ISSN 2278-3091
Volume 8, No.1.6, 2019
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse5181.62019.pdf
https://doi.org/10.30534/ijatcse/2019/5181.62019

Industrial Revolution Reshaping Repetitive Task in Digital Workplace

Mohamad Kamal Md Dahlan[1], Natrah Abdullah[2], Ahmad Iqbal Hakim Suhaimi[3]
[1]Faculty of Mathematics and Computer Sciences, UiTM, Shah Alam, Malaysia kamaldahlan@gmail.com
[2]Faculty of Mathematics and Computer Sciences, UiTM, Shah Alam, Malaysia natrah@tmsk.uitm.edu.my
[3]Faculty of Mathematics and Computer Sciences, UiTM, Shah Alam, Malaysia aiqbal@tmsk.uitm.edu.my

ABSTRACT

Industrial revolution has changed the history of humanity. It has been the game changer of modern human history. The revolution has also altered our lives and work as well. Digital workplace for instance has becoming a new way of working style in today's working workforce. With the IR4.0 strategy initiative, advanced technology has accelerated the evolution of the digital workplace environment in the organization. Despite, the digital workplace is an alternative way of working concept, we found that there still lack of discussion on type of task which related to the digital workplace. Therefore, this paper is: (1) to investigate and identify type of task related to the digital workplace, (2) to discover task involvement during Industrial Revolution until today, (3) also discussed in this paper is to identify relationship between technology and task in organization. The study involved several methodology processes in overviewing and retrieving literature reviews from previous studies on task related to the digital workplace. From our findings, repetitive task and automation are identified as type of task in the digital workplace. Besides that, we found that task involvement in workplace changes since the beginning of Industrial Revolution. Also, we noted that there is a positive relationship between technology over task. The relationship would impact on the way task is done.

Key words: Digital Workplace; Repetitive Task; Automation; Workflow Automation; Digital Automation Process; Industrial Revolution

1. INTRODUCTION

Industrial revolution has changed the history of humanity. It has been the game changer of modern human history. The revolution has also altered our lives and work as well. Digital workplace for instance has becoming a new way of working style in today's working workforce. It about the use of advanced technology to help employees to work in a mobile or virtual workplace environment [24]. Many scholars defined digital workplace differently. Among the popular definition is; the digital workplace is the virtual, digital equivalent of the physical workplace [24]. With IR4.0 strategy initiative, technology advanced such as Cloud Services, Artificial Intelligence (AI) has accelerated the evolution of digital workplace environment in the organization. Meanwhile, task involvement has change from repetitive to automation. Starting from Industrial Revolution 1.0 until Industrial Revolution 4.0, we have can see the transition of task from repetitive based task towards automation. Automation can be used in many ways, such as managing & tracking [6] records, organizing [7] & share documents, creating task as well as supporting customer service. Automation also helps organization to visualize, understand as well as improve business process by allowing information to be shared, accessed, edited and stored through cloud computing services [9] while working in a remote areas. The changes of task from repetitive to automation not only benefits on employees but also to the organization as a whole. Among the benefits of automation are support everyday activities [18], remove human error, improve quality and speed [12], increase work performance [13], accuracy [12], productivity [17] as well as consistency [17]. Despite, the digital workplace is an alternative way of working concept, we found that there still lack study on type of task related to digital workplace practices [1]. Therefore, this study is: (1) to investigate and identify type of task related to the digital workplace, (2) to discover task involvement in the workplace since the beginning of Industrial Revolution until today, (3) also discussed in this paper is to identify relationship between technology and task in organization. The study involved several methodology processes in overviewing and retrieving literature reviews from previous studies on task related to the digital workplace. From our findings, repetitive task and automation are identified as task involvement in the digital workplace. Meanwhile, we found that task involvement in workplace changes since the beginning of Industrial Revolution. Also, we noted that there is a positive relationship between technology over task.

2. RESEARCH METHODOLOGY

To get a comprehensive overview of type for task-related in the digital workplace, firstly, we have conducted extensive literature reviews. The first step in our literature is the definition of a search term. Since the terminology used for digital workplace has changed over the years, we included several terms such as digital transformation and future works that are related to our understanding of digital workplace. Secondly, we then continued searching term by finding type of task involved in digital workplace. In this part, we used several keywords such as repetitive task, automation, workflow automation and business process automation (BPA). Also, we used several synonyms for 'impact' such as effect or result, to be able to retrieve all articles that describe the outcome or benefit of task automation. Meanwhile, to identify task involvement during Industrial Revolution, we used search term such as Industrial Revolution, IR1.0, IR2.0, IR3.0 and IR4.0. Lastly, to identify relationship technology and task, we search article related to technology, work and disruptive technology. The above search term was applied to all search engines subsequently: (i) ResearchGate, (ii) SpringerLink, (iii) ScienceDirect, and (iv) Google Scholar (v) SAGEPub (vi) SemanticsScholar (vii) IJATCSE Journal. SpringerLink, ScienceDirect, SAGEPub, IJATCSE Journal, and SemanticsScholar is a search engine that mainly found journal articles, ResearchGate has a wider article base and also includes conferences and workshops proceedings. Finally, Google Scholar was added to broaden the scope even further and to also find more recent articles as well as books that may be of interest to look into. Result from the term search, 27 articles were found respectively. The literature then were scanned for relevance based on title and abstract. Irrelevant articles were removed from the literature list. Thus, a total of 24 relevant articles were found from the search engines. Next step is summarize the content of our findings and classified based on categories.

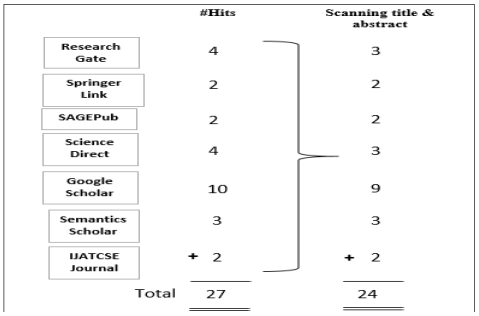

Figure 1: Methodologies process on retrieving articles

3. RESULT AND FINDINGS

From our literature reviews, we have identified two main types of task related to digital workplace: Repetitive, Automation (see Figure 2). From the perspective of repetitive and automation task, there are many studies exist that the emerging technologies has change daily routine task on operation and administration into automation and do have impact on organizational efficiency and effectiveness as well as performance.

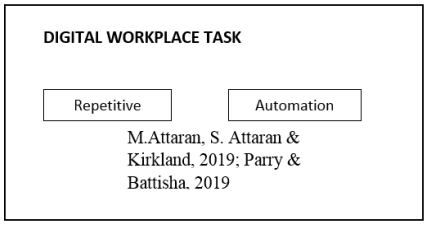

Figure 2: Type of task related to Digital Workplace

3.1 Repetitive Task

One of the main strategies of IR 4.0 is to change or eliminate repetitive task into automation. In this case, repetitive task can be made automated which means replacing traditional processes such sending emails and memos into automated based task. With the advanced technologies tools, task that employees do manually can be automated using unified platform to manage all the daily activities, plus the use of mobile technologies allows task can done whenever and wherever they located. In the past ten years, office work has been shifting from repetitive tasks to knowledge-based, flexible, and adaptive tasks [2]. It has been proven that employees waste significantly less time and company resources when they have access to the right information at the right time, and by working under productive work practices [2]. Repetition task can be defined, as an activity or specific action that is repeated or performed over and over again in the workplace. In the organization, repetitive task such as approving, submitting requesting, sorting as well as managing is a daily routine task for every employee in an organization. These tasks actually can cause significant delays in getting real work done. Therefore, by changing the way they work into automation can help employees to cut down on the number of hours spent dealing with busy work and at the same time remove human error. Repetitive task such as request which from customer would take time to answer or to fulfill the request. An automated smart chatbox can solve the problem in real-time which no need to take a time delay. Besides that, coordinating task may also bring problem headache to the employees to handle. Coordinating task referring to coordinate job between

teamwork to ensure organizational success. This include coordinating a new coming officer who come for report duty. Human Resource Department (HRD) must coordinate with other departments to ensure the process of onboarding goes as quickly and smoothly as possible. However, reference [3] mentioned vice versa on the impact of automation where can cause job unemployment. This is due to the current task performed by employee is replaced by machine.

3.2 Automation

Meanwhile, automation is a technology that can perform tasks that were previously performed by humans. Reference [4] identified automation is about focusing on systems that operate autonomously, often in structured environments over extended periods, and on the explicit structuring of such environments. Automation mainly being used in several areas such as information technology, manufacturing, transport as well as operations. In information technology, automation focuses on workflow processes. It is a new breed of information technology designed to automate business processes by coordinating and controlling the flow of work and information between participants [5]. Automated workflow is used to enhance everyday business processes because when business workflows, you can concentrate by focusing on the things that matter. It also allows teams to spend more time on the actual work itself and less time on the processes that support them. The idea of automating the transmission of documents from person to person in an organization first is insurance claims processing [6]. Since that time, many workflow systems have been introduced and other technologies such as document management systems, call centers, and Enterprise Resource Planning systems (ERP) have developed workflow capabilities [6]. Automated workflow can be used in many ways, such as managing & tracking records [6], organizing [7] & share documents, creating task as well as supporting customer service. With automated workflow, the task can be done easily without human intervention or with human intervention. In the case of digital workplace, the term of digital automation is referring to the use of unified or integrated advanced technology tools such as social, mobile, cloud computing services, IoT and analytics to perform a process or process to accomplish a workflow. Since digital workplace is based on virtual working style, digital automation workflow can replace current traditional workflow, whilst allowing future flexibility to support changes in the business environment [8]. Digital automation workflow also helps organization to visualize, understand as well as improve business process by allowing information to be shared, accessed, edited and stored through cloud computing services [9].

Table 1: Literature reviews on benefits of task automation

No.	Benefits of automation	Author(s)
1.	Automation can save time in parts of the hiring process particularly repetitive high-volume tasks that improve labor market efficiency [11].	Balliesterand & Elsheikhi
2.	Automation can increases productivity and thereby causes jobless [3].	Vermeulen, Kesselhut, Pyka & Saviotti
3.	Automation of activities can enable businesses to improve performance, reducing errors, improving quality and speed [12].	McKinsey & Company
4.	To embrace automation, education and training skills is a must in order employee to engage more comprehensively with machines as part of their everyday activities [12].	McKinsey & Company
5.	Machines able to substitute for humans in the performance of daily task [13]	Healy, D. Nicholson & Gahan
6.	The role technology is playing in changing task and organizations [10].	Cascio & Montealegre
7.	Intelligent automated systems are essential to execute complex tasks such as situation assessment and decision-making [16].	R.Breton & É. Bossé
8.	Automation can improve operator performance and reduce workload [17].	S. I. Chen, T.A.W. Visser & S.Loft
9.	Automated systems are used to support more and more everyday activities [18].	C.P.Janssen, S.F. Donker, D. P. Brumby & A.L.Kun
10.	Suitable computer tools can automate many educational tasks, and thus allow both educators and students to devote a lot more of their time to actual teaching and learning [19].	D.L.Lamar, M.L.Richards on & B.Carlson
11.	The benefits of Robotic Automatic Process on task are accuracy, improved employee morale, productivity, reliability, consistency, non-invasive	A. Asquith & G. Horsman

	technology, compliance and a low technical barrier [20].	
12	Automation of farming practices has proved to increase the gain from the soil and also has strengthened the soil fertility [21].	K.Jha, A.Doshi, P. Patel & M. Shah

3.3 Industrial Revolution

Industrial revolution has changed the history of humanity. It has been the game changer of modern human history. The revolution has also altered our lives and work as well. The impact makes people began to behave and organize themselves in a new way. There are four industrial revolutions which are taking shape right before our very eyes. The industrial revolution started since 1760s until now. There are Industrial Revolution 1.0 (IR1.0), Industrial Revolution 2.0 (IR2.0), Industrial Revolution 3.0(IR3.0) and Industrial Revolution 3.0(IR4.0)

3.3.1 Industrial Revolution 1.0 (IR1.0)

The Industrial Revolution, now also known as the First Industrial Revolution, was the era where new series of the invention of manufacturing processes were first introduced in Britain, then spread across Europe and the United States (1760 – 1840). Many people consist of men, women, and children were migrated from rural lifestyle areas to cities to search for a job. Jobs that involved during the era were coal mines and factory work. The first industrial revolution leads to the invention of new manufacturing processes where transition included changing from hand production methods to machines, and the use of new basic material such as steel and iron, and steam power. During this period, human and machine worked side-by-side in producing mass quantities of products. Not like the traditional way where products were produced relied on human labor. Workers were placed in factories as the working place and factory system was introduced to segregate workers based on their specialization. The strongest and most immediate impact due to the industrial revolution was the textile industry. High demand for textile was on the rise all over Britain caused production increased. Workers that worked in factories operated spinning equipment such as spinning jenny and power loom could run up to 24 hours a day, 6 days a week and typical shift 10-14 hours. Meanwhile, the introduction of new basic materials such as iron, coal mines and new energy resource - steam power had contributed to the developments in transportation and communication. During this development, many workers were needed to build railway line for locomotive, producing iron and coal mines activities. Thus, the impact of invention not only could increase productivity but also at the same time provided more jobs to people.

3.3.2 Industrial Revolution 2.0 (IR2.0)

Industrial Revolution 2.0 began in the middle of 19th century (1870 – 1914). Second Industrial Revolution is a phase where introduction of mass production with the help of steel, electrical, gas and oil energy. The new energy was replacing the old energy - iron, and steam. The development of new technologies led to the introduction of two things that would change the world: public transport such as trains, automobile, and bicycles, communications such as telegraph and radio. During the period, more and more workers were recruited from all over places. The manufacturing sector expanded from 2.4 to 10 million workers and manufacturing employment grew more than twice as fast as the workforce as a whole from the years 1880 to 1920 [14]. Major productions were goods and steels. Steel became the major material used for the manufacturing of tools, bridges, and railroads, while factory's machines were operated using electrical energy compared to the previous one. More railway lines were linked using steel materials to expand transportation. The locomotive which widely used during the era, has becoming the medium to transfer production from the factories. Thus, with the additional labor force, mass production and structured infrastructure have impacted the economic productivity as a whole. Meanwhile, systematic and standardized assembly line has been introduced as each worker or machine performs a particular job that must be finished before the product moves to the next position. As a result, job can be done faster and quicker compared to the previous industrial revolution.

3.3.3 Industrial Revolution 3.0 (IR3.0)

Third Industrial Revolution began in 1970s through application of electronics and Information Technology. The revolution witnessed the rise of digital technology where electronic such as transistor, microprocessor, telecommunication, and computers as well as Internet were invented. Besides that, Industry 3.0 has led to more automated systems onto the assembly line to execute human tasks. The task that normally automated was the daily routine works. It not only practiced in the factory but also in the workplace. As a result, more job can be done and permanently remove human error**.** Although automated systems were in place, it still relied on input and intervention of humans.

3.3.4 Industrial Revolution 4.0 (IR 4.0)

The Fourth Industrial Revolution (IR4.0) also known as the Industrial 4.0 is the trend towards automation and data exchange in manufacturing technologies and processes without human intervention which includes Internet of Things (IoT), cloud computing services, mobile and artificial intelligence. The Fourth Industrial Revolution (IR 4.0) is expected to change how we live, work, and communicate. For the workplace, IR4.0 has transformed the way people work towards digital transformation [15]. With advanced technologies, the IR4.0 trend is turning the repetitive task into automation. The repetitive task normally involved routine day work where employee used to do. Administrative and operation task is the most routine work for employees do every day. Performing repetitive task typically can produce employee's boredom. Therefore to avoid this, alteration of task is needed to get the job done efficiently. In this case, automation task is an alternative way to solve the problem. Meanwhile, automation task refers to the use of software to reduce the manual handling of simple tasks or a series of more complex tasks to make processes more efficient and employees more productive as well as it can improve business processes and increase productivity. For digital workplace, automated task allow employees to work in a flexible way based on geographical differences. It also, freeing them to focus on more important work. With automation, working process will be shortened and be simply. Besides that, automation is the change agent that will make certain task to make easy, improve efficiency as well as remove human error. Furthermore, Fourth industrial revolution broadening working concept where job can be done across different geographical location. This means, with the use of Internet and telecommunication, workers can communicate and collaborate among themselves. Thus, it promotes flexibility and knowledge sharing among the workers. Table 2 below is the series of Industrial Revolution on repetitive task.

Table 2: Type of task involvement in Industrial Revolution

	IR 1.0 (1760 – 1840)	**IR 2.0** (1870 – 1914)	**IR 3.0** (1969-2000)	**IR 4.0** (2011-Today)
DEFINITION	The transition of hand production method to machine.	The introduction of division of labor and mass production with sophisticated machine.	The invention and manufacturing of electronic devices and integrated circuits automated machines.	The trend towards automation and data exchange in manufacturing technologies and processes.
TECHNOLOGY	1) Water and steam-powered machines were developed to aid workers. 2) Application machines were built such as weaving machine as to increase production capabilities.	Electricity becoming the primary source of energy was used power application machines.	Programming Logic Controller (PLC) was introduced. Hence, it is the beginning of computers, robot and automation using electronics were used in performing tasks.	The raised of Internet and telecommunication, resulting in physical borderless. The use of Internet of things (IoT), Cloud Computing Services, mobile, Big Data and Artificial Intelligence affecting the way we work.

PROCESS \ STRUCTURE	1) Replacing from manual-based production to machines to increase productivity. 2) Recruited many workers to work in factories 3) Factories were built for the worker to work.	1) Systemized assembly line has been introduced as each worker or machine performs a particular job. 2) Transportation was built for easy movement.	1) Robots were used to substitute with human ability in performing job in workplace 2) Automation task concept was introduced within organization business process.	1) Transforming physical workplace into a virtual workplace where task can be done anywhere and anytime. 2) Embedding automation and Artificial Intelligence into system-to ensure the effectiveness and efficiency of work.
TASK	Working repetitively side-by-side with machines in producing products.	Worker still works repetitively with machine but in mass production. Human interaction still needed for operating machines	Repetitive tasks were substituted by the automated system such as submitting, retrieving, sorting, managing, organizing, tracking and approving.	Due to borderless locations, repetitive tasks such as monitoring, communicating and collaboration were done through automation and advanced technologies such as AI, IoT & Cloud Computing Services.
PEOPLE	Many workers (including man, women & children) involved in repetitive work. Basic knowledge was required to operate the machine.	Many workers were recruited based on work division for mass production. Repetitive work continues.	Automation is taking over repetitive work from humans.	Automation is taking more control on task over the different geographical locations. Skilled workers are recruited to operate it.

4. RELATIONSHIP BETWEEN TECHNOLOGY AND TASK

Meanwhile, the study found that there is also a positive relationship between technology and task. According to previous scholar, technology plays in changing task of organization [10]. The technology is not just helping people to do things better and faster, but they are enabling profound changes in the ways that work is done in organizations. Since digital workplace is a virtual working concept, technology is needed to enable employee to communicate and collaborate within teams. Without technology, task cannot be achieved and accomplished. Figure 4 is the relationship between technology and task where technology determine the type of task in digital workplace. Digital workplace technology from previous study consists of communication channels, social technologies and intelligent context [22], while digital workplace task consists of repetitive and automation.

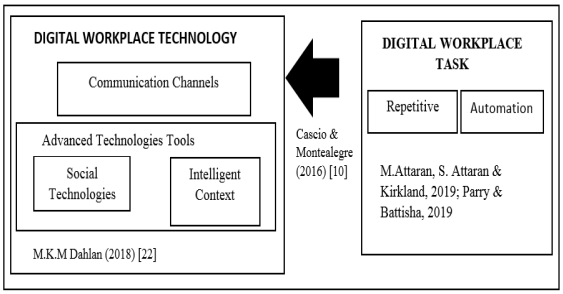

Figure 4: Relationship between digital workplace task and supporting factors for digital workplace technology.

5. CONCLUSION

Industrial revolution has changed the way task is done. Routine task are now can be done by the machine. For digital workplace, industrial revolution has reshaping task which improve everyday business processes. Based on findings, interestingly, two type of task in digital workplace; (1) repetitive and (2) automation. The findings is very consistent with previous scholar who noted that repetitive task can be improved quality and save time through automation [23]. Also supported by reference [3] who noted that automation is needed in repetitive task as to eliminate inefficient process in digital workplace. Meanwhile, task involvement in workplace changes since the beginning of Industrial Revolution until today from repetitive task to automation. Also, there is a positive relationship in previous study of digital workplace technology supporting factors and digital workplace task.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Teknologi MARA (UiTM), Malaysia for partly funding the study given by BESTARI PERDANA grant (600-IRMI/DANA 5/3/BESTARI (P) (091/2018)).

REFERENCES

1. S. Koeffer. **Designing The Digital Workplace of the Future-What Scholars Recommend to Practitioners,** in *Proc. 36th International Conference on Information Systems (ICIS 2015)*, 2015, pp. 1-21.
2. M. Attaran, S. Attaran, D. Kirkland. **The Need for Digital Workplace: Increasing Workforce Productivity in the Information Age,** *International Journal of Enterprise Information System*, 2019, Volume 15, Issue 1, pp 1-32, January-March 2019 https://doi.org/10.4018/IJEIS.2019010101
3. B. Vermeulen, J. Kesselhut, A. Pyka & P. P. Saviotti. **The Impact of Automation on Employment: Just the Usual Structural Change?,** *Sustainability* 2018, Vol. 10, 1661, pp 1-27, May 2018.
4. K.Y.Goldberg. **What is Automation?**. *IEEE Transactions on Automation Science and Engineering*, Vol. 9, No. 1, January 2012. https://doi.org/10.1109/TASE.2011.2178910
5. Stohr, E., & Zhao, J. L. **Workflow Automation: Overview and Research Issues.** *Information Systems Frontiers*, Vol. 3, No.3, 281-296, Sept 2001.
6. S.V.R.K.Rao, M.S. Devi, A.R.Kishore & P. Kumar. **Wireless Sensor Network based Industrial Automation using Internet of Things (IoT)**. *International Journal of Advanced Trends in Computer Science and Engineering*, Vol. 7, No.6, November-December 2018. https://doi.org/10.30534/ijatcse/2018/01762018
7. J. R. Abollado, E. Shehab & P. Bamforth. **Challenges and Benefits of Digital Workflow Implementation in Aerospace Manufacturing Engineering.** *Procedia CIRP*, Vol. 60, pp 80-85, May 2017.
8. A. Parkes. **A Case Study of Workflow Implementation Success Factors,** in *Proc.* Australasian Conference on Information Systems *(ACIS)*, 2004, pp 1-5.
9. A.E.Karrar & M.F.I. Fadl. **Security Protocol for Data Transmission in Cloud Computing**. *International Journal of Advanced Trends in Computer Science and Engineering*, 2018, Volume 7, No.1, January –February 2018. https://doi.org/10.30534/ijatcse/2018/01712018
10. Cascio & Montealegre. **How Technology Is Changing Work and Organizations.** *Annual Review of Organizational Psychology and Organization Behavior* 2016, Vol. 3, pp 349-375, March 2016.
11. T. Balliesterand & A. Elsheikhi. **Research Department Working Paper No.29: The Future of Work: A Literature Review.** International Labour Organization (ILO), Vol. 29, pp 1-54, March 2018.
12. McKinsey Global Institute. **A Future That Works: Automation, Employment and Productivity.** *McKinsey Global Institute*, Executive Summary, pp 1-22, January 2017.
13. J. Healy, D. Nicholson & P. Gahan. **The Future of Work in Australia: Anticipating How New Technologies Will Reshape Labour Markets, Occupations and Skill Requirement.** *NSW Government, Future Frontier Analytical Report*, pp 1-55, August 2017.
14. C. Hirschman & E. Mogford. **Immigration and the American Industrial Revolution from 1880 to 1920**. *Social Science Research*, Vol. 38, Issue 4, pp 897-970, December 2009. https://doi.org/10.1016/j.ssresearch.2009.04.001
15. S.R.Hamidi, A.A.Aziz, S.M.Shudidan, A.A.Aziz & M.Mokhsin. **SMEs Maturity Model Assessment of IR4.0 Digital Transformation** in *Proc. 7th International Conference on Kansei Engineering and Emotion Research*, 2018, pp 721-732.
16. R.Breton & É. Bossé. **The Cognitive Costs and Benefits of Automation** in *Proc. RTO HFM Symposium on "The Role of Humans in Intelligent and Automated Systems"*, 2002, pp 1-12.
17. Chen S.I., Visser T.A., Huf S., & Loft S. **Optimizing the balance between task automation and human manual control in simulated submarine track management**.

Journal of experimental psychology. Applied, Vol. 23, Issue 3, pp 240-262, September 2017.

18. C.P.Janssen, S.F. Donker, D. P. Brumby & A.L.Kun**. History and future of human-automation interaction.** *International Journal of Human-Computer Studies*, Vol. 11, Page 99-107, November 2019.
19. D.L.Lamar, M.L.Richardson & B.Carlson. **Automation of Educational Tasks for Academic Radiology.** *Academic Radiology*, Vol. 23, Issue 7, pp 919-932, July 2016.
20. Asquith & G. Horsman**. Let the robots do it! – Taking a look at Robotic Process Automation and its potential application in digital forensics.** *Forensic Science International: Reports,* vol. 1, pp 1-6, November 2019. https://doi.org/10.1016/j.fsir.2019.100007
21. K.Jha, A.Doshi, P. Patel & M. Shah**. A comprehensive review on automation in agriculture using artificial intelligence**. *Artificial Intelligence in Agriculture,* vol. 2, pp 1-12, June 2019.
22. M. K. M. Dahlan, N. Abdullah, and A. I. H. Suhaimi. **A Study on Supporting Factors of Digital Workplace Diffusion in Public Sector** in *Proc. International Conference on User Science and Engineering*, 2018, pp. 327-335. https://doi.org/10.1007/978-981-13-1628-9_29
23. D. M. Rafi, K. R. K. Moses, K. Petersen & M. V. Mäntylä. **Benefits and limitations of automated software testing: Systematic literature review and practitioner survey** in *Proc. 7th International Workshop on Automation of Software Test (AST)*, 2012, pp. 36-42.

P.Miller. ***The Digital Workplace: How Technology is Liberating Work.*** Dog Ear Publishing, 2012, pp 1-220.