ANNEX 5

CHARTING THE FUTURE OF ADULT LEARNING RESEARCH AGENDA IN SINGAPORE

Consultative Paper by the Subgroup on

Future of Human Capabilities in a Digital Economy and Society

31 March 2020

Note

This consultative paper is an output of Subgroup of the Taskforce on the Future of Adult Learning Research Singapore on the focus research area 'Future of Human Capabilities in a Digital Economy and Society'. It provides the Subgroup's observations, curation of expert opinions, recommendations, and translation in addressing the focus research area. The principal authors are: Arthur Chia, Simon Freebody, Ho Yew Kee, Alfred Huan, Dennis Kwek, Lee Kwan Min, Lim Lai Cheng, Poon King Wang, Sim Soo Kheng, Teo Hock Hai. The authors would like to acknowledge helpful inputs provided by Professor Nancy Law, Ms Olga Strietska-Ilina, Professor Lee Kwan Min and Associate Professor Rabindra Ratan who presented four papers in the symposium relating to this focus area.

The views and suggestions presented in this paper are those of the authors as listed. The contents are intended for discussion and generating ideas, and are not necessarily the views or policy prescriptions of the Institute for Adult Learning (IAL).

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Overview

The consultative paper by the Subgroup provides a macro articulation of the issues to frame adult learning in a digital world, that raises questions about the nature and role of adult learning and its possibilities to contribute to social, economic and personal well-being. The paper adopts a capability approach, which emphasises human dignity, meaning(s) of life and work, and inclusiveness in a digital world.

The Subgroup recognises the significance of digital technology in the future economy and society, and the complex implications for work, labour markets, and society. Thus, the paper articulates and casts a medium- to long-term view of the "future" in discussions about the digitalisation of work and life, and how they can benefit people. Rather than forecasting the future as a methodological tactic, it questions current ways of seeing and understanding technological innovation and human development, and calls for (new) concepts to shape thinking about the digital future(s), human capabilities, and ways to integrate theories and concepts with the practical.

The consultative paper uses a mind-map to develop questions and identify issues that address the future of human capabilities in a digital economy and society. These questions and issues, which are deeply informed by a holistic concern for human well-being, have been clustered around five key areas for further dialogues and research. The five areas are:

1) Understanding the digital future(s)
2) Understanding the purpose(s) of life in this future(s)
3) Investigating and generating new proposed human capabilities needed to live and thrive in this future(s)
4) Investigating and proposing new kinds of learning that might be needed to generate such capabilities
5) Surfacing and addressing the risks related to human capabilities such as dehumanising of workers, disempowerment, marginalisation of certain individuals without certain skills associated with the digital future(s).

The paper raises big-picture questions that suggest new ways of thinking and conceptualising the digital future; new ethics which requires us to pose new questions about social trust, safety and risk, and well-being in a digitally connected and algorithm-rich world, and stewarding progress which requires new sets of principles to build new institutions of knowledge and systems of learning, and foster new forms of collaborations. The paper also proposes a list of possible research areas and questions that warrant further exploration and discussions.

With this paper, we hope to ignite a rigorous discussion of what it means to be human and to be learning in the brave new world of digitalisation.

Introduction

Without any doubt, digital technology will be a main disruptor of the future economy and society. The World Economic Forum (WEF, 2018) states that "As technological breakthroughs rapidly shift the frontier between the work tasks performed by humans and those performed by machines and algorithms, global labour markets are undergoing major transformations." The digital economy and society are increasingly being shaped by fast technological advancements in a wide range of areas, such as robotics, artificial intelligence, quantum computing, internet of things, fifth-generation wireless technologies (5G). These advancements combine hardware, software and biology (cyber-physical systems), and emphasise advances in communication and connectivity. Seen as the Fourth Industrial Revolution (Schwab, 2016), these advancements bring exponential changes to the way we live, work and connect to one another, and even challenge our ideas about what it means to be human in an age of super-connectivity and super-augmentation.

Such developments in both developed and developing nations necessarily compel companies, communities, governments and nations to assess these rapid transformations and to seize the opportunities for proactive engagement, training and preparation of people for this new global digital labour market and society. At the economic level, concerns are raised about how individuals could be better equipped in their role as homo economicus in order to have a well-functioning labour market and economic well-being. At the societal level, the people have to be likewise retooled, reskilled and retrained to cope with a digital society, in which the use of technology is much like electricity's invention which powered livelihood and generated a fundamentally new way of living. Yet, digitalisation and its impacts are but one side of a coin, and questions about the nature of humanity and the role of humans in the digital age have given rise to discussions of homo sociologicus, or the sociological man who ontologically makes sense of the social nature of humans, learning and society (Ng & Tseng, 2008). Hence, the future, while increasingly digital, must be considered in both economic and social terms, from epistemological and ontological perspectives, and with pragmatic and ethical considerations in mind.

The aim of this consultative paper is to encourage a capability approach to stimulate a deeper understanding of the nature and investigation of human capabilities. It highlights five key areas where dialogues and research should take place to gain greater knowledge and deepen or further understanding to ensure the nation's human capital is prepared for the disruptions of digital technologies. These five areas were considered by the Subgroup to be fundamentally central to any discussion, debates and research into the future of human capabilities in the digital economy and society. Unpacking the Subgroup's research focus, the five areas constitute clusters of inquiry: (1) Understanding the digital future(s); (2) Redefining the purposes of life in this future(s); (3) Investigating and generating new proposed human capabilities needed to live and thrive in this future(s); (4) Investigating and proposing new kinds of learning that might be needed to generate such capabilities; (5) Surfacing and addressing the risks related to human capabilities such as dehumanising of workers, disempowerment, marginalisation of certain individuals without certain skills associated with the digital future(s).

Framing the Problem

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) proposed a global Sustainable Development Goals (SDGs) framework premised on the principle of "leaving no one behind" in the pursuit of human, social and technological developments. Taking a holistic and systematic approach to achieving sustainable development for all, 17 goals were proposed as building blocks for inclusive prosperity creation. A key aspect of the United Nations SDGs is that it recognises the important role that education plays to mobilise the knowledge, collaborative actions, socio-technological advancements and ethical deliberations required to tackle the critical socio-economic challenges to human, social and technological developments. Indeed, among the 17 SDG goals are the ones that focus on "good health and well-being" (SDG #3), quality education (SDG #4), decent work and economic growth (SDG #8), industry, innovation and infrastructure (SDG #9) and partnerships for the goals (SDG #17). These goals are congruent with the work and ambition of Subgroup 1's focus on the investigation of human capabilities in the digital economy and society.

Subsequently, this consultative paper adopts a capability approach to stimulate a deeper understanding of the problem: the investigation of human capabilities in a digital society and economy. Human capabilities are generally described as what people are effectively able to do and be, or the positive freedom that people have to enjoy as valuable "beings and doings" (Alkire, 2005). Human capabilities as discussed in the capability approach are the combination of two main things (Nussbaum, 2001):

a. the internal capabilities of a person, which include bodily as well as mental capabilities, both innate and realised through training;

b. the suitable external circumstances, which include the individual's embedding in institutions and practices and his/her access to resources.

As the world is becoming increasingly technology-driven, technology is being identified as the third constructive element in human capabilities (Oosterlaken, 2011). As Oosterlaken (2015) explained, technology influences our capabilities as individuals not because we use them, but because they are embedded in the socio-technical systems in which we are also embedded as an individual. Not only does technology influence human capabilities, it may also change our interpretation of what certain internal capabilities mean in a new environment.

In framing our approach to the topic, we propose three overarching questions to frame our exploration:

a. Are new conceptualisations of human capabilities needed in a digital economy and society?

b. If yes, what are the new conceptualisations of human capabilities that we should have a good grasp of?

c. How can we ignite the synergy between a person's internal capabilities and his/her embedding in the external environment in this digital era?

The Subgroup sought high-quality research that could produce high-impact knowledge contributions to the above fundamental questions about human capabilities in the digital future. We focused on the following research questions, which helped to guide our thinking and investigation on the topic.

From the macro perspectives:

a. What are the impacts of digital technologies on the current labour market? What are the factors that encourage creations of new jobs in the digital economy?

b. What are the new challenges to well-being and wholeness for life in a digital society? What are the potential risks to individuals, groups and communities that are brought about by technological advances? How can we improve inclusiveness/equity/social mobility, and mitigate social polarisation and fragmentation in a digital society?

c. Given that traditional literacies such as reading, writing, speaking and listening are changing with the use of technology, what kind of literacies would be a fundamental educational requirement of every child? What are the ways to understand and identify new literacies; e.g. “digital literacy” for a future economy and society?

d. What new capabilities are needed in the future digital economy and society? How can they be identified and developed?

e. How should learning dynamically adapt to constantly changing technologies? How will learning be different from our current concepts of competencies/skills etc; e.g. ASK (Attitudes, Skills, Knowledge)?

f. What are the economic and social impacts of learning, that would take into consideration the diversity of preferences across a population, and the impacts that could be differentiated, even when the same technology is applied in a similar manner? (e.g. the use of facial recognition technology in a prison versus a hospital)

g. What infrastructure and institutional arrangements would best support the development and utilisation of a person’s internal capabilities to contribute meaningfully and constructively to the future digital economy and society?

From the micro perspectives:

a. What should be core technological and non-technological skills/competencies for an individual in a digital economy?

b. Assuming technological advances facilitate the personalisation of learning, how could schools design or institutionalise personalised learning in both the real and virtual learning environments?

c. What kinds of socio-technical infrastructure would be conducive to support connected learning within and across communities and age groups?

d. How do we promote adaptive self-learning capability in both young and adult learners in a digital society and economy? How do we use digital technologies to promote a mindset of lifelong learning?

e. How does digitalisation change our understanding and development of generic/soft/employability skills?

Proposed Scope

The consultative paper approaches this topic with a vision of future(s) as the first starting piece and with five related clusters of issues relating to such future(s). We argue that there is no singular future that we are advocating, but rather, there are multiple futures contingent on policies, actions and strategies that can promote or align with some desirable futures more than others. The future is not determined by the technologies we develop, but technologies

do change and create new agencies within complex sociotechnical systems that require new conceptions (of relations and agencies). These new conceptions "recognise the inseparability of humans and technology" (Suchman, 2018, p.63). As researchers have argued, forecasting the future can be flawed and it is more useful to critically think and discuss which futures are plausible and desirable, and which ones are less desirable.

The consultative paper uses a mind-map in Appendix 5-A to develop questions and identify issues that address the future of human capabilities in a digital economy and society. These are clustered around five main areas, as follows:

a. Having an understanding of the digital futures in 10-, 20-, 30-years' time and beyond
b. The new definition and/or re-definition of purpose of life, meaning and what it means to live well
c. The new human capabilities needed to live "well" in the future digital economy and society
d. The kind of learning needed to enable individuals to live in this new digital economy and society
e. The risks that come with the new digital economy and society, human capabilities and learning.

There are also alternative ways to frame this issue (see Appendix 5-B). Such a framing approach utilises a broad-based holistic perspective, which covers multi-disciplinary fields of study, and different approaches in the study with analysis performed at different system levels. In addition, the issue could be examined based on objects under study.

Consequently, at the Future of Adult Learning Research Symposium, Singapore, held on November 14 and 15, 2019, four keynotes were presented in relation to this topic: Professor Nancy Law's "In Search of Well-Being: Humans with Advanced Augmented Capabilities in a Super-Connected World"; Ms Olga Strietska-Ilina's "Skills for Thriving in a Digital World"; Professor Lee Kwan Min's "Experiences of Human-Machine Interaction, Explicated"; and Associate Professor Rabindra Ratan's "Experiences of Human-Machine Interaction, Applied". This consultative paper has synthesised the discussions and key issues raised in the keynote presentations and the ensuing discussion during the Symposium, facilitating the next phase of the adult learning research agenda for Singapore.

The Digital Futures

There needs to be a visionary understanding of how the digital futures of economy and society will be like in the future. However, the changing dynamism of technology does not allow us to forecast too far a horizon because of the "unknown-unknowns". Is there any schema that could help us to chart a roadmap to understand the impact of digital technology on education, the economy and society?

The first cluster focuses on the plausible futures and considers what the digital economy and society will look like in 10-, 20- or 30-years' time and beyond. It seeks to anticipate the key attributes of a future economy and society, and the similarities and differences compared to the current state. Such an example of anticipating a possible future has occurred in the past during the industrial revolution. The invention of cars or motor vehicles significantly changed the landscape, and visionaries like Henry Ford were ahead of their time and able to

conceptualise how the evolution of such revolutionary technologies would change the way of life: “Everything that helps make man a little freer is headed along the highway of Truth. This does not mean books and ideas only; it means mechanics and commerce and science. Even the motor car is an element in the liberation of mankind and will rank higher than many a philosophy in its effect on human destiny: it is freeing more men, freeing them into more different regions, than most book systems do”[1].

Minimally, it is conceivably possible that within the next five to 30 years, we will experience the following:

- In five years, we might see completely autonomous vehicles roaming our roads, and digital and AI literacies will be treated like basic literacy or numeracy;
- In 10 years, AI systems might provide better diagnosis and treatment for illnesses and replace human decision making;
- In 20 years, machine-human interface designs might drastically reduce the workers needed for manual or routine tasks and the seemingly irreplaceable human decision making might become rarer;
- In 30 years, half of all current work activities or more might become automated while entirely new jobs and occupations could be created.

While future forecasts are always prone to errors or revisions, they nevertheless help us to take stock of the current milestones in digital technology development to allow us to learn from possible missteps. For example, we are increasingly aware that programmers and inventors of AI may impute their personal biases and prejudices in the AI system they build. This can result in legitimising prejudices and discriminations where checks and balances cannot be adequately undertaken because of the complexity of the AI system; in other words, the black-box AI is un-auditable.

Increasing concerns regarding futures include what minimal capabilities are required to live meaningfully in these digital economies and societies. Issues necessarily include work/life balance, new social compacts between citizens and governments, and legislations and governance around enabling equitable digital access. Furthermore, the advent of big data raises issues around the protection of personal privacies. In addition, the veracity of the information will be tested time and again to distinguish between authentic news and fake news, and the need to educate the citizenry on media literacies to discern fact from fiction.

Major Developments and Trends

There are global trends that we can nevertheless ascertain that will impact the digital futures. These are major developments in education, economy and society. Educational researchers, especially sociologists of education, have been acutely aware of how the world of education has changed over the last five decades (Mehta & Davis, 2018). The following key developments in education are argued to have an impact on our digital futures.

First, education has become more critical to policy debates globally, largely due to the increased recognition that education is central to employment in the digital economy and the recognition that increasing the number of educated workers will enhance economic growth and social well-being. While this has been the case in Singapore since independence, the

[1] Ford News, 15 February 1923, page 2.

government has shifted emphasis from providing structural and infrastructural support for education to supporting individuals' opportunities for social mobility through an increasingly porous education system.

Second, there has been significant increases in economic inequality, leading to massive social disparities in income and wealth distribution. The recent Global Wealth Report 2019 by Credit Suisse reported that over 2.18 million people in Singapore are in the top 10% of the global wealth population, with 5% of Singaporeans belonging to the world's richest 1%. Of concern, the report noted that 14% of Singapore's population had less than US$10,000 in financial assets. Potential increases in social stratification have placed an even greater burden on education and skilling up the workforce as a means to level the playing field and provide social mobility.

Third, global migration and population movements, and increasing inter-racial and inter-ethnic families are leading to futures where complex mosaics of social, cultural and ethnic diversities are the norm. Consequently, the heterogeneity of lived experiences, knowledge and work ethics have led to huge variations in human capabilities in a digital world where economy and society have to intersect with education and learning to prepare workers for the digital futures.

Fourth, educational providers have become highly pluralistic globally, and the ecological landscape around schools and centres of learning have become more complex. Educational providers are shifting away from credentials and certifications that demand significant resources and time, to micro-credentials that encourage lifelong learning while enabling the development of field-specific skills at the same time. The expansion of gig economies due to low credential requirements and flexible arrangements meant that the very definition of human capabilities needs to be re-evaluated and redefined to support economic development. What role does education and learning play in an informal economy where traditional credentials and certifications from educational providers, such as universities and polytechnics, may no longer be essential for workers to be economically productive?

Fifth, the goals of schooling have become more ambitious, and will continue to do so in the foreseeable future. The penetration of digital educational technologies, the increasing qualities of teachers and the advent of AI have meant that schooling and education is not only for all students, but a reasonable trajectory can now be made towards the ideal of individualised and personalised learning for all learners. Globally and in Singapore, there is a significant push for education to embrace not just the traditional forms of curricular knowledge such as literacy and numeracy, but to encompass 21st century skills, digital literacy and dispositions. Some nations have begun to incorporate newer forms of literacies, such as digital and AI literacies, into their core K-12 curriculum. The old Fordist model of schooling is now being transformed into a digital, highly inter-connected organisational forms where students are networked into new and rapidly expanding repositories of knowledge. Yet, history tells us that educational structures are incredibly resistant to change, and if future-oriented educational aims are to be actualised, deep considerations of how some of the entrenched institutional structures (such as examinations, school subjects or school placements) may have to be re-evaluated and even dismantled or modified.

Sixth, education and learning are becoming an omnipresent force in modern social life. Education is now a birth-to-death phenomenon, with more children gaining access to preschools, more people acquiring degrees, and more adults taking classes alongside their jobs or in retirement. Education encompasses both formal and informal forms, with creation of new industries to cater to training and retraining workers. As Baker (2014) noted, we are in an age of the "schooled society" or a society that is actively created and defined by education. To

this, we would add that we are moving steadily towards an era of the “schooled economy and society” where education, economy and society are symbiotically generative of each other.

The impact of technological developments on the economy and society is also creating new spaces of working, living and learning where the boundaries between work, living and learning are blurring at an accelerated pace. New industries supporting online education, informal learning and flexible work arrangements are driven by technological affordances enhancing communications and workflow processes. Likewise, technological innovations and digitalisations are impacting jobs and employment through new forms of labour automation, labour augmentation, new job creation, re-shoring, off-shoring, labour market fragmentation and multiple labour market employment.

Sociotechnical Co-evolution

To better understand the digital futures and to analyse it, Professor Nancy Law suggested that the relationship between technological innovation and human development needs to be significantly reconsidered. She proposed that rather than thinking about technological and human development as separate and distinct, as is traditionally understood, there is a need to consider technological and human development as interconnected and intertwined. Such a “sociotechnical co-evolution’s perspective” (Geels, 2002) recognises that developments in both spheres affect each other and are interdependent. With each technological innovation, society evolves its rules, norms, policies and infrastructure leading to social transformations, and vice versa. When viewed in this manner, connectivity takes on fresh perspectives, as can be seen when super epidemics such as the outbreak of Severe Acute Respiratory System (SARS) in the 2000s, and the Novel Coronavirus in 2019 and 2020 — an effect of super-connectivity itself as the disease spread through human transport pathways — generated new technological innovations as well as innovations to social infrastructure in order to contain the spread of the disease and minimise health risks. Likewise, the invention of the gasoline engine co-evolved with the global political and economic history of oil and gas extraction, car manufacturing industry, and transport infrastructure.

These critical developments that will affect the future — educational and labour market transformations, connectivities, changes to the nature of the human as a super-augmented and super-connected being — have raised deep questions about the purposes and meaning of life in these digital futures, which are examined next.

Purposes of Life

The second cluster follows from the first, and asks what forms of new meanings and purposes of life, living, working and learning are possible and desirable. As mentioned, the sociotechnical co-evolution will challenge our ideas and beliefs about what it means to be human. In the face of such unprecedented changes and challenges, it is therefore crucial for us to understand how to achieve personal and economic well-being in this constantly evolving digital landscape.

For discussion on the purposes and meaningfulness of life, a society needs to be in a relatively peaceful and harmonious existence. Across the speakers in the Symposium, there is a collective agreement that human development in the digital futures should not just be focused

on economic growth, but on enhancing *well-being*, seen as the "fundamental safety of an individual within a society" (Law, 2019). This entails considerations of good working conditions, work-life balance, fulfilment and the ability to connect as well as disconnect from the digital environment. Taking on an expanded meaning of well-being beyond just the mental and physical aspects, Ms Strietska-Illina argued that facilitating enhanced well-being included not just ensuring the economic and social participation of every individual, but achieving a sense of fulfilment that each individual experiences. In both senses, digital technologies have the potential to free people to pursue higher purposes, as well as social participation and self-fulfilment.

These latter affordances of technologies open up the space for individual empowerment, enabling people to make sense of, envision and create the future, and to acquire the capabilities required for making life meaningful and fulfilling. As Lee (2014, p.13-14) pointed out, the opportunities to learn and acquire capabilities and skills "will enhance equity in terms of the availability and accessibility of educational opportunity for individuals, and this further empowers individual citizens to be active learning agents, and moreover enables the learning agent to better function as an active citizen in society". One example of the sense of empowerment described here would be to consider how older workers could assume the role of mentors. Leveraging on technology with flexible work arrangements, which can be advantageous to older workers, multi-generational work teams can be formed that bridge the divide between the young and old, novices and experts. Different configurations for working, learning and living can be enabled through different generations coming together to share knowledge, experiences, sense-making and wisdom, leading to a sense of empowerment for both generations, and a strong sense of purpose in life.

The idea of multi-generational teams coming together requires a whole-of-society approach, to reduce and remove stereotype barriers about both groups of workers. Such multi-generational teams can often work together to solve problems, raising new notions of the social compact between individuals, institutions, businesses and governments. Digital technology can be an enhancer or a hindrance to such collaborations.

Discussions around the purposes of life must necessarily include ethical considerations of the impact and consequences of the digital economy and society. As pointed out by Kenny et al. (2016), work opportunities are being affected, and reduced, as a result of technological change and economic turbulence, with "young people from low-income backgrounds, who have less education, and who belong to a racial or ethnic minority group are often marginalised from the economic, academic and social resources needed to compete for the stable and decent work opportunities that do exist". With education seen as a precursor to gainful employment and access to associated economic, health and social benefits, ethical issues need to be addressed as to how every person in a society can be educated, be given the best opportunities to learn, and enjoy physical and psychological well-being across the life span.

Likewise, in technological developments, especially in the use of automation and AI, ethics on an organisational level will have to be considered. The key question is: Whose ethics or values is the system embracing in decision making as part of the autonomous or automated process? Additional questions include: How could these ethics be developed? Could AI develop its own ethical system based on a mathematical probability or rule? What are some of the core issues in ethics in the technological and digital development? Great advances have taken place in the AI development with the ultimate goal of achieving singularity or a consciousness for the AI. How would this affect the human race or our reason for living and being?

This may require the search for a new definition of ethics, the quality of life and new indicators or measurements of quality of life as examples. This is akin to the happiness index used by

some countries to gauge the wellness of its citizens or the use of the Gini coefficient to measure the economic inequality in income distribution. Further development may be required to create digital literacy or digital accessibility or digital well-being indices to allow us to measure our progressions or stresses due to usage and exposure to digital technologies.

New Conceptualisation of Human Capabilities

The third cluster examines the human capabilities needed to thrive in these digital futures, including deliberating on new conceptualisations of human capabilities that may be driven by technological advancements (such as AI).

Human capabilities are generally described as what people are effectively able to do and be, or the positive freedom that people have to enjoy as valuable "beings and doings" (Alkire, 2005). In this consultative paper, such capabilities are necessarily contextual to Singapore's economic and societal needs, and can include individual capabilities such as creativity, empathy, discernment, morality, cultural awareness, or organisational capabilities (but not limited to these). Indeed, the International Labour Organisation (ILO) has a skills agenda that are proposed to be necessary for the digital futures. The skills comprise five interdependent components:

1. Developing specialised technical skills, which include care skills grounded in social and emotional intelligence and STEAM (Science, Technology, Engineering, Artistic and Mathematics) skills to foster innovation with social responsibility
2. Promoting stronger foundational skills, which include the traditional literacy and numeracy skills, as well as newly important skills such as research literacy to facilitate self-directed learning, and environmental literacy
3. Fostering core work and transferable skills, which include learning-to-learn, agility, the 4Cs (communication, collaboration, creativity & critical thinking), and future thinking
4. Promoting entrepreneurial and artisanal skills, which include a focus on job creators and not only job takers, as well as demand for artisanal customised products
5. Enhancing digital skills, which include basic and generic digital literacy skills, intermediate and advanced digital skills like programming and digital media, and digital applications skills such as Building Information Modelling (BIM) in construction.

The ILO skills agenda is congruent with the changing nature of work. The Futures of Work (2018) reported that by 2022, it is expected that the average task hours across 12 industries will have shifted to "58% task hours performed by humans and 42% by machines", from 71% by human and 29% by machine in 2018. In addition, "by 2022, 62% of an organisation's information and data processing and information search and transmission tasks will be performed by machines compared to 46% today". The human-machine frontier will shift from work where machines can replace human beings. However, it also creates opportunities where humans can be redeployed into other works which are new and can only be done by humans. For example, today we have the motor mechanics because motor vehicles are a common feature in our everyday life. In a digital future, it is possible that digital technicians or technologists will be a new wave of professionals.

This will call forth new human capabilities to cope with the new opportunities introduced by new work tasks. There would also be new cadre of professionals who need to come online in the new digital economy and society. For example, we anticipate a significant demand for data analysts and scientists, software and application developers, e-commerce and social media specialists and cyber forensic auditors. Many of these jobs can only be performed by distinctively human skills (WEF, 2018) and their unbounded creativity. To facilitate these new work tasks and jobs, Symposium speaker Ms Strietska-Illina advocated a "human-centred agenda for the future of work" driven by three key investments:

1. Investing in people's capabilities
2. Investing in the institutions of work
3. Investing in decent and sustainable work

This suggests accompanying investments in education, businesses/organisations and economy respectively, which require governments to take an ecological approach to the future work agenda.

At the same time, it might be useful to think about how the relationship between humans and machines is changing at the task level, because technology changes what we do task-by-task, and not job-by-job. Economists, consultancies and governments are all starting to study the future at the level of tasks, and this provides a granular and specific way to track disruptions, and determines how work and jobs can be transformed, and how workers can be transitioned. Researchers have also highlighted that there may not be enough workers like data analysts and software developers for those who want them, and they call attention to issues of economic capacity, job quality, and re-distribution of wealth among nations (Brown, 2019). Ultimately, the emphasis on skills development in conjunction with geopolitical and national economic transformation and organisational changes can help to enhance and support individual and societal well-being: first, as an enabler of growth, and second, as a buffer from social and economic shocks. From a broader perspective, human capabilities should also be reconceptualised as new ways of seeing, understanding, living and learning in the world through technology. It is the latter that we now turn to.

Learning

Along with the human capabilities needed, the fourth cluster on learning forms the conceptual nexus of this consultative paper's intellectual ambit.

Learning can be defined as the ability to discover or uncover new things or knowledge over time, and a child learns the moment he or she is born. Learning here takes an expansive sense of encompassing the lifespan (from child to adult), from micro-genetic and psychological aspects to the acquisition and socialisation of attitudes, skills, knowledge, values, morals and dispositions, and from formal/institutional learning environments to informal/incidental/emergent/serendipitous environments.

Central to this cluster is the impact of digitalisation and technologies that can help to reconceptualise and transform the nature of learning and indeed, formal education as we know today. This could result in new learning models that blur the distinction between formal and informal learning, individual and societal based learning and the generally accepted K-12 education followed by tertiary education. It may require the re-engineering of the formal education system as we know of today.

Some of the key considerations include when, what and how digital technologies are to be incorporated into the learning syllabus of schools (both K-12 and tertiary). It may also

necessitate the proposition of bringing digital technologies to early childhood development, since these young individuals are digital natives born in a rapidly digitalising world.

In the area of learning, there will also be the need to consider the role of educators and the tools available to them to effect deep education in digital technologies. The role and skills of teachers, their assessment methods and the curriculum will all have to be reconsidered in the light of this digital revolution. For example, when should coding be introduced to the formal education system, and more importantly, what is coding supposed to inculcate as learning outcomes as part of digital skill or knowledge for the students? The same can be asked for data analytics or machine learning.

Another dimension of learning is how human-machine interaction (HMI) can be introduced in the context of learning to accelerate learning or to open up new frontiers of learning which never existed. For example, while the use of “virtual experiences”, avatars, augmented realities and others may have high setup costs, they open up new potential frontiers of learning.

Virtual experience (VE) is a product of para-authentic objects premised on valid connections, and it depends on how machines could “understand” and replicate human interaction. VE can be described and explained in terms of a typology of intentionality detector (ID), eye detection detector (EDD), shared attention mechanism (SAM), and theory of mind mechanism (ToMM). VE can be introduced selectively and wisely in the course of learning to aid learning, which at times is not possible due to physical constraints or inability to have the necessary feedback mechanisms.

In the early development of social robots, scientists and engineers have failed to achieve “natural interaction” because of a lack of understanding of VE. However, with better research in VE that leads to new applications, for example, the MIT approach in robotics where machines encompassed the “mind reading modules”, there was a marked improvement in social interactions (between humans and machines). All these will continue to make in-roads into learning and will be systematically deployed into learning sciences. This also posits the possibility that robots could one day manifest its own personality and improve HMI. The challenge is how to design such robots/machines and how to deploy them to enhance learning.

Another dimension of the impact of digital technologies on learning is in the area of learning games. The experiences of gaming and the design of games or gamification are manifestations of human-machine interaction (HMI). Using “serious games” and “entertainment games” as archetypes of HMI activities, and appropriate deployment of the notions of “flow” and being in the “zone” into learning experiences are opportunities accorded by this digital technology. This is analogous to the application of learning theories, such as Vygotsky’s Zone of Proximal Development (ZPD) using digital technology. Vygotsky argued that learning is an experience facilitated through dialogues with a "knowledgeable other" such as a peer, a more knowledgeable person or expert. Gradually through social interaction and sense-making, the learner develops the ability to solve problems independently and do certain tasks without help. Can HMI fulfil the role of this knowledgeable person or expert?

Avatars can be used to augment learning, allowing for the presentation of idealised selves or interactions with pedagogical agents in ways that enhance motivation and engagement in educational content. Avatars have no limitation across space and time, and do not only transcend conventional social and cultural divides and categories, but also enable and empower people to create new relationships, possibilities and identities. According to the "Proteus effect", people are influenced behaviourally by their avatar's characteristics, and this phenomenon could be harnessed toward educational goals, as Dr. Ratan's research suggests. Take the example of students creating avatars to represent themselves as scientists while they are participating in an online science class. This self-representation can be guided to enhance their self-efficacy and motivation to interact with their classmates and engage with challenging course material more confidently, thereby enhancing the learning experience and outcomes.

The design and development of avatars require thinking about “gamification” or the application of gaming concepts in non-gaming contexts, focusing on how game mechanics and resource management could improve learning. Here, gamification is not merely (about) “levelling up” or “accumulating points”. It goes beyond the mechanics (of implementation) and even pedagogy alone. Avatar development is about inter-disciplinarity, which combines design thinking, pedagogy and HMI. If it is deployed into learning, it opens a new frontier for learning. While research and knowledge generation about the utilisation of avatars in learning are still ongoing, the majority of research results thus far suggest that it is a promising approach.

A distinction can be made between ‘learning’ and ‘sense-making’. Professor Nancy Law explained that learning involves fundamental individual and structural changes. These changes should and/or tend to be permanent but could also dissipate over time. The changes could also be at different level; e.g. biological neuro-muscular change and/or even at institutional levels. Sense-making emphasises the macro, the climate or environment (of learning) for the learner. Sense-making is a kind of conditioning or orienteering of the learner. It appeals to approaches like design (to orientate the learner), whereas learning in educational settings tends to be more intentional and goal-oriented. This distinction resonates with Professor George Siemens, who argued that learning is mainly cognitive while sense-making is heavily social, and offered a sustainable approach for human development in the world of AI. He noted that learning is aligned to knowledge attributes, while sense-making is aligned to what he called beingness attributes. In essence, the future of learning required a redressing and re-introduction of ontological aspects, on top of what has traditionally been the strength of institutes of learning — epistemological aspects. This is a curricular question that institutes of learning and education ministries will have to grapple with — the epistemological (knowledge) and ontological (being) balance.

Another dimension of learning in a digital society and economy is the constant changes in technology, which will make obsolete present digital knowledge and technology. For example, pagers, fax machines and dot matrix printers were all high technology equipment in their time but are deemed as collectors’ items today. The speed of change in digital technology would require upgrading in knowledge and skills to cope with the constant changes. The concept of a lifelong learning ecosystem highlighting the linkages between systems and the changing mindsets of learners towards a journey of continuous learning will be crucial. Policy making in the learning arena must incorporate lifelong learning in the context of a digital society.

Such a lifelong learning agenda requires us to consider curricular aspects. First, the objectives of lifelong learning, as advocated by Dr Cheong Wei Yang, should be to develop growth mindsets, to foster deep curiosities to create better futures, and to develop a strong sense of social responsibility. Second, lifelong learning requires the recognition that expertise is both collective at the macro level and distributed at the individual level. Encouraging lifelong learning means ensuring that everyone has a role to play and thrive in society. Finally, lifelong learning means that the places and spaces of learning are no longer just located in the education system but distributed across different sites of knowledge, skills and being development — in workplaces, in corporate universities and other emerging alternative sites for epistemological and ontological development.

Risk

As in the introduction of any new way of life and the continuing advancement of technologies introduced into our everyday life and work, there are unintended consequences in technological developments, and these issues need to be recognised upfront.

The last cluster provides a cautionary note in the consultative paper. It articulates the position that any technological advancements will always have risks, challenges and consequences to individuals and societies.

The Industrial Revolution 4.0 has the potential to bring benefits as well as disadvantages. These can include increasing learning disabilities, man-made or natural (caused by physiological, psychological and technological barriers), and increasing marginalisation and exclusion of sectors of society unable to adapt to the pace of technological advancements.

Unless attended to, these digital futures may have negative consequences to learning, social lives, well-being, and individual creativities, increasing polarisation of the community, and more broadly, making lives unbearable as a digitally illiterate navigates and survives in the digital explosion.

The risk in this fifth cluster is confined to the risks involving our understanding of learning, future, human capabilities and digital technology. The risks are non-trivial, as society has never been this way before with such rapid changes and challenges to our current way of life and work. For example, it probably has taken mankind hundreds, and if not thousands, of years to perfect the art of producing physical currencies that are extremely hard to counterfeit. However, it takes slightly more than 10 years to create a digital currency like bitcoin that is traded and used globally. This is not including the plethora of digital currencies and platforms for payment and e-commerce purposes. Facebook, one of the largest social media networks in the world, plans to roll out its own digital currency, Libra, in 2020. This in itself can make Facebook into a digital central bank for the world!

There is a real challenge in how society changes when technology advances too quickly. Is society ready, and also are we ready in terms of individual cognitive and metacognitive development for this technological change?

Human beings are highly adaptable and they have learned to avoid doomsday warnings of new developments that can obliterate human existence or activities. Humans are tenacious and versatile, and they have the tendency to overcome the perceived adverse consequences. For example, Socrates believed that writing was not an effective form of communication as compared to face-to-face communication. He argued that face-to-face communication is the only possible way where knowledge is transferred from an individual to another. Would the current maxim that machines, AI and digital technology can never replace a human teacher fall within the same genre of argument? The risk then becomes allowing digital technology to push its influence into the human realm of learning sensibly without prejudice or overt optimism.

The challenge for learning in a digital society is in conceptualising ‘learning technology’ that connects minds over time and space, and augments individual and collective performance. But this also potentially creates new societal fractures in the form of the ‘digital divide’, which is shaped by how people use technology; for example, the containment of the SARS epidemic in 2003 is a story of global technological and scientific cooperation. This demonstrates that the impacts of technology are not just individual but systemic.

The key strengths and usefulness of digital technology include ease of transaction, concentration of information, speed of retrieval of critical information, and virtual and instantaneous access. However, the resulting automated decision making can become the greatest risk factor in the digital economy and society.

As discussed earlier, any automated system embeds within it the morals and ethics of its creator. For example, an AI credit rating system not only uses the massive historical data to compute and assess the probability of credit default for individuals for lending decisions, it

may inevitably include the biases of the team of creators, particularly if the team of creators come from a particular pool of individuals from a certain segment of the society. The problematic outcome is that the system legitimises the prejudices or bias of its creator! Another example is the unintended outcome reportedly experienced by Amazon, which had used AI algorithms since 2014 to review job applicants' resumes. However, by 2015, the company realised that the AI-based algorithm was not rating candidates in a gender-neutral way as it was trained using predominantly male resumes of a particular group accumulated over the last 10 years. The use of AI can then inadvertently reproduce or intensify marginalisation and exclusion on the grounds of past patterns via machine learning and mathematical probability.

This also raises the possible risk that the new digital human-machine frontier will limit creativity, as the creative design and interactions with advanced technology, machines, algorithms or AI are only confined to a small segment of the population who has the capability to handle them. This will reduce the pool of capable or creative individuals, since the setup cost for being capable in creating AI or advanced digital technology is significantly raised.

The possibility of humans and machine 'co-learning' mentioned in the earlier section also raises the possibility that both can act as a 'check and balance' on each other, helping each other understand, decide and navigate the moral and ethical risks posed by over-relying on either the human or the machine.

Conclusion

This consultative paper describes the challenges and questions to which we hope in-depth research, dialogue and discussions will provide possible leads and solutions. The digital revolution can be likened to sunlight. It will bring brightness and illumination to all sectors of life. However, it also has the capability of exhausting the over-exposed individuals or those who are fearful of the sunlight.

Learning in a digital society and economy is an evolutionary process. Market mechanisms will drive its direction, speed of progress and the major beneficiaries of the developments. Governments have a role to ensure that the well-being of citizens are advanced in a pareto optimal manner. This will require significant amounts of investment in research to provide answers to the known-unknowns and to uncover the unknown-unknowns. There will be questions that will need to be better clarified and where the answers will take time to be obtained while others are low-hanging fruits.

Professor George Siemens may have provided a most appropriate summary concerning research on education in relation to this topic. He said that researchers need to prioritise their research on the positive impacts on people's lives, and to develop new frameworks or paradigms that are meaningful to people. He emphasised that adult education needs to be impactful, and the research needs to move towards practicality. Research frameworks, methods and approaches should have a practical end in improving actual lives of people. How are we to marry research theories and concepts with the practical?

Key Research Questions Raised in the Consultative Paper

Framing the Problem

RQ1 Are new conceptualisations of human capabilities needed in a digital economy and society?

RQ2 If yes, what are the new conceptualisations of human capabilities that we should have a good grasp of?

RQ3 How can we ignite the synergy between a person's internal capabilities and his/her embedding in the external environment in this digital era?

Questions from the macro perspectives:

RQ4 What are the impacts of digital technologies on the current labour market? What are the factors that encourage creations of new and quality jobs in the digital economy?

RQ5 What are the new challenges to well-being and wholeness for life in a digital society? What are the potential risks to individuals, groups and communities that are brought about by technological advances? How can we improve inclusiveness/equity/social mobility and mitigate against social polarisation and fragmentation in a digital society?

RQ6 Given that traditional literacies such as reading, writing, speaking and listening are changing with the use of technology, what kind of literacies would be a fundamental educational requirement of every child? What are the ways to understand and identify new literacies; e.g. 'digital literacy' for a future economy and society?

RQ7 What new capabilities are needed in the future digital economy and society? How can they be identified and developed?

RQ8 How should learning dynamically adapt to constantly changing technologies? How will learning be different from our current concepts of competencies/skills etc; e.g. ASK (Attitudes, Skills, Knowledge)?

RQ9 What are the economic and social impacts of learning that would take into consideration the diversity of preferences across a population, and the impacts that could be differentiated even when the same technology is applied in a similar manner? (e.g. the use of facial recognition technology in a prison versus a hospital)

RQ10 What infrastructure and institutional arrangements would best support the development and utilisation of a person's internal capabilities to contribute meaningfully and constructively to the future digital economy and society?

Questions from the micro perspectives:

RQ11 What should be the core technological and non-technological skills/competencies for an individual in a digital economy?

RQ12 Assuming technological advances facilitate the personalisation of learning, how could schools design or institutionalise personalised learning in both the real and virtual learning environments? What new modalities in learning can digitalisation afford us?

RQ13 What kinds of socio-technical infrastructure would be conducive to support connected learning within and across communities and age groups?

RQ14 How do we promote adaptive self-learning capability in both young and adult learners in a digital society and economy? How do we use digital technologies to promote a mindset of lifelong learning?

RQ15 How does digitalisation change our understanding and development of generic/soft/employability skills?

The Digital Futures

RQ16 Is there any schema that could help us chart a road map to understand the impact of digital technology on education, learning, the economy and society?

RQ17 What role does education and learning play in an informal economy where traditional credentials and certifications from educational providers, such as universities and polytechnics, may no longer be essential for workers to be economically productive?

Purposes of Life

RQ18 Whose ethics or values should the AI system be embracing in decision making and in taking on human responsibilities as part of the autonomous or automated process?

RQ19 How could and should these ethics be developed? What/who should be involved in such development(s)?

RQ20 Should AI be allowed to develop its own ethical system based on a mathematical probability or pre-set rules? How can we monitor how the AI is carrying out ethical decisions on our behalf?

RQ21 What are some of the core issues in ethics in the technological and digital development?

RQ22 How would singularity or a consciousness in AI impact the human race or our reason for living and being?

Learning

RQ23 When should coding be introduced to the formal education system, and more importantly, what is coding supposed to inculcate as learning outcomes for digital skill or knowledge for the students?

RQ24 Can human-machine interaction (HMI) fully replace the role of this knowledgeable person or expert? How then will this impact what humans learn?

Risk

RQ25 Is society ready, and also are we ready in terms of individual cognitive and metacognitive development for this technological change? How can the individual be supported to make this transition effectively and painlessly?

RQ26 Would the current maxim that machines, AI and digital technology can never replace a human teacher fall within the same genre of argument?

Impact/Outcomes

RQ27 How can we marry research theories and concepts with the practical to sustain a meaningful role for humans in a digital society and economy?

RQ28 How can we keep track of and account for the impact of digitalisation on humans' well-being and inclusivity in society and economy?

RQ29 How can we evaluate how well humans are responding and dealing with the challenges of a digitalised world?

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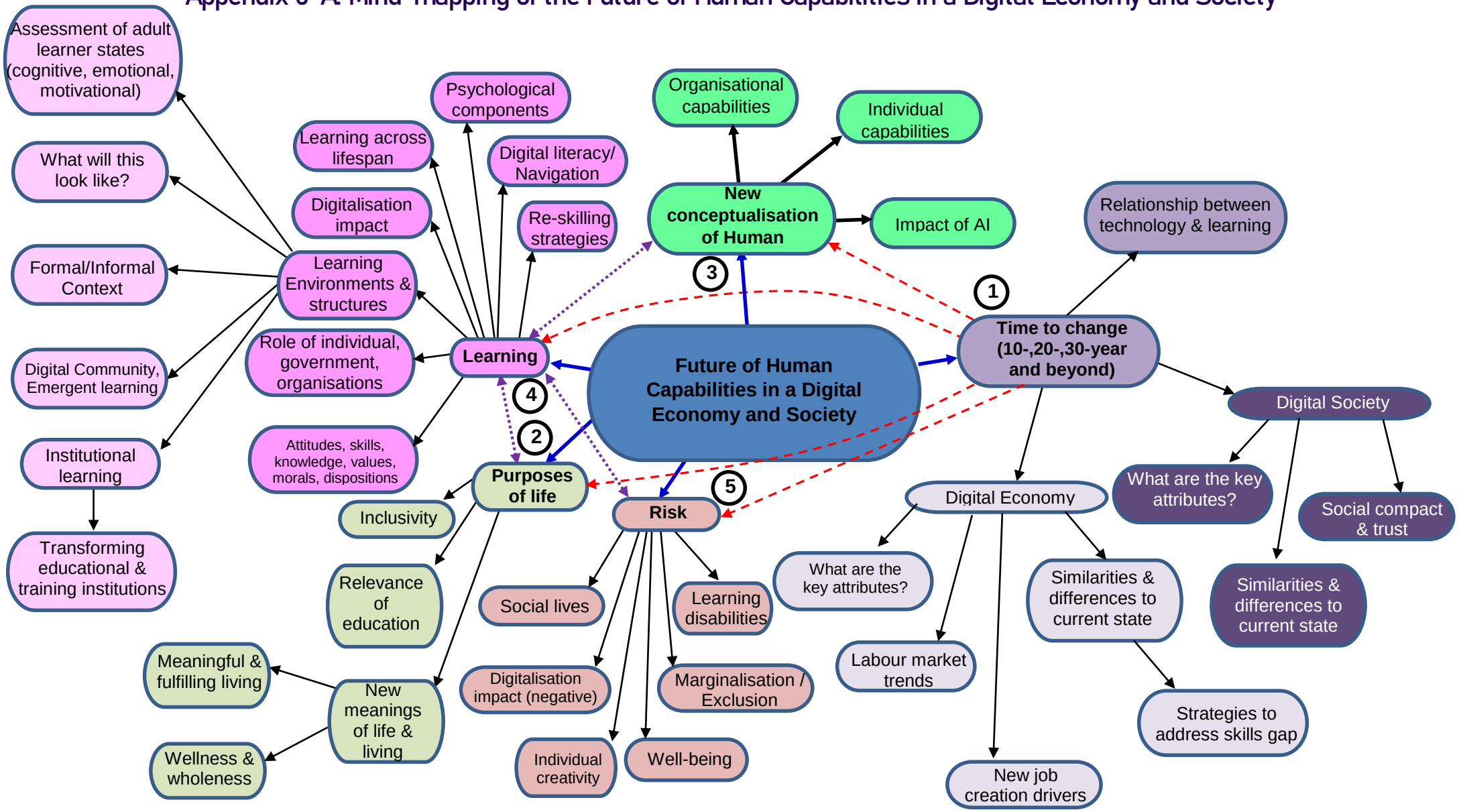
Appendix 5-A: Mind-mapping of the Future of Human Capabilities in a Digital Economy and Society



Appendix 5-B: Possible Frame to Approach the Future of Human Capabilities in the Digital Economy and Society

1. Inter-disciplinary: Fields of Study

(broadly conceived as each speaks to one another on various levels)

- Historical
- Economics / Political Economy / Labour Economy
- Comparative
- Ethnography / Anthropology
- Governance, ethics
- Social Justice

2. Study Approaches

- Comparative
- Critical
- Practical (solutions-driven)

3. Subjects and Objects of Study

- Individual
- Organisation/industry
- Communities and/or societies
- Technologies
- National programmes / institutional logic
- Jobs, occupations and/or vocations

4. Systems

- Production systems
- Ecosystems
- Markets
- Infrastructure
- Regulatory

How

What

Where (Role)

Human Capabilities