will assist the library to publish reference materials electronically plus to perform the library as a modern outlook. This scenario is congruent with Okoye (2013) which stated that new and more sophisticated information and communication technology products and applications are being introduced and appropriated in library's landscape.

In the same way, knowledge and skills are also essential in completing the competencies needed by the academic librarians. Rapid changes in technology and associated shift in research and scholarly communication at university library has affected the level of knowledge and skills of academic librarian (Schmidt et al. 2016). For the purpose of delivering good and high quality of services and products to users, a librarian needs to have proper planning to deliver quality of instruction to users in different format of styles and needs where they should be able to explore a broad range of print, graphic, audio-visual of resources and communications skills (Anyim, 2018).

3. Problem Definition

Industrial Revolution (IR 4.0)

IR 4.0 can be defined as humans meet the cyber world, where technology and people are not distinct. In addition, technology and people will become integrated, customized and smart-automated. In UiTM, the advancement of ICT in IR 4.0 era can be considered as the influencing factor of good characteristic of graduates in which the element of soft skills, competencies, creativity and multi-tasking become the main factors to be improved as to meet industry needs. Based on Afizan (2019), academicians should accept the student's perspective in exploring and learning new things in IR 4.0 era. They should stimulate themselves to discover new values added that existed in whatsoever working climate change. Saunah (2019) also agreed that academicians and students should not only have to upskill themselves, but they must also learn new skills and challenges delivered by IR 4.0 and learn to cope with the changes. In doing so, changes in technology and higher education should be managed intelligently by all stakeholders as to improve the graduate employability.

Universities have to give high priority and focus in improving learning and teaching environment, syllabus, curriculum, quality of academicians and the development of digital access which are pertinent in IR 4.0 development. Afizan (2019) also added that universities' students should not only smart in finding information to support their academic performance but also capable to use their wisdom to optimize knowledge as the main challenge in facing IR 4.0. Based on this proposed study, the researcher expected that academic librarians need to publish understanding and efforts on how to produce global and competitive students in IR 4.0 challenge that would be taken as a guideline of best practices in their daily responsibilities.

In relation to Malaysian higher education system, IR 4.0 required higher qualification graduates to be working in this new era. According to Maria, Shahbodin & Pee (2018) there is a term arose among the researchers and education practitioners which is Education 4.0. This is the starting point of education system to reshuffle and aligned with IR 4.0. Based on Malaysia Education Blueprint 2015-2025 for higher education, it is suggested that students have to learn other global languages. Secondly is to acquire thinking skills, which refers to the importance of possessing critical and innovative thinking, and entrepreneurial mind set. While the third point is knowledge where students are expected to understand well the field they studied, able to utilize and apply the knowledge on solving problem in real world. For this reason, there are some programs and technologies involved in redesigning higher education system in Malaysia which are CEO@Faculty, 2u2i, and MOOC. According to this scenario, the researcher expected that the academic librarians should bring their roles and efforts to support those programs by giving valuable guidance and information and awareness on industrial field; and assist the students and academicians to collect, share and utilize the materials needed in the learning process by applying technological and ICT approaches.

According to Chang & Huynh (2016) and Noh (2015), academic librarians are advised to examine the suitability and necessity to restructure the business process flow especially the ones that are involved with removing any outdated and manual processes that slow down the efficiency of service delivery to students. It is time to deploy high automation capabilities in any process levels. Noh (2015) also added that one of the most common effects of technology is the ability for academic librarian to work on mobile, allowing them to participate more with their users.

In this light, current changes in IR 4.0 era in library technologies reflect and are congruent with Library 4.0 which are described in the context of intelligent system, Makerspace, context-aware technology, Open Source, Big Data, Cloud Service, Augmented Reality, State-of-the-art Display, and Librarian 4.0. In complement with this statement, a study by Muhammad Akmal & Rabihtul (2018), highlighted that academic librarian should create new attributes of skills and improvise themselves by learning new knowledge with a determination to change the working styles that meet the 4th IR trends especially in information services. Hence, academic librarians should continuously be prepared to empower students in terms of knowledge and skill capabilities, especially by making them understand how the technology works and become technology literate so that they are able to use the knowledge properly and wisely.

Information & Communication Technology (ICT) & Library Application

Roles and responsibilities of academic librarians are rapidly changed based on the advancement of ICT. Recently, new and more sophisticated information and communication technology products are being introduced and applied into the profession of librarians (Okoye, 2013). The study by Okoye (2013) revealed that academic librarians have not acquired core ICT based competencies. This scenario has become one of the challenges for academic librarians especially working in universities.

In such scenario, students arrive on campus with their information seeking habits of new sources and new technologies (Ross & Pongracz, 2008). Therefore, the skills in managing and applying new technologies in academic library become necessities not only in assisting students but also in academic activities. According to Ross & Pongracz (2008), transformation technologies and the behaviors they engender have rapidly changed the creation and distribution of scholarly journals, data and other research outputs. In this light, the roles of academic librarians are not only to deal with the technologies but also to deal with students and academicians. Similarly, study by Kaba (2017) revealed that academic librarians have new challenges that related to information technology and communication skills. As a result, knowledge and skills of academic librarians should be changed as what has been mentioned by Okoye (2013) which assumed that the environment surrounding librarian has changed dramatically and yet the roles of academic librarians when performing their responsibilities should be pertinent with the new setting.

On the other hand, the advancement on new ICT and technologies in library system need academic librarians to acquire skills and knowledge of selecting proper vendors, skills on analyzing a library software and knowledge on library software application. Many cases involving the complications and problems due to the lacking of skills and knowledge have been discovered in many academic libraries. As for example, 18.8% of the libraries had converted their databases to new software but had faced problems of data loss (Omeluzor & Oyovwe-Tinuoye, 2016). Similarly, studies by Osaniyi (2010), Omeluzor et al. (2012) and Mbakwe and Ibegbulam (2014) revealed that Nigerian academic libraries are faced with several challenges in the application and use of integrated library system, including virus attack, poor state of power supply, maintenance culture, vendors' lack of support and lack of training.

Other factors that hinder the application and use of integrated library system include insufficient funding of library software, poor infrastructure, retrospective conversion of information materials into digital form, unavailability of library software experts and insufficient training programs for staff on the use of library software. Besides, the researcher found many evidences such as suggestion from Osaniyi (2010) and Omeluzor et al (2012) which stressed the need for libraries to determine the strength and capability of any automation software in managing their library

collections as well as the cost before adoption and use. In addition, Hassan (2016) have argued that vendors' attitudes towards supporting their clients were unacceptable. Furthermore, they noted that commercial vendors do not have any incentive to offer their software at nominal cost or free, while some software have failed due to inherent problems and virus attack (Omeluzor et al., 2012). From these statements, it can be concluded that academic librarians should acquire sufficient skills and knowledge in handling library software and applications as well as managing external vendors intelligently.

As part of ICT and library applications, the elements of media generated from various electronic sources should be pondered. According to Schmidt et al. (2016), the advantages of digital library are allowing the library to become user friendly and increasing the present era of data collection and knowledge information. Librarians nowadays are needed to manage different types of information and data with the wealth of information for further explorations and exploitation based on digital methods and tools. These skills and competencies will build up the librarians to a proper level of research degree staff in the initiatives of open science, research data management, digital curation, digital humanities, e-Research and data science.

Issue on Marketing Library Materials & Services

One of the important skills in academic library is marketing the library materials and services. Study by Garoufallou, et al (2013) found that the spread of marketing library services in 151 Greek academic libraries proved to be limited but the majority of Greek academic librarians realized the importance of marketing. According to Rowley (2000) and Ewers & Austen (2004) marketing in library involved of viewing their user's identity and understand his/her needs and demands then adopt marketing strategies to meet those needs. Recently, an increasing number of online resources related to library marketing also emerged.

This trend provides many opportunities to academic librarians in marketing their library materials. Slebodnik (2006) in her study collected important web sources on library marketing that could help academic librarians develop their own marketing and outreach programs. In this light, Web 2.0 tools (blogs, wikis, social networking websites) offer academic libraries a set of technologies where every user is able to contribute content (Anderson, 2007), creating a shared network space that promotes, research, collaboration, education, entertainment and social activities (Storey, 2006).

According to Garoufallou, et al (2013), marketing activities in academic libraries include creating brochures, leaflets & pamphlets; website; user orientation seminar; e-mail; posters; bookmarks; announcement in press or local media; online newsletter; bulletin / newsletter (printed); books presentation / exhibitions; postcard and many others. Similarly, free web access to information through search engines (like 'Google' which employ simple and user friendly interfaces) have created new challenges for those involved in the marketing of information service (Kumbar, 2004; Broady-Preston et al., 2006; Schmidt et al., 2006; Garoufallou et al., 2008).

With this concern, the researcher assumed that marketing initiatives by academic librarians will also be influenced by their knowledge, skills and attitudes. This study will also scrutinize on the experiences by academic librarians in recent developments of new ideas especially on how they market digital library services, developing institutional repositories, incorporating Web 2.0 and social media tools in the IR4.0 atmosphere.

4. Research Methodology

The researcher determined that sequential exploratory strategy is the most suitable mixed methods design for this study which was conducted in two phases and characterized by the collection and analysis of qualitative data (unstructured interview) followed by the collection and analysis of quantitative data (survey questionnaire). Due to this and after considering the nature of this study, the exploratory design suggested by Creswell and Plano Clark (2007) was felt most appropriate. The design consists of a two-stage approach, preceded with qualitative data to explore a phenomenon and followed by the quantitative data. On the other hand, Creswell (2014) stated that mixed methods generally not only display the advantages of both quantitative and qualitative methods, but also display some limitations as they need more time, financial resources and coordination, and especially an in-depth methodological knowledge. Table 4.1 shows the research objectives and research questions for this study.

Table 4.1: Research Objectives and Research Questions

No.	Research Objectives	Research Questions
1.	To assess the required technical competencies of academic librarians in IR 4.0 era	What are the required technical competencies of academic librarians in IR 4.0 era?
2.	To assess the required general competencies of academic librarians in IR 4.0 era	What are the required general competencies of academic librarians in IR 4.0 era?

The first phase of data collection involves unstructured interview with three head of librarians from Perpustakaan Tun Abdul Razak (PTAR) of UiTM Kedah, Penang and Perlis. All interviews' transcriptions will be categorized to identify the themes and patterns. In the second phase, a survey questionnaire will be applied at 35 PTAR's branches of all UiTM campuses which comprises of 102 academic librarians. The data transcriptions from unstructured interviews will be coded into software NVivo Version 12 for the analysis. The analysis will involve the process of coding textual data; review and recode coded data, search for combinations of words in the text or patterns by theme and analyze the existence and frequency of concept in a text. A survey questionnaire by using five-point Likert scale will be adopted to address the second and third objective of the study. SPSS for Windows Version 25 will be used to analysis quantitative data collected and will be reported using appropriate statistics including frequency counts, percentage, means and standard deviation.

Table 4.2, 4.3 and 4.4 present a total of 63 items in survey questionnaire covering the elements of knowledge, skills and attitudes will be tested for seeking the (i) level of knowledgeable, skillful and attitudes of competency and (ii) requirement level of knowledge, skills and attitudes of competency.

Table 4.2: List of Knowledge

No.	Element of Knowledge	Authors
1	Enterprises System	Sallati et al (2019)
2	Data Security And Protection	Kazancoglu & Ozkan (2018), Sung (2018), Sallati et al (2019), Manavalan & Jayakrishna (2019),
3	Knowledge Management	Li et al (2019), Dalmarco et al (2019), Manavalan & Jayakrishna (2019)

4	Big Data Analysis	Frederick (2016), Dalenogare et al (2018), Muhammad Akmal & Rabihtul (2018), Dalmarco et al (2019)
5	Cloud Technology	Kroski (2009), Frederick (2016), Dalenogare et al (2018), Muhammad Akmal & Rabihtul (2018), Tosello et al (2019), Dalmarco et al (2019)
6	Artificial Intelligence	Tosello et al (2019), Hussain (2019)
7	Robotics & Simulation	Frederick (2016), Tosello et al (2019), Dalmarco et al (2019)
8	Data Analytic	Sung (2018)
9	Internet Of Things (Iot)	Manavalan & Jayakrishna (2019)
10	Servers Management	Ratledge & Sproles (2017), Sallati et al (2019)
11	Organizational Knowledge	Li et al. (2019)
12	Virtual Reality Technology	ALA (2014), Liagkou et al (2019)
13	Cyber Physical System	Dalmarco et al (2019)
14	Cyber Security	Dalmarco et al (2019)
15	Digital Technologies	Ratledge & Sproles (2017), Dalenogare et al (2018), Muhammad Akmal & Rabihtul (2018), Montgomery (2018)
16	Intelligent System	Muhammad Akmal & Rabihtul (2018)
17	Context-Aware Technology	Muhammad Akmal & Rabihtul (2018)
18	Open Source	Muhammad Akmal & Rabihtul (2018)
19	Augmented Reality	Muhammad Akmal & Rabihtul (2018)
20	Mobile Technology	Ratledge & Sproles (2017), Muhammad Akmal & Rabihtul (2018)
21	Social Media	Hussain (2019)
22	Electronic Resource Management	Ratledge & Sproles (2017)
23	Instructional Technology	Ratledge & Sproles (2017)
24	Web Technology	Ratledge & Sproles (2017)
	Library Technical Services	Omeluzor & Oyovwe-Tinuoye (2016)
	Intellectual Property	Huang & Lai (2009)

Table 4.3: List of Skills

No.	Element of Skills	Authors
1	Decision Making	Muhammad Akmal & Rabihtul (2018), Dalmarco et al (2019)
2	Communication	Choi & Rasmussen (2006), Ratledge & Sproles (2017), Muhammad Akmal & Rabihtul (2018), Kadir et al (2019), Sallati et al (2019)
3	Virtual Communication	Sallati et al (2019)
4	Computer Programming	Tosello et al (2019)
5	Research	Montgomery (2018), Sallati et al (2019)
6	Networking	Sallati et al (2019)
7	Media	Sallati et al (2019)
8	Language	Sallati et al (2019)
9	Labor	Ancarani et al (2019)
10	Goal Seeking	Hidayatno et al (2019)

11	Analytical	Sallati et al (2019)
12	Logic	Sallati et al (2019)
13	Administrative	Kabugo et al (2019)
14	Problem Solving	Kadir et al (2019)
		Sallati et al (2019)
15	Brainstorming	Muhammad Akmal & Rabihtul (2018)
16	Collaboration	Dalenogare et al (2018), Sung (2018), Montgomery (2018), Hidayatno et al (2019), Sallati et al (2019)
17	Marketing	Muhammad Akmal & Rabihtul (2018), Montgomery (2018)
18	Customer Relationship	Muhammad Akmal & Rabihtul (2018)
19	3D Printing	Frederick (2016)
20	Budget Management	Dzandza & Akussah (2018)

Table 4.4: List of Attitudes

No.	Element of Attitudes	Authors
1	Self-Confidence	Kazancoglu & Ozkan (2018)
2	Emotional Steadiness	Kazancoglu & Ozkan (2018)
3	Innovative	Muhammad Akmal & Rabihtul (2018), Montgomery (2018), Ancarani et al (2019)
4	Flexibility	Muhammad Akmal & Rabihtul (2018), Ancarani et al (2019), Dalmarco et al (2019)
5	Competitive	Ancarani et al (2019)
6	Motivation To Learn	Sallati et al (2019)
7	Reliability	Sallati et al (2019)
8	Responsibility	Sallati et al (2019)
9	Integrity	Muhammad Akmal & Rabihtul (2018)
10	Change Management	Montgomery (2018)
11	Influencing	Montgomery (2018)
12	Negotiation	Montgomery (2018)
13	Creativity	Montgomery (2018)
14	Sensible Behavior	Kadir et al (2019)
15	Social Behavior	Kadir et al (2019)
16	Community Engagement	Muhammad Akmal & Rabihtul (2018)
17	Leadership	Kazancoglu & Ozkan (2018), Muhammad Akmal & Rabihtul (2018), Sallati et al (2019)

5. Conclusion

Universities have to give high priority and focus in improving learning and teaching environment, syllabus, curriculum, quality of academicians and the development of digital access which are pertinent in IR 4.0 development. University's students should not only smart in finding information to support their academic performance but also capable to use their wisdom to optimize knowledge as the main challenge in facing IR 4.0. Based on this proposed study, the researcher expected that academic librarians need to publish understanding and efforts on how to produce global and competitive students in IR 4.0 challenge that would be taken as a guideline of best practices in their daily responsibilities. In doing so, academic librarians should be well-

equipped with extension of certain knowledge area and always be responsive with the trends and types of managing information, as well as new technologies and applications. As a result, this study will be assessing the current level and requirement of competencies and will become a guideline for academic librarians of PTAR in performing their daily routine tasks and responsibilities especially in IR 4.0 era.

Acknowledgement

The authors are grateful to acknowledge and express their gratitude to all academic librarians at 35 Perpustakaan Tun Abdul Razak (PTAR) of UiTM branches for their cooperation and kindness during the process of data collection. The authors also would like to thank the two anonymous reviewers for their helpful comments on the earlier draft of this manuscript and also Voice of Academia, UiTM Kedah for providing the valuable opportunity to publish this paper.

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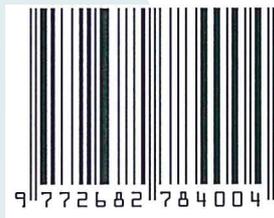
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ISSN: : 1985-5079

