Big Data from a Student's Perspective

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Abstract—The Industry Revolution 4.0, or simply "Industry 4.0", marks the next paradigm shift in mechanized and automized work in a global economy. Digital entities such as the Internet of Things (IoT), Artificial Intelligence and Big Data are one of many building blocks that pave the way for Industry 4.0. As a student, realizing the need to incorporate Industry 4.0 concepts into our curricula and equipping ourselves with the necessary skillsets while working in tandem with higher education institutions is key in being an Industry 4.0 ready graduate. This article brings forward several key competency areas a creative worker should possess, and reviews how big data, a key component under the umbrella term "Industry 4.0" brings value and enhancements to students. Big data can be used to manage students from monitoring their academic involvement to predicting behavioral aspects. Furthermore, big data and among other Industry 4.0 components sees the emergence of a new type of learning environment called learning factories, where Industry 4.0 concepts are fully integrated within the curriculum on a physical, hands-on setting. Ultimately, big data stimulates research collaboration through data sharing and using developed computational tools to disseminate data, enabling primary research to impart higher accuracy data interpretation.

Keywords—Industry Revolution 4.0, Big Data, Research, Student

1. Introduction

The 4th industrial revolution, or simply coined a global buzzword as "Industry 4.0" (Mudin *et al*., 2018), marks the next paradigm shift in mechanized and automatized work in a global economy, in which the direction it heads to is the cyber physical system (Neugebauer *et al*., 2016; Kagermann *et al*., 2013). As ideas and jargons gets publicized and proposal cropping up from various backgrounds to define what Industry Revolution 4.0 is, the public perception towards this advancement is in the increased presence of digital entities such as Internet of Things (IoT), Artificial Intelligence and Big Data (Lasi *et al*., 2014).

2. Literature Review

The need for Industrial Revolution 4.0 in a student's life/ academic journey arises as entire organizations digitizes and vertically integrates processes across itself (Xing and Marwala, 2017). The idea of consistent digitalization and linking of all productive units in an economy, and the seamless integration of machines into the information network between students and academics is what makes Industrial Revolution 4.0 a need in tertiary education (Xing and Marwala, 2017).

As Industry 4.0 becomes an emerging topic and industries shift towards adopting it, universities and particularly graduates must adapt to this shift of paradigm by enhancing certain skill sets and key competencies in both interpersonal and intrapersonal aspects. Professor Mahendhiran Nair from Monash University Malaysia (2018) describes 10 skills a creative worker must possess in facing the new economy: critical thinking, sound ICT literacy, Good Technical skills and communication skills, Sound Multidisciplinary/interdisciplinary knowledge, Learnability, Strong power of association, Opportunities for experimentation, Fostering problem-solving and observation skills, Leadership skills.

In other literature, authors identify three pillar categories to classify core managerial competencies (Grzybowska & Anna, 2017), which are: technical competencies, managerial competencies and social competencies (Fitsilis *et al*., 2018; Grzybowska & Anna, 2017). In Industry 4.0, higher education enabled work profiles will gain significances over labour workforce which will most likely by replaced with automated process (Prifti *et al*., 2017). Hence, Grzybowska and Anna (2017) proposed key areas to the three core managerial competencies which include: creativity, problem solving, conflict solving, decision making, analytic skills, research skills, entrepreneurial thinking and efficiency thinking, amongst of which decision making and problem solving areas being the most sought after in key industrial sectors.

A. Student Management

Big data, which refers to the incorporation of data mining and the predictive analysis of it, has seen an increased usage by higher education to classify students and predict student outcome and behavior (Johnson, 2014). Learning Management Systems (LMS) such as Blackboard and Moodle are integrated collaborative software platforms used by universities all around the globe. Within these virtual learning environments (VLEs), teachers are able to continuously monitor a student's academic progress through supportive applications such as chat rooms, wikis and blogs (Banica & Radulescu, 2015). One metric of a student that big data can classify is the level of student engagement with the higher education institution, and by monitoring student engagement, good areas of practice can be identified by institutions as well as pinpoint possible areas of improvement (Coates, 2010). Hence, with the advent of advanced ICTs and business intelligence, systems such as the Student Engagement tracking System (SES) developed by the University of Bedfordshire (Duan *et al*., 2013) enable the university to better understand student engagement from various data collection points. This provides evidence-based feedback to students from its real time monitoring that can positively impact students' behavior for class attendance and library usage (Duan *et al.*, 2013). Several real time analysis methods are being proposed and implemented into E-Learning platforms (Udupi *et al*., 2016; Logica & Magdalena, 2015). The analysis of data stream from these web-based learning platforms allow higher education institutions to track a students' progress in courses and detect the students at risk by monitoring the daily health and usage of these E-Learning platform. Big data can be impactful to a student's experience as higher education institutions in modern times are constant changing and adapting to address the challenges Industry 4.0 will bring (Sani, 2018). as to whether the institution is able to produce Industry Revolution 4.0 ready students.

B. Resource Sharing

Big data may act as a vessel for collaboration involving students and learning professionals and show a huge educational potential in resource sharing and idea exchanging (Banica, 2014). Students are able to gain industrial insight as big data can be an educational approach that contributes to develop experience-based knowledge through the establishment of Learning Factories (Baena *et al*., 2017). Baena *et al*. (2017) argues that a proper transformation process may contribute towards introducing new manufacturing trends such as industry 4.0 into an academic context that enhances the process of training budding engineers. The emergence of learning factories (LF), such as the Bernard M. Gordon Learning Factory in Penn State University provides a University-Industry partnership where students interact with industrial sponsor, further bridging the gap between industry, faculty and students (Lamancusa *et al*., 2008; lf.psu.edu, 2019). From here, students are able to gain hands-on experiences as learning factories often focus on the technical skills as well as train decision making, group work and performance monitoring skills (Schallock *et al*., 2018). It is this sharing of resources through a unification of various aspects of an industry and the collaborative effort and communication that positively impacts a student and their learning experience. The push for big data has seen higher education institution take a different approach in learning environment by having a focus on industry 4.0 and strong hands-on aspects (Elbestawi *et al*., 2018). Although the idea of learning factories has not seen footing locally in Malaysia, this nevertheless shows the educational potential both in using big data to educate and cultivate IR 4.0 ready graduates.

C. Research Collaboration

With the mainstreaming of internet technologies, the gradual change of student research and subsequently academic researchers shift towards the need for accessible data in literature writing and data analysis. The presence of big data stemming from the 4th industrial revolution allows novel methods of doing research, bringing together faculties from all around the world to collaborate.

Through IR 4.0, the availability of a massive pool of data from various sources such as academic, government, sensors and satellites are within reach with the implementation of big data and the Internet of Things (EY.com, 2017). From the cluster and compilation of available data, research validation and cycle time of data analysis can be reduced, improving the efficiency from students and academic researchers. With big data as the foundation for search engines such as Google Scholar, this provides a research platform that can propagate findings exponentially faster through the use of social media, blogs and discussion forums.

Students and researchers make use of large datasets long before the term “Big Data” was coined, but the modern differences lie in more sophisticated and advanced tools being available to analyse and combine various datasets (Pink, 2016). Not all data taken from big data are useful in analysis and decision-making processes; instead, the industry and academia are interested in disseminating the findings of big data (Acharjya and Kauser, 2016). Big data liberates students and researchers from the need to generate new surveys on each new learning situation; current big data assets can be leveraged for research topics, enabling deeper primary research to be conducted to fill in knowledge gaps, in turn allowing researchers to present accuracy into the data assets (Pink, 2016).

Strong analytical tools have made possible to analyse large sets of data within short amount of time and reduced cycle time in data collection, validation and processing (EY.com, 2017). For instance, the Total Pangea III supercomputer is capable of 31.7 petaflops of computing power and can more accurately locate new petroleum resources and further calculate the potential revenue opportunities (Ismail, 2019). This supercomputer enables Total, a global energy company to reduce geological risks in exploration and development, accelerate project maturation and delivery, optimize field operations that would have taken years using a manual method. With the presence of enhanced computing, coupled with the Internet of Things solutions and big data, this drives better analytics and research to mitigate potential risks through thorough evaluation using modern methods. New computational tools and methods enable researchers to interpret data in new ways which are unbiased and data driven (Enago.com, 2018). Students and researchers having access to these data sets can enable cross referencing and validating of their own research, thus synergizing collaboration between industries and researchers through the sharing of data.

3. Conclusion & Recommendations

In summary, it can be concluded that the term "Industry Revolution 4.0" describes various IT driven changes in the academic industry. In order for IR 4.0 to be effective and efficient in the academic industry, it is vital to have technology roadmaps for prime industries within the country that will usher a new direction in educational transformation (Haseeb, 2018). Haseeb (2018) suggests two main components in educational transformation: to transform educational content, delivery and management across various disciplines, and to devise IR 4.0 geared curricula that produces the necessary technical manpower to face the industry. Hence, a collaborative model can be fostered between students, faculties, academia and industries to utilize and develop big data in the transition to the 4th industrial revolution.

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