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on the Context of Sustainable Development
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MAPPING THE FOURTH INDUSTRIAL REVOLUTION GLOBAL TRANSFORMATIONS ON 21ST CENTURY EDUCATION ON THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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ABSTRACT

Whether we are ready for it or not, the fourth industrial is impacting all facets of the society. World Economic Forum has reported that the fourth industrial revolution will impact major areas that including (i) disruption to job and skills, (ii) innovation and productivity; (iii) inequality; (iv) agile governance; (v) security and conflict; (vi) business disruption; (vii) fusing technologies; and (viii) ethics and identity. Despite these transformations, are we preparing our graduates for such a volatile ever-changing future working environment? Are our current 21st century teaching and learning practices designed with such transformations in mind? Are our educators equipped with the knowledge, expertise and skills for integration of such transformations in the education system? Are our existing teaching and learning ecosystems flexible enough to deal and cater for such changes? The keynote address will address these key issues and discuss our how we map the fourth industrial revolution in the current 21st century education landscape.

I. INTRODUCTION

Rapid transformations in the fourth industrial revolution are impacting major areas which including (i) disruption to job and skills, (ii) innovation and productivity; (iii) inequality; (iv) agile governance; (v) security and conflict; (vi) business disruption; (vii) fusing technologies; and (viii) ethics and identity, as illustrated in Figure 1 (World Economic Forum, 2017). Nontheless, how do we, as educators, respond to such disruptive changes in the education system? This article revolves around these eight themes and discusses how we can manage these global transformations in our regional and local educational landscapes.
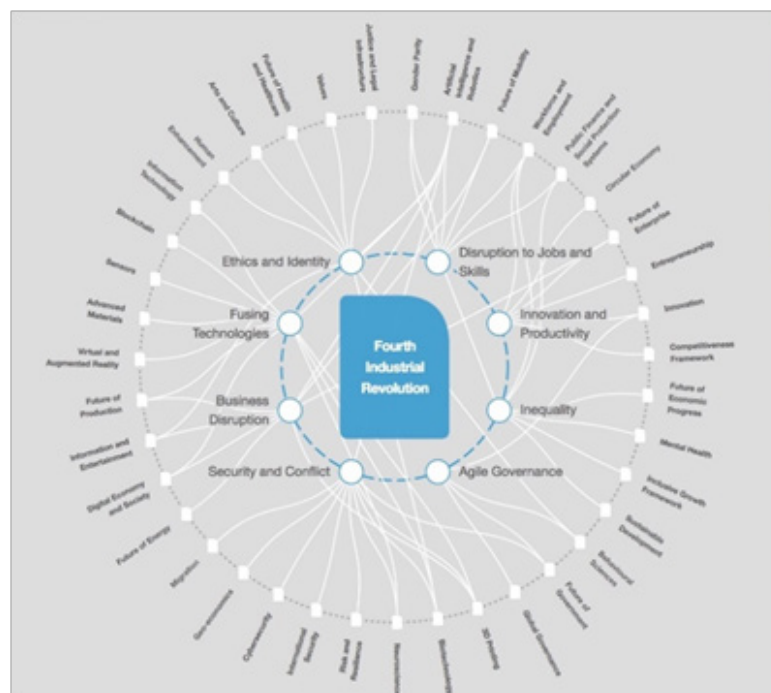

Figure 1: Global transformations in the fourth industrial revolution
(World Economic Forum, 2017)

II. Issue 1: Disruption to job and skills

The fourth industrial revolution will have a large impact on future jobs. As new technologies create new jobs (such as social media experts), job displacements will also occur (e.g. toll booth operator). This scenario largely impacts the skills of future workers in which the skills need to interchangeable and adaptable enough to be utilized in diverse work environments that require different skills sets – hence, create a large gap between skills that the industry need and skills that the future graduates possess (World Economic Forum, 2017). The World Economic Forum reports that there are five sub-issues that will impact the *disruption to job and skills issue, which are gender parity, artificial intelligence and robots, future of mobility, workforce and employment as well as public finance and social protection systems*, as shown in Figure 2. Yet, how do we link these issues to the 21st century education? Educational ecosystems need to be designed for the future. First, with regards to gender parity, the issue of women and girl inequality has time and time again been a highlighted issue. According to UNESCO, empowering women in sustainable environment fields yield positive results in which inclusion of women increased the successfulness of environmental treaties (UNESCO, 2016). In education, technical-based skills (e.g. engineering) could help in empowering women and reduce the gender gap in male-dominant jobs. Second, in terms of *artificial intelligence and robots* as well as *future of mobility*, curricular should be designed from early childhood levels – integrating fourth industrial revolution technologies in teaching and learning, so that children are aware of the potential of such technologies from early ages. Third, with regards to *workforce and employment*, graduates should be equipped for the new dynamics of the 21st century workplace in which a wide variation of skills are needed for the ever-evolving job market. Finally, for *public finance* and *social protection systems*, global finance systems such as the introduction of digital currencies has disrupted the global trade market. Current educational systems should cater for the management of such currencies as those currencies could become dominant forces in the near future.
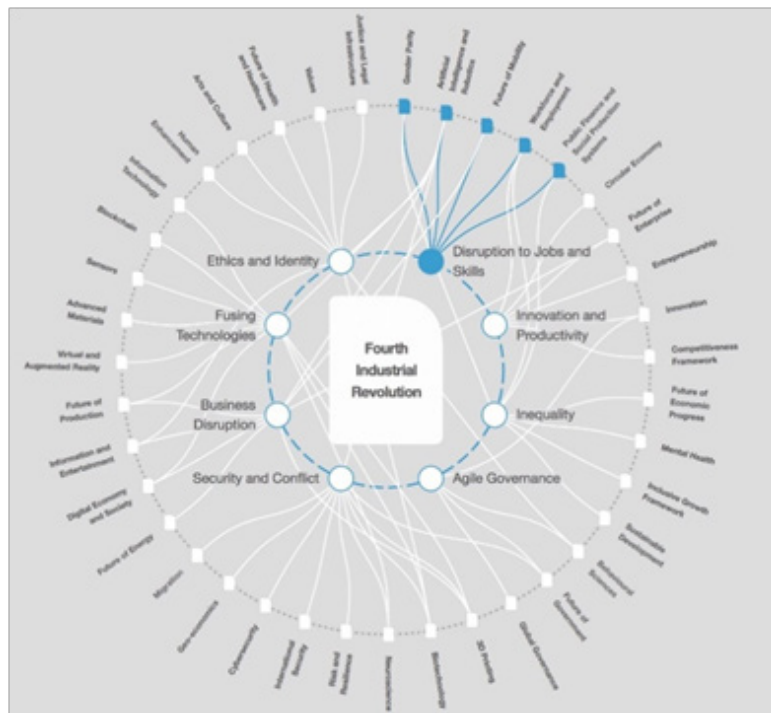

Figure 2: Sub-issues related to *disruption to jobs and skills*
(World Economic Forum, 2017)

III. Issue 2: Innovation and Productivity

The second issue impacting the society is *innovation and productivity*. The fourth industrial revolution involves "cognification" of the world around us. Spurred by the rapid advancement of technology, aspects such as *circular economy, future of enterprise, entrepreneurship, innovations* and *competitiveness framework* will come in play, as illustrated in Figure 3 (World Economic Forum, 2017). In line with

these transformations, educational ecosystems should anchor aspects such as innovations, entrepreneurships and competitiveness. As more and more educational institutions strive more production of innovations, quality of educational products and learning ecosystems will improve. Yet, the issue will constantly towards making education accessible to everyone – so that one is left behind (Miles & Singal, 2010). We should

think about educational designs and solutions in capitalizing the potential of fourth industrial revolution technologies. Technologies such as drones – could be used in hard to reach places and improve access to education (Fokides et al., 2017) and technologies such as internet-of-things (IoT) could be used to make smart educational environments even smarter than before in enhancing teaching and learning practices.

Figure 3: Sub-issues related to *innovation and productivity*
(World Economic Forum, 2017)

IV. ISSUE 3: INEQUALITY

Although technologies have been reported to provide access to education and elevate equality, they also have the tendency to worsen inequality in terms of social stability. Here, the challenge is the fact that although new technologies democratize entrepreneurship and employment, they bring new challenges such as domination of global technological giants hence causing deeper inequality and social fragmentation, shown in Figure 4 (World Economic Forum, 2017). In the context of education, we should design learning systems that caters for digital literacies to be spread out to the community as a whole in aiming for the public to be digital literate. While previous studies have shown that inequality levels have dropped, inequity levels have risen. This is causing new illness such as social media addiction, which is a rising concern among the new generation (Andreassen et al., 2017). Thus, the good and the

bad of digital impact should be taken in account while designing for enhancement of teaching and learning.

V. ISSUE 4: AGILE GOVERNANCE

The fourth industrial revolution has already shown the agility of governance (Figure 5) via the establishment of e-Estonia. Estonia has disrupted the mere lines of citizenship and social contracts between nations and redefined in what is truly meant by becoming a global citizen. As more and more nations adopt the global citizen models and more radical citizenship models, governance at global and local levels have to be re-aligned to adapt to these changes. Existing regulations should be molded and be re-invented to understand and suit the uncertainty of social, economic, and technological shifts (World Economic Forum, 2017; Turban et al., 2018). The education field should also follow suit implementing agile

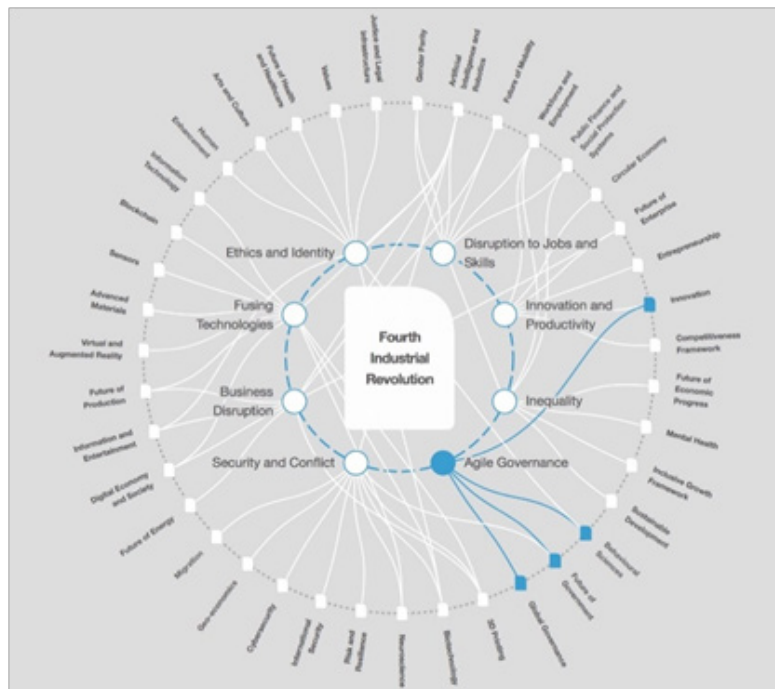Figure 4: Sub-issues related to *inequality*
(World Economic Forum, 2017)

Figure 5: Sub-issues related to *agile governance*
(World Economic Forum, 2017)

governance in ensuring the educational ecosystem can adapt to change and still stay relevant. This involves designing agile governance not only for policy and decision-makers, but also for educators and students at ground level to ensure current educational systems produce graduates that are well equipped for the fourth industrial revolution.

VI. Issue 5: Security and Conflict

The fifth issue involves *security and conflict*. Again, while technologies bring opportunities and advancements, it is without its drawbacks and dangers. Technologies such as social media sites have previously been used to conduct various attacks on governmental institutions. The sites

have also been used on global warfare, in terms of recruiting global teams from various countries around the globe. Moreover, as machines are getting more advanced and smarter, there is a potential that these technologies to be used in creating conflict – for instance the use of autonomous machines in war (World Economic Forum, 2017).

In relevance to education, critical issues such as cybersecurity should be core elements to be taught from lower to higher education. As physical and digital worlds are becoming more blurred, preparing for securities for both are becoming increasingly crucial.
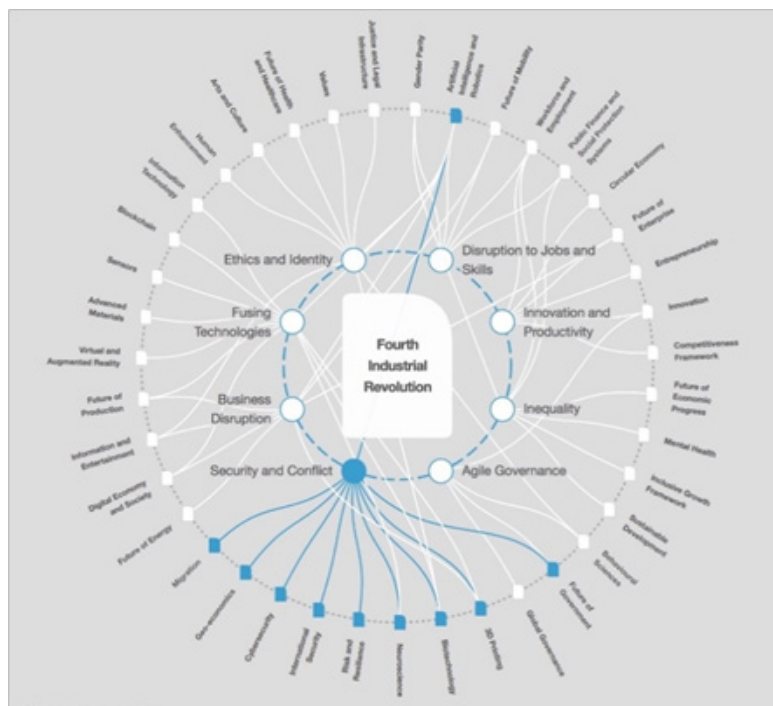

Figure 6: Sub-issues related to *security and conflict*
(World Economic Forum, 2017)

VII. Issue 6: Business Disruption

The sixth issue of the fourth industrial revolution is *business disruption* (Figure 7). Technological advancements have made businesses ubiquitous, in which business have shifted to an online on-demand model. The revolution has made us a digital society supported by a digital economy, where digital transformations with emerging technologies have fueled business disruptions. *Business disruptions* have also impacted the educational sector as well. New educational learning environments such as massive open online courses have disrupted the current educational market towards a more flexible and global learning environment. Yet, such disruptions challenge the current business models in terms of tuition fees as these environments are open and freely accessible. Thus, educators and policy makers should design future learning environments that cater for new business models while ensuring the teaching and learning is meaningful (Nordin et al., 2015; Nordin et al., 2016).

VIII. Issue 7: Fusing Technologies

Fusing technologies is among the fundamental aspects driving the fourth industrial revolution. (Figure 8). Technological advancements in this revolution are blurring the lines of physical, digital, and biological spheres. The interconnectedness of the spheres allows for collaboration across multiple disciplines fueling technological advancements in crucial areas where technology is most needed. For example, the advancements in artificial intelligence have allowed robots to become more advanced than ever before. Robots have been used for industrial purposes in the previous industrial revolution, yet, now as they become more intelligent and more autonomous, they are increasingly becoming more engaging in the society providing a broader variety of tasks (World Economic Forum, 2017). The *fusing technologies* aspect is also prevalent in the educational sector, where technologies are becoming increasingly important in teaching and learning environments. With the assistance of technology, educational innovation and creations

are constantly being produced thus leading to more enhanced and advanced educational ecosystems (Norman et al., 2015; Wilson et al., 2017).

IX. Issue 8: Ethics and Identity

The final issue related to the fourth industrial revolution is *ethics and identity* (Figure 9). The innovations in the revolution have redefined the essence of lifespan, health, and cognition. As new biological discoveries are made challenging social norms, issues of ethics become more crucial. For example, with regards to alteration of genetic codes, we have to think about the boundaries that should be made in alternation of these codes for future generations. Technological advancements also challenge the issue of identity, both physical and digital ones as there is tendency that both are disconnected from one another (World Economic Forum, 2017). In the education world, ethics play a crucial role in the world of academia in ensuring intellectual property is intact with the creator. Yet, as more and more educational products are becoming open and accessible, ethical boundaries should be highlighted to ensure ethical values are cultivated in education.

Figure 8: Sub-issues related to *fusing technologies*
(World Economic Forum, 2017)

Figure 9: Sub-issues related to *ethics and identity*
(World Economic Forum, 2017)

X. Conclusion

This article has addressed eight main issues related to the fourth industrial revolution and linked the issues with education in the 21st century. The article has also discussed potential solutions, implications and future directions of how the current educational ecosystem can survive the fourth industrial revolution. The challenge is not a simple issue to spot sometimes as the rapid advancement and fusion of technologies are blurred in the physical, digital and biological spheres. It is hoped that we can prepare future generations for the ever-changing and challenging world that lies ahead.

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