

THE 4th INDUSTRIAL REVOLUTION – A BUDDHIST PERSPECTIVE FOR SUSTAINABLE SOCIETIES AND WELLBEING

by Peter Daniels*

ABSTRACT

The effects of the purported global “Fourth Industrial Revolution” (4IR) are likely to be profound – even in relation to the extensive impacts of previous industrial revolutions beginning in the late 18th Century and escalating, since the 1980s, with the pervasion of the microprocessor and the internet. They will cover a multitude of very significant social benefits and costs affecting most of the world’s people, as well as natural and built environments in which they dwell. The Fourth Industrial Revolution is not easy to clearly define and distinguish but is typically characterised by the “blurring” of the physical and digital worlds - with embedding of digital processing and transfer to provide functions in everyday economic, social, and household environments. Interconnectedness and virtualisation are also key in the 4IR.

There are a diverse range of potential links between Buddhism and the nature of the Fourth Industrial Revolution. However, the focus in this paper is upon matters related to sustainability and human wellbeing. It comprises a preliminary Buddhist-influenced analysis of the 4IR and likely consequences in terms of environmental impacts and also more fundamental aspects of the root causes of samsaric suffering.

This is an exploratory Buddhist analysis of such developments. It includes the positive and negative options and helps to inform

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recommendations on how Buddhism can pre-empt and sway pending change towards more sustainable societies and higher individual and community wellbeing. Mindfulness and awareness of the real sources of wellbeing (and hence suffering) are key aspects of the Buddhist-inspired analysis of relevant effects and identification of responses to guide the 4IR.

1. INTRODUCTION

It is ironic that hundreds of years of profound technological “success” throughout much of the world now seems to offer limited further gains in social and psychological wellbeing. This may well represent a reaffirmation of the inherent wisdom in Buddhism that enhanced material accumulation and comfort, beyond some basic level, won’t really reduce our suffering (improve our “happiness”). Such a limitation would seem counter to the optimism and excitement surrounding the “Fourth Industrial Revolution” (4IR) which is generally heralded as promising an amazing new world with longer, healthier lives, unlimited access to information and entertainment, massive productivity gains, and the potential removal or arduous, menial and routine labour task - all founded upon accelerated trends emerging with the digital revolution.

It is true that the Fourth Industrial Revolution (4IR) can help continue the substantial reductions in global poverty witnessed over the past 40 years.¹ However, for most people in higher income nations on the vanguard of the 4IR, the benefits (perhaps beyond physical health) are less certain given wellbeing trends measured since the mid-20th Century.² The onset of the 4IR seems premised on a type of ignorance recognised in Buddhism (*avidyā*) regarding the link between wellbeing, and the motives and expected outcomes that propel an intensification of techno-economic progress experienced to date.

As described by Schwab (2017), Bloem et al (2014), Jones (2017) and others, the 4IR is characterised by many dimensions,

1. The percentage of the world population classes as “extremely poor” has been estimated to have fallen from around 42% in 1981 to less than 10% in 2016 (The Economist 2017).

2. The empirical evidence on the link between subjective wellbeing (SWB) or life satisfaction and economic growth is unclear (for example, see Deaton 2008).

However, a significant part of its defining essence is the proliferating augmentation, fusion, or perhaps even supplantation, of primary human physiological (including mental/intellectual) functions with processes and artefacts of digital technology, microprocessors and related network systems. The new developments in innovation and adoption are certainly extensions of the Third Industrial Revolution that were based on the powerful synergies that emerged from the “digital revolution” and computers and ICT (information and communication technology). Yet, these developments are considered to be distinctive enough to be classed as a new “industrial revolution”. Amongst the diverse descriptions of such a complex social phenomena, is a distinguishing theme of great relevance to the topic addressed here – replacement of direct human environmental experience (including labour, social interaction, entertainment, empirical and experiential knowledge acquisition activities, and understanding of the world) with digital media and interfaces, artificial intelligence (AI), robotics, virtualisation, the Internet and its countless connected sensors and other devices, and data reservoirs.

While the scale and scope of the 4IR is awe-inspiring, there is no doubt that it will have very profound and often disruptive changes with undesirable consequences. Despite the broad economic gains and people’s recognition of their comforts and material fortune from technology success, there is a great deal of evidence, if rather disparate and ad hoc, of the dangers of acquiescence to unconditional technological optimism (overviewed in Section 3 of this paper).

Given the potential extent and magnitude of such change from a 4IR on our life-worlds, it is easily understood why it is widely accepted (by many leaders in business, government, the media and the community in general) that we need to carefully deliberate upon this matter (Huffington 2017). The priority should be positive human wellbeing outcomes – something which is not assured by a technological era driven by profit motives and unconditional technophilia built upon speed (instantaneous demand satisfaction, and expectations thereof), electronic connectivity, comfort, convenience, competitive edges, productivity, output and performance increases, and near limitless time-filling and entertainment choices. Many community

leaders now realise the need to question the assumption that these, arguably vestigial, motives and goals will lead to better wellbeing, needs to be questioned.

This paper examines many of the trending effects already observed (and those predicted) for the 4IR, and how Buddhism can help assess these effects and inform societies to choose and act to create better community wellbeing outcomes. Hence, it represents a Buddhism-inspired analysis of the 4IR and the likely implications for humans, using the ancient tradition's understanding and view of the primary universal sources and "laws" that affect positive wellbeing (and its obverse, *samsaric* suffering, in Buddhism³). This involves a focus upon how the 4IR relates to *dukkha* and the Four Noble Truths. Environmental effects also play a key role in the discussion.

The general links between Buddhism and the 4IR have been analysed elsewhere (for example, see Jones (2017) and other papers in the Buddhism and the Fourth Industrial Revolution Workshop sponsored by the Korean Association for Buddhist Studies in Seoul in 2017, Bristow (2017), Smith (2015)). However, this paper is unique in its emphasis upon sustainability analysis and the long-term, sustained wellbeing of human beings. This rests on the assumption that people are deeply embedded in a web of inter-connectedness with each other, and the natural world of which they are part. A major paper theme is how the 4IR might impact, and best be shaped in view of joint environmental and social (including economic) sustainability. An important topic is the Buddhist analysis of potential influence of the 4IR on ecological footprints and material and energy flows, and how Buddhism would be likely to support transformation of the 4IR into a "green" version (known as a "green techno-economic paradigm" (or green TEP) in some areas of science). Of course, this quest necessarily involves consideration of wellbeing aspects and how the 4IR affects the key sources of wellbeing, in accordance with the Buddhist worldview.

The following section provides a brief overview of relevant aspects of the 4IR. Section 3 summarises a detailed list of the poten-

3. In Buddhism, *samsara* refers the cycle of birth, mundane existence and death, permeated and perpetuated by desire and ignorance, and its karmic consequences (King 2009).

tial (and overlapping and inter-connected) effects of the 4IR on the economy, broader society and culture, and the natural environment. It highlights some of most relevant impacts associated with the world view of Buddhism and Section 4 discusses how the this ancient wisdom might help analyse and assess these impacts contribute to guiding communities to best mould the power of the 4IR for long-term good.

“The fourth industrial revolution is in its infancy, and it is far too early to predict what form it will take. But the more we can understand its nature and causes, the more likely we are to reap the benefits and minimize the risks.” (Thomson 2015)

The essential assumption for this paper is that Buddhism can help understand and evaluate the motives and impacts of the 4IR to achieve Thomson’s proposition.

2. WHAT IS SO SPECIAL ABOUT THE FOURTH INDUSTRIAL REVOLUTION?

The (first) Industrial Revolution is well-known from modern history classes in schools. Its onset marked a momentous change in the nature of economic and broader social systems – change that has evolved and spread with common themes and effects across the world, especially over the past 50-60 years. Beginning in England in the late 1700s with a concomitant capability to use inanimate, often fossil fuel, power, and the invention of machines using this power to greatly mechanise and speed craft production tasks, the wave of accumulating technologies spread quite rapidly across Western Europe and the USA (Deane 1979). The 1st Industrial Revolution also involved a host of complementary and related innovations in metallurgy, transport, and communications, commerce and banking, The result was a very substantial increase in productivity and overall output, especially in textiles, chemical and metal products. This new industrial economy provided substantial increases in the material standard of living for some but a forbidding and often dire working life for the rural migrants and other working class labourers (caught in the radical restructuring of labour demand and political economic conditions).

What is less known is the series of subsequent “industrial” or

technological-economic revolution epochs that have been identified since the classic 18th Century developments. Focusing on the four revolutions that are commonly identified tends to ignore the rather continuous and cumulative nature of these times. However, they are considered to have sufficient unique features to be deemed as separate “industrial” epochs. The term “industrial” (typically associated with manufacturing activity) to describe such profound social and economic transformations is somewhat myopic given the scope and depth of impacts and, in later sections, we will propose that the concepts such as “techno-economic paradigms” are more appropriate for the social scientific analysis of related societal dynamics.

Some of the primary features of each of the four industrial revolutions have been classified into a number of dimensions and are presented and compared in Table 1. In keeping with the approach typical of much of the literature in this field, economic system and socio-cultural impacts are not covered in detail in the industrial revolutions description table.

The first two industrial revolutions tend to be largely about mechanical and energetic assistance in the production of physical goods, while information and knowledge accumulation and access are central to the third revolution. One of the defining features of the 4IR is the move towards integrating information, sensor, virtual reality and decision-making (and physical artefact) systems more directly into human consciousness and even bodies. The 4IR represents a continued move away from an era based on new energy sources towards a technological phenomenon – “digitalization” – where virtual perceptions strongly guide human actions in the physical world (Sentryo 2017).

The 4IR concept was effectively instilled by the work World Economic Forum leader Klaus Schwab in his 2017 book “The Fourth Industrial Revolution”. A principal message of the book was that this latest industrial revolution was likely to involve more profound changes than at any time before, and hence the need for great care and deliberation on the nature of 4IR technologies and their impacts. The scope of earlier revolutions was more localised, if expanding over time. The clearly global nature of the transformations and influence of the 4IR increases its significance.

The primary features of the 4IR have been outlined in the Introduction and are analysed in more detail in the final column of Table 1. This is described a little more in the final part of this section with a preview of some key links between the 4IR and Buddhism.

Overall, one of the most distinctive traits of the 4IR has been described as the rapid innovation and adoption of “cyber-physical systems” (Schwab 2017; Bloem et al 2014) that “fuse networked and connected digital devices with physical and biological systems” (Jones 2017). This biodigital fusion is perhaps the most radical feature of the 4IR and covers a cluster of related technologies based on an intense interplay or even the embedding of digital technology with “fleshy biology” (including close physical connections between sense and cognitive organs) (Jones 2017).

Table 1: Major dimensions of the 4th Industrial revolution and its predecessors

	1 st Industrial Revolution <i>1770s to mid 1800s</i>	2 nd Industrial Revolution <i>Late 1800s to mid 1900s</i>	3 rd Industrial Revolution <i>Mid-1900s to 2000</i>	4 th Industrial Revolution <i>21st Century</i>
Main energy sources (and key materials)	Switch from human and other animate energy to inanimate energy (esp. coal). Coal, water and steam.	Steam power, coal-based electricity, petroleum	Fossil fuels, hydroelectricity, nuclear. Some renewable sources.	Mixed. Coal, petroleum, natural gas but diminishing relative importance. Increasing use of renewables – solar, wind, etc.

<p>Key technology change and improvement clusters</p>	<p>Mechanised, if not mass production.</p>	<p>Internal combustion engine and cars.</p> <p>Mass production, Fordist and Taylorism (scientific management of production).</p> <p>Shift</p> <p>Some analogue electronic.</p> <p>Vacuum tubes, transistors in later period.</p>	<p>The rise of electronics. Computers - microprocessors and memory/storage, then network systems. Software systems.</p> <p>“Digital revolution” aiding production (vs directly) producers; shift from mechanical to analogue electronic then digital.</p> <p>Electricity and other energy storage systems.</p> <p>Mobile phone and other computing. Robotics.</p> <p>Biotechnology.</p>	<p>Artificial intelligence; algorithm-driven search, consumption and other analytics; apps and systems for numerous tasks; robotics; the Internet of Things; autonomous vehicles; 3D printing; synthetic biology and genetics, genome editing; distributed ledger technology (DLT), blockchain, quantum computing, nanotechnology; biometrics; renewable energy ; peer to peer and shared economies</p>
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Main sectors affected	Textiles, metals	All manufacturing. Steel, petroleum, electricity, utilities.	Most sectors – esp. information-related and mass production (whitegoods, autos etc)	All
Geographic extent	Britain, Western Europe, North America	N.America, Western and Central Europe, Russia, Japan, Australia. Spreading Mid East, S.America	Same as 2 nd IR but also East and South Asia. Near global	Global
Miscellaneous production aspects	Mechanical production based on steam (esp. textiles), rediscovery of cement, sheet glass, gaslight.	Standardisation of machine parts. Paper making, rubber.	Digital automation of production by electronics and information technology.	Microelectronics recreates the good or service. Deconstructing and producing new forms of existing and new physical and biological matter at atomic, molecular to supramolecular levels.

<p>Economic system characteristics</p>	<p>Creation of factories. Capitalists and workers social structure. Industrial capitalism replacing late feudal system/Nation States/merchant capitalism or mercantilism.</p> <p>Small and local firms.</p>	<p>Emergence of large firms, limited liability corporations, joint stock ownership.</p> <p>Large-scale agricultural production and automation.</p> <p>Heavy engineering.</p>	<p>New ways of processing, storing and sharing information.</p> <p>Globalisation.</p>	<p>Extensive ecosystem of internet devices linked to improve the quality, efficiency and security (and perhaps resilience) of production and process operations; IIoT (Bloem et al 2014). Linkages between machines, personal devices, real-time control and analytics, security devices; sensors and actuators. Prolific new business services based on virtual-physical world link and intelligent machine replacement of routine tasks. Demise of low skill mass production and employment capable of automation.</p>
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Table 1 (contd.) Major dimensions of the 4th Industrial revolution and its predecessors

	1 st Industrial Revolution <i>1770s to mid 1800s</i>	2 nd Industrial Revolution <i>Late 1800s to mid 1900s</i>	3 rd Industrial Revolution <i>Mid-1900s to 2000</i>	4 th Industrial Revolution <i>21st Century</i>
Transport system	Canals, slow implementation of railways	Steam turbine engines - railway, the ships; in later era, ICE automobiles and aircraft	Automobiles, trucks, aircraft, high speed trains.	Automobiles, trucks, aircraft, drones.
Communication and information systems	Limited.	Telegraph, then radio and telephone	Television. Mobile phones. Internet. Teleworking.	Internet. Mobile devices. Cyber-physical systems.
Human settlements	Industrial urbanisation	Continued migration to cities. Skyscrapers.	Suburbanisation then some inner city redevelopment and rural decentralisation.	Mixed. Increased density? Globalisation.
Integration of technology and human physiology	None	None	Limited	High

Sources: Adapted and extended from Schwab (2017), John Grill Centre (2018), Khan and Isreb (2018), Huffington (2017); Klugman (2018); The Oracle (2018) and others.

This represents a merging of the capabilities of humans and machines where technology is not just used, but deeply embedded in our lives, and increasingly physically connected or implanted into our bodies. It is the mark of change for the transition into the 4IR - technology was physically separate (a kind of extended augmentation) but starts to become internalised (physiologically and, of course, in shaping our lifestyles) (Khan & Isreb 2018). This fusion covers everything from perception (virtualisation) to biological physiology (cyborgism). It is commonly noted as the “blurring” between physical, mental and digital boundaries, between nature and machines, and the physical and artificial, and heralds the integration of the human, biological (non-human) and other physical, and digital realms (Chansoda and Saising 2018; Schwab 2017; Jones 2017).

The current technological epoch is more than biodigital fusion. Virtualisation has many degrees in service consumption, information acquisition, and experience. For example, while gaming and SMS may lack pre-industrialisation human elements, many 4IR communications retain strong physical human connection modes e.g. visuals and voice in Skype and related telecommunications application software, and improved air and high speed train travel can enhance the potential for real human contact.

Perhaps a more universal attribute of the 4IR is an intensification of one of the major trends on the Third Industrial Revolution – marking the onset of a form of extreme connectedness (for example, the “Internet of Things”) linking the virtual and physical worlds. A consequence of this profound connectedness and the AI and processing systems that can manage such “big data” is the capacity for multiplicative, compounding power and speed in information access, learning and decision-making, versus the simple additive models from the past.

As noted earlier in this section, the power and extreme connectivity of the 4IR is widely recognised to have very significant and highly ‘disruptive’ impacts – both positive and negative – upon society. Technophiles are often highly optimistic and excited about

the 4IR's prospects to “advance humanity” (John Grill 2018) and the *potential* economic and recreational gains are superlative indeed (for example, note the beneficial developments of the past half century as espoused by Steven Pinker (2019)). However, unconditional adoption of the 4IR trends will take humanity into new territory and present many unintended effects or “externalities” and critical socio-psychological and ethical issues that will deeply affect individual and community wellbeing. The changes will continue to transform the way we work, recreate, socially interact, sense the world, eat, move and even sleep, and arguably, think. Past industrial revolutions (IRs) have also had massive impacts on human lifeworlds – for example, electricity and automobiles, but in some ways these impacts were more physical regarding human activity (e.g. travel and household chores) while the 4IR has a strong perceptual and cognitive dimension and may have deeper influence in terms of mental impacts and issues.

The 4IR is far from simply a technological phenomenon that will fill all our present unmet needs and make us happy. Indeed, it is open to question exactly what the 4IR will bring and why we want these outcomes – including the presumed eternal beneficial effects such as economic gains. The 4IR won't be stopped but the transformations in train (and the inevitable powerful unintended effects) call for careful consideration and assessment. What is it that needs to be addressed or improved by the 4IR -health, longer lives, poverty, diversity of experience, life and lifestyle choice, more entertainment, free time, an easier life, inner and peace and contentment? How have these goals been achieved in earlier IRs?

Buddhism has considerable wisdom to offer in terms of evaluating these goals and questioning and evaluating the real value and direction of changes likely to come with the 4IR. It has a contribution to make in terms of fundamental questions about what we want and what will give us lasting wellbeing, and can relates these to underlying assumptions and motives (and desires and choices) that will propel and direct the 4IR.

3. IMPACTS OF THE FOURTH INDUSTRIAL REVOLUTION

The effects of the 4IR have been widely discussed. There is often

considerable excitement about the promise of technology marvels in brave new worlds, perhaps with some trepidation about the associated dangers for employment. However, it must be emphasised that deeper, more insightful analysis suggests that the potential future effects of the 4IR are much more extensive and unpredictable than portrayed in popularist accounts. The far-reaching impacts certainly have the potential for both “good” and “bad” and, while the value and evaluation of many of these effects can be highly subjective, careful consideration and wisdom will surely help provide better outcomes for local to global communities.

Some impacts, such as longer life expectancy and improved health, seem to be clear-cut wellbeing wins, but it is much more difficult to assess the eventual wellbeing effects of change such as continued increases in entertainment choice and realism, information and communication access, integration of cyber systems into the human psyche and body, and artificial intelligence (AI) guiding individual and collective decisions. Indeed, extended analysis would reveal that even substantial life expectancy improvements will present some formidable challenges to future societies.

Nothing is as simple as it seems, and one of the main lessons learned from science and society studies over the past half century has surely been that there are always very substantial unintended consequences of every major human intervention. Furthermore, these unintended consequences can have very significant effects on wellbeing. They are known by many terms (including “externalities”, “spillover effects”, “flow-on effects”) and have become a major feature of study across the natural and social sciences, and policy studies (Thiele 2011). The pervasive influence of unintended effects is still often forgotten in the heady exhilaration of ushering in new technological systems and this is evident in the retention of the technologic notion of “*industrial* revolutions”. Recognition of the far more profound importance of the full range of economic and other socio-cultural (and environmental) impacts is explicitly embraced in related approaches such as the evolution of “techno-economic paradigms” (Freeman et al 1986). We will return to this concept in the next section.

Table 2 presents a detailed list of the positive and negative,

direct and more indirect social and economic spillover, effects that have been linked to the 4IR. The reader is strongly advised to check these impacts closely, or at least refer to the table as needed, as the basis for the discussion of Buddhist-related contributions to positively shaping the 4IR in Section 4 of the paper. Key elements of these impacts, sometimes with more detailed notes, are summarised in the table. It must be recognised that many are complex, multiple dimensions, with considerable overlap between many of the impacts, and some ambiguity regarding their relative and net benefit or cost. The impacts been ordered in their rows to reflect a general logic of similarity.

The 4IR will continue to bring many of the **positive** contributions to society that have been provided by the previous “industrial revolutions”. In the benefits section of Table 2, the inter-related impacts (1 to 3) of economic and income growth, productivity growth and transaction cost reduction (e.g. transport, information access, and communication), and to a lesser extent the consumer choice and supply-side efficiencies and (5,6,7 and 8) are all related to the great potential that the 4IR has in further alleviate poverty and reduce suffering for poorer humans. The data-based problem-solving power of the 4IR and its ability to supply information, and visual, audio and other data, and other services at zero or very low marginal cost, further reinforces the spectacular growth in output available for consumption by those already economically advantaged.⁴ Indeed, as I write this paper, the 4IR-related efficiency increase from an ability to source references, and check ideas and concepts (let alone create a systematic, readily disseminatable document) is phenomenal and an enormous boon to personal research productivity.

We will return to explore some of the Buddhist-inspired views on these economic gains and other effects in the next section. However, it is worthwhile to pre-empt that Buddhism questions the veracity of the link between wellbeing and material accumulation and consumption abundance beyond that required for economic

4. Kahn and Isreb (2018) note how technology developments associated with the 4IR have been estimated to boost to global economy by \$US (2017) 15.7 trillion by 2030.

security. More important is the underlying intent of actions, compassion in the distribution of benefits, and nature of spill-over harm generated by the actions leading to this abundance. This is a common theme throughout the rest of the paper.

Table 2: Social and Economic Impacts of the 4th Industrial Revolution – Positive and Negative

IMPACT	POSITIVE IMPACTS OF THE 4IR	<i>Closely Related to IM-PACT</i>	NOTES
1	increased incomes, quality of life (material or expenditure based)	2,3	Excess wealth has also led to notable increases in philanthropy
2	increased productivity - in a wide range of areas; do same with less (labour, total factor, time) ; very strong price reductions and associated real increases in real income (purchasing power).	1,3	Closely linked to increased incomes. Productivity is not good at capturing price reductions from better technology (it uses the value of output) that is, it ignores service productivity. A better measure for labour productivity should be hours to produce an equivalent service or benefit.
3	enormous reductions in transaction costs and waste - reduced transport/travel, time and communication costs and constraints (and demand); trade facilitation	1,2	Convenience, time-saving Transport efficiency – optimal routes, congestion info, cycling route info
4	greatly enhanced knowledge accumulation capabilities/efficiency and education potential	2,3	

5	improves consumer decision-making (so that expenditure item functions at least match consumer demands) ; efficient choice and consumer information; more informed, customised consumption - DEMAND-side	2,4	Choices that potentially increase satisfaction (holidays, recreational activity; location/timing); assuming consumers have true preferences (informed choices lead to improved subjective wellbeing)
6	optimised service delivery (e.g. transport) - SUPPLY-side efficiency	1-3	Closely related to transaction cost reductions
7	facilitate problem-solving e.g. household and vehicle maintenance information and tasks, GIS, social/meeting logistics	ALL	Most of the positive effects listed here relate to problem-solving.
8	zero or very low marginal cost of many goods and services, knowledge and know-how for solving questions, problem-solving	4,7	Especially quaternary sector services.
9	more entertainment; diversity ; stimulation; learning; experience	4	
10	good and services demand and expect wellbeing from are services/info that can be completed or consumed <i>without physical connection</i> – just information transfer.	4,11	

<p>11</p>	<p>environmental efficiencies – natural resource input productivity and waste treatment technology improvements</p> <p>Closely related to productivity and transaction cost reductions.</p> <p>The reduced need for physical connection in (10) contributes to environmental/energy efficiencies.</p>	<p>1-8, 10</p>	<p>Many of the sources for this are flagged in previous items – e.g. savings in need and efficiency of travel, energy management.</p> <p>4IR technologies can continue to enhance material and energy-saving (and increase consumption service) e.g. less travel, less time, quicker problem-solving (increase service-intensity of goods and services)</p>
<p>12</p>	<p>health diagnostics, treatment, ill-health prevention</p>		
<p>13</p>	<p>creativity potential</p>		<p>The 4IR can enhance the skills, means and possibly the time for greater creativity for people</p>
<p>14</p>	<p>governance improvement – feedback, coordinate, engage with governments</p>		

15	social media, blogs, fora, gaming, social network sites (e.g. dating) that increase interaction, relationships and social belonging in peer networks and social networking		<ol style="list-style-type: none"> 1. useful information; problem-solving 2. belonging to a community (if virtual) 3. meeting and social interaction with real (more compatible?) people – so potential direct contact enhancement (e.g. Pixel Buds) 4. cross-cultural understanding and cohesion but may facilitate extremism, manipulation, etc
16	increased collective awareness and moral consciousness; encourage honesty and sincerity		However, this can also facilitate possible manipulation and mass propaganda.
17	reduced conflict and warfare		Close to 4. in (15) above. Better communication and understanding among the community vs. nationalist elitist profiteering and propaganda for benefit of national elites. Cultural barriers reduced.
	NEGATIVE IMPACTS OF THE 4IR	<i>Closely Related to Impact</i>	NOTES
1	• potential increases in inequality and unemployment		

<p>2</p>	<ul style="list-style-type: none"> lifestyle/mismatch diseases – physical and mental (many of the possible relevant mental dysfunctions are noted below) 	<p>Negative health effects [many of these are since 2IR not just 4IR] – obesity including childhood and reduced outdoor activity among children, diabetes etc from tech-economic “success”; processed food, sugar, social media, TV & computers, sedentary lifestyle, chronic stress; temptation opportunity and intimate relationships (ease of infidelity)</p> <p>Sugar & Processed Food – hunter-gatherers ingested 30 -450 tea-spoons sugar per year; now we average 22-32/ day</p> <p>Sedentary lifestyles => pre-industrialised humans used to walk 9-15 kms a day; now less than 0.5kms</p>
<p>3</p>	<ul style="list-style-type: none"> evolutionary mismatch between human physiology and new environments and ways of life. <p>Mental and social dysfunctions from dislocation from nature in the urban, built environment.</p>	<p>Modern society (and the built and transformed natural environment) are very different from what we became over 100,000s of years of slow evolutionary processes ; so, there is a mismatch or maladaptation. Humans not changed much biologically in 25,000 years.</p>

4	<ul style="list-style-type: none"> • stress and worry from rapidity and extent of change related to the 4IR 		
5	<ul style="list-style-type: none"> • on-line presence as a narcissism vehicle; unreal hedonistic/attention status and stress/depression from addiction to this and loss of attention 		
6	<ul style="list-style-type: none"> • information/sensory overload (over-stimulation); busyness—close to evolutionary mismatch below; and also distraction/education 		Option paralysis – everything is so complex and full of information, decision-making and choice becomes almost incomprehensible
7	<ul style="list-style-type: none"> • the 4IR may lead to psychological pressures by confronting an ultimate limit from the finite human mental capacity to evaluate large quantities of complex info 		This is very close to information overload and may be a cost or a self-regulating constraint on the 4IR.
8	<ul style="list-style-type: none"> • environmental costs – productivity gains leading to increased income and consumption and material, energy and waste flows (the “rebound effect”); complex, toxic, new materials. 		
9	<ul style="list-style-type: none"> • globalising technologies leading to cultural homogenisation and loss of cultural meaning and diversity. 		Loss of richness and bonding and meaning of cultural experience in a highly connected rather homogenous cyborg world full of semi-immortals.

10	<ul style="list-style-type: none"> • removal of sense of freedom, stimulation, joy and serendipity given losses from the “quantified self” – cyborgism/cybernetics/human augmentation; and perfection and high predictability 		Closely related to (9) and disconnection (19)
11	<ul style="list-style-type: none"> • expectation of efficiency, constant access for work duties, and instant gratification 		Related to most of the following 4-5 effects, the 4IR represents a big leap in bolstering the apparent control and manipulation of lives and our lifeworlds – especially nature and natural processes. Expected external control of fundamental life aspects such as birth, death, emotions by technology is probably unrealistic and a cause of wellbeing loss.
	NEGATIVE IMPACTS OF THE 4IR	<i>Closely Related to Impact</i>	NOTES
12	<ul style="list-style-type: none"> • expectation of ease and comfort and ability to avert pain and ill-health 		As in previous negative impact (11)

13	<ul style="list-style-type: none"> • increase distraction capability – attention economy <p>Close to negative impact (3).</p>		<p>Though the 4IR offer great potential for knowledge access and accumulation at personal level it can also induce laziness and distraction – games, messages, videos; poor attention span and concentration/ control required for smart brains; brain exercise; impulsive behaviour.</p> <p>Potential education disruption.</p>
14	<ul style="list-style-type: none"> • the 4IR may bring increased good and service benefits that are “adaptive” 		<p>In economic science, adaptation refers to the fact that new, better, increased consumption often tends to become the new norm and people adjust and expect continuation. The result is limited sustained gains in wellbeing.</p>

<p>15</p>	<ul style="list-style-type: none"> • the 4IR can increase vulnerability to powerful and mass subversive/insidious influence, and warfare <p>This capability also has the potential for very substantial benefits.</p>	<p>Potential for deceit and manipulation by leaders/elite; inequality maintenance, potential for horrific and pervasive cyber-attacks. Easier for fake perception to become reality. Military technology attacks ; biological weapons, autonomous weapons, robot wars, mass harm facilitation by anonymous small groups. Related, increased ability of individual and collective power to affect others (with knowledge).</p> <p>Fears of generating the trajectory towards the forbidding onset of the momentous “Singularity” (see Kurzweil 2010).</p>
<p>16</p>	<ul style="list-style-type: none"> • can facilitate exploitative governance – surveillance, control, brainwashing, social control and filtering; privacy loss <p>Relatedly closely to (15)</p>	<p>Conventional democracy models may suffer and be less workable (especially with (15) as well); may be offset by citizen engagement advantages of new 4IR technologies; also amenable in autocratic governance societies</p> <p>Cyberbullying; sexting; loss of privacy in general and ability to lead lives desired (but this may also be a positive social check)</p>

17	<ul style="list-style-type: none"> • social media – a microcosm of the digital reality ; has heaps of good and bad (too much to cover) 		<p>Has many potential good and bad effects – complex and pervasive and too difficult to cover in detail here. On the negative side, the virtualised, symbolic somewhat unreal basis of interaction is proposed as significant source of loss of real physical connection. Of course there are many offsetting potentially positive connection effects as well.</p>
18	<ul style="list-style-type: none"> • arguably, the limited ability to raise and sustain real wellbeing via economic progress benefits assumed in the 4IR (at least beyond some point). 		<p>Increased wealth and entertainment increase but not substantive related gains in wellbeing for the “typical” high income nation citizens. The adaptive nature of new goods and services (see (14)).</p>
19	<ul style="list-style-type: none"> • disconnection – wellbeing losses from reduced direct connection with other people and nature 		<p>Virtualisation of social and natural environment connections. Time use, lifestyle and deferment capability accompanying 4IR effects can significantly reduce physical interaction and immersion in social and nature worlds.</p>

Sources: Adapted and extended from Chansoda & Saising (2018), Conceição & Heitor (2011), Kidslox (2018), Schwab (2017), Sunstrom (2015), Thomopolous & Karanasios (2014), The Oracle (2018), Wisnioski 2015.

Other major benefits of the 4IR will include the sustained increase in problem-solving support information (7) – an efficiency gain which has ramifications for almost every part of economic and other life activities, by reducing production input costs such as

material, energy and time. The 4IR also promises ever-increasing entertainment options and depth, diversity, audio-visual and other information stimulation, and potential learning experience. We will return to propose a Buddhist view of these developments in the next section.

Positive environmental impacts linked to (10) and (11) in Table 2 are significant and worth highlighting for the upcoming discussion of the contribution from Buddhism. One major set of outcomes of the 4IR is the general increase in resource efficiency that its associated information and communication technologies bestow. Technological gains in direct labour productivity as well as reduced transaction costs and need for physical connections and travel to perform many economic, household, and recreational activities all lead to less materials, energy and time (and often waste emissions) for each unit service of output. Examples of reduced need for physical connection include ordering taxis, booking flights and accommodation, selecting, buying and delivering products, watching films and series, playing games, family logistics, and social meeting arrangements and timing.

Of course, the overall effect of these trends upon environmental pressures depends upon ongoing changes in the level and nature of consumption (and population change).

A quick list of some other 4IR advantages includes:

- Improved health diagnostics, treatment, ill-health prevention
- Enhanced learning, means and possibly more time for creative activities (given that the anticipated increase in free time from economic productivity gains with previous IRs has not happened)
- Governance improvement – improved potential feedback, coordination, engagement of communities with governments
- Social media, blogs, fora, gaming, social network sites (e.g. dating) that may increase interaction, relationship effectiveness and opportunity, and social belonging in peer networks and social networking

- Increased collective awareness and moral consciousness; encouraging honesty and sincerity
- Reduced conflict and warfare from better communication and understanding across peoples and cultures.

In terms of existing or impending **negative** impacts from the 4IR, the list is just as extensive.

One of the major concerns, expressed during any period of marked technological innovation, is the fear of labour-saving automation and job loss. The 4IR, with its remarkable capacity for robotics, AI and information access and processing to perform any routine mechanical or decision-making task, certainly seems to have great potential to eradicate a significant portion of existing occupations. Coupled with the consequences of winner-takes-all scenarios from monopolisation of 4IR technologies, widespread unemployment is also seen to possibly contribute to deepening and troubling inequality. This is a complex topic and beyond the purview of the paper to discuss in detail. However, two important observations need to be noted regarding the 4IR and inequality.

First, historically, the “creative destruction” of automation has not led to lasting unemployment. Substantial disruptive structural unemployment does occur as a result of rapid changes in the nature of demand outpacing skills, but the labour market, eased with appropriate policy, tends to adjust. Unfortunately, it may well lead to deepening dual labour markets polarised into low skill, low paid jobs, and high-skill and demand higher pay jobs – the “digital economic divide” (Chandsoda and Saising 2018). Relative inequality has grown – notably at global levels (but at very different rates across countries) (Savoia 2017).

Second, while deepening *relative* inequality and increasing gaps seem unfair and objectionable and may lead to discontent and social conflict, the broad wellbeing consequences will depend upon compassionate and ethical redistribution and access to essential food, housing and other services, and the perceived fairness of political economic systems. Technology change productivity gains should allow increased overall output and surplus and balanced and fair distribution, and raising the economic “floor” for all, may maintain

social stability and community wellbeing. These are complex issues and cannot be explored in more detail here but will be re-visited in a Buddhist-inspired context in the next section.

Moving on from inequality impacts, there are a range of lifestyle and ‘mismatch’ physical diseases and mental illnesses that can be associated with the 4IR (though many have these have growing since the Second Industrial Revolution). They concern inter-related problems such as obesity, diabetes, excess sugar and processed food and growing meat consumption, sedentary lifestyles for work and entertainment, lack of exercise, repetitive actions and related injuries from the use of digital technology equipment. Some more detail and examples are provided in (2) of the negative impacts section of Table 2.

These health issues are also closely related to the “evolutionary mismatch” problems (3) that are seen to occur when human’s physical attributes no longer “fit” environmental changes created by rapid technological change. The idea is that human bodies (including their brains) evolve slowly (over 10,000s of years or more) while physical and energetic world around us has been very totally transformed over the past 300 years (e.g. in a multitude of ways from lighting and circadian rhythms, to shelter and other built urban forms, transport modes, posture, entertainment sources, food composition, social interaction, to name a few) (Sunstrom 2015; Wisnoiski 2015). Alternatively, many human cognitive functions may well suffer a kind of neurological atrophy from lack of use and full, more efficient servicing by AI and internet systems. The relatively new scientific and social movements of eco-psychology and biophilia focus on the problems proposed as a result of removing a large part of most human lives from natural environment settings where they have been embedded for 100,000s of years (Wilson 2017).

In turn, these mismatch problems have a clear counterpart in the capacity of the human mind to deal with enormous amounts of diverse and instantly available information. The 4IR can provide people with as much information as they want. Information and sensory overload with mental over-stimulation and extreme busyness (see impact (6) presents a challenge to the human mind (see (7) and its development based on countless centuries of low, slow

levels of information and simple ways of living. This can lead to “option paralysis” where everything is so complex and full of information that decision-spaces are almost incomprehensible (Sunstrom 2015; Alinsky 1989). It can easily involve excessive accountability, contactability, distraction, and information and loss of the ability to go slow, rest, reflect, and engage in meaningful conversation and other social interaction and creative release (Schwab 2017). This would tend to exacerbate stress levels and threaten healthy social lives and mental processes (see (4), (5)).

Some other likely negative effects of the 4IR, that are of lesser relevance to Buddhist perspectives, are listed in Table 2. These include:

- loss of bonding and a sense of meaning and belonging from cultural homogenisation in a predominantly shared cyber world of experience (9)
- narcissism dependence via social media (5)
- loss of the sense of freedom, and the stimulation, joy and serendipity lost from the “quantified self” (cyborgism, cybernetic, human augmentation) and high predictability and control of life in a 4IR world (10)
- increased vulnerability to powerful and mass subversive/insidious influence, and warfare (15)
- possible facilitation of exploitative governance – surveillance, control, brainwashing, social control and filtering; privacy loss. (16).

Some of these do have at least partial links to key Buddhist interests in the effects of the 4IR (e.g. (9) the loss of shared unique culture upon direct inter-connectedness).

However, there are several other impacts of more direct relevance to Buddhist-inspired perspectives that may help beneficially shape the 4IR. The latest two IRs have certainly helped bring about enormous growth in environmental resource productivity – including natural capital demands for inputs and waste assimilation functions for the human economy. However, productivity here is measured as environmental pressure per unit of output and unfor-

tunately there is a strong offsetting effect (the “rebound effect” or Jevon’s paradox) from ongoing increases in consumption due to higher income, that can offset these gains. We will return to these and other issues in the following section.

Another relevant outcome of the 4IR is the greatly increased expectation of efficiency, constant access for work duties, and instant gratification (negative impact (11)). The 4IR represents a big leap in creating a feeling of apparent control and manipulation of lives and our lifeworlds – especially regarding nature and natural processes. There has certainly been an increase in the power of humanity to be able to transform and impact nature (on global scales) in intended and unintended, positive and negative ways via science and technology and the scale of the human population and economy (especially since the Enlightenment & First IR)(Smith 2015). Buddhism has considerable reservations about the net wellbeing effects of taking refuge in this chimera of controlling life events (see Section 4).

On a similar level, the 4IR has brought major levels and increases in expectations of comfort and ease in life and relief from pain and ill-health (12), a topic which is also central to Buddhist thinking about the true path to reduced suffering.

One other major impact area relevant to Buddhism is the immense growth in potential for presenting information and peripheral activities that can distract them from central life functions and peaceful mind conditions (13). As noted in Table 2, although the 4IR offers vast knowledge access and accumulation capabilities, it can also induce laziness and distraction and poor learning – through interrupting messages, games, videos; poor attention span and concentration and control required for smart brains; lack of brain exercise; and encouraging impulsive and “unmindful” action, habits and behaviour.

Although not really a negative impact in its own right, a major failing of the 4IR seems to be occurring with a core promise and motive. Given there are many clear adverse effects of this revolution for society, it is troubling that perhaps the primary expected set of benefits does not appear to be forthcoming. The technology

changes of the past 100 years have had many positive impacts for a substantial part of the world's population – providing economic security, improved health, pain management, deferring sickness and death, and information access, diversity of experience and rapid and efficient problem-solving. However, the productivity, wealth, health and entertainment/experience gains can be seen to have not substantially reduced fundamental existential suffering for those already beyond some moderate level of income (see impact (18)).

The evidence on the relationship between subjective wellbeing and life satisfaction (“happiness”) and income levels is complex and mixed (for example, see Drabsch and Wales (2012), Deaton (2008) and Sacks, Stevenson and Wolfers (2010)). Other studies have found that levels of happiness generally go up as income rises, but not past a certain point (often cited as around \$US 75,000 (2015) annual income). However, there are many complex biasing and confounding factors in assessing this relationship – especially for *stated* levels of wellbeing.

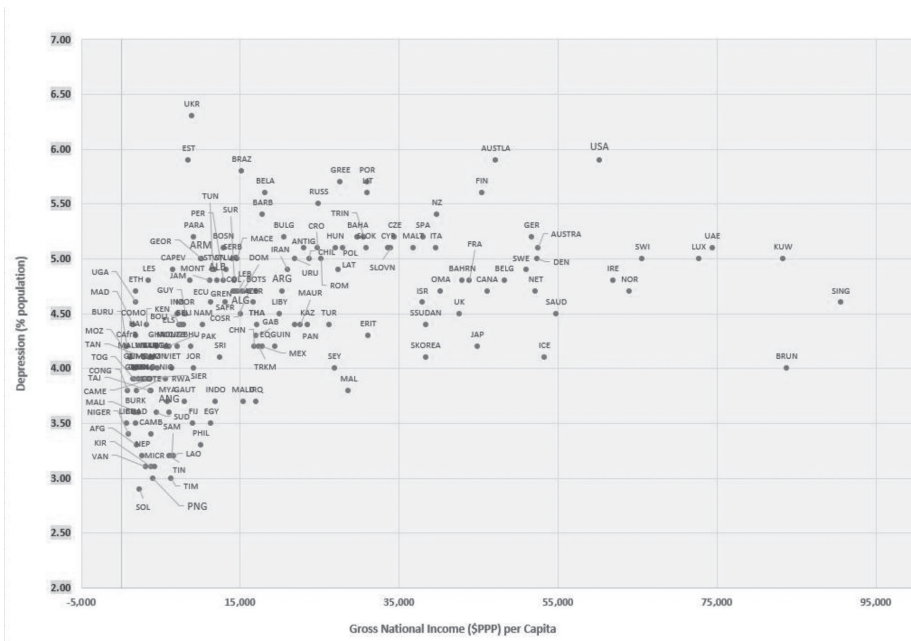
One “objective” indication that suggests that the benefits of the IRs are failing to deliver in terms of alleviating overall inner personal suffering, can be identified in Figure 1. While there are sure to also be measurement biases involved here, this evidence shows that depression rates (per capita) have little to do with the comparative purchasing power of people across nations. If anything, depression levels are lower in the lower income nations.

Wealth and entertainment (amidst the technology revolutions) do not seem to bring sustained wellbeing at the deepest levels. It is likely that lifestyles have not responded so people work less and connect more, but rather people have turned to accumulating more stuff to amuse, entertain, stimulate, comfort or gain status. Such assumed time use and activity sources of joy rest on a spurious theory of “happiness” but these assumptions still dominate in our present system and are inculcated in the young – “get educated and a great job, work hard and maximise your income and expenditure and you will be happy”. Productivity and profit maximising underpinnings will raise the (consumer) “standard of living”, but this does not translate to better subjective wellbeing past some point (Smith 2015). As expected, Buddhism has much to say about this resilient,

and arguably vestigial, consumer market assumption.

The final negative impact is probably the central point for the potential contribution of Buddhism to shape the 4IR. It is actually closely related to many of the previous effects which tend to feed into this condition. This is “disconnection’ impact (19) which is meant to encapsulate the effects of the various ways in which the 4IR tends to reduce *direct* connection between individuals and both (a) other people and (2) nature. Much of the influence can be linked to the “virtualisation” of social and natural environment connection, contact and interaction, and the possibility that the substitution of reality by representations or virtualisations (and attendant “fakeness”), may not be in the long-term interest of human wellbeing. It hints at some kind of “realness = wellness” link. This is foremost a physical issue and has many related physical health consequences (as discussed previously) but at the deepest level the effects are manifest as a source of mental suffering in the Buddhist perspective (the focus of the next section).

Figure 1 - Cross-Country Plot of Depression Disorders by Income Per Capita 2016



Source: WHO (2017)

4. CONTRIBUTIONS FOR POSITIVE OUTCOMES FROM 4TH INDUSTRIAL REVOLUTION FROM THE BUDDHIST WORLD VIEW

It is ironic that it can be claimed that a major outcome of the 4IR – (network) connectivity that greatly expands the potential linkages between humans and at least ‘windows’ on the external world – can present as a very troubling impact in the form of disconnection. These issues, spread across a range of effects, have been pre-empted in the previous section and have been identified in other papers on this topic (e.g. see Jones 2017). Together, they can be analysed to share much in common with Buddhist perspectives on the nature of suffering (and its obverse, wellbeing).

We will return to the disconnection-Buddhism topic soon. However, it is useful to list a selection of the most relevant 4IR general effect areas that will be addressed, at least briefly, in the Buddhism-inspired contributions noted in this section. As expected, the topics overlap considerably and the separation is primarily for heuristic purposes. They include:

- disconnection – of a direct and immersive form; from other people and nature (and its related physical and health problems)
- the questionable link between material standard of living, abundance, comfort and convenience, and sustained physical, and especially mental, wellbeing
- natural environment impacts and related non-violence, minimum intervention, peace and harmony
- distraction, diversity and entertainment
- very high levels of information, knowledge and indirect communication access
- information overload versus mindfulness
- inequality and economic redundancy
- expectations of control and desirable situational permanence.

The central role of the Four Noble Truths and Eightfold Path in Buddhism lay out much of the basis for its potential wisdom

for informing strategic wellbeing change in the 4IR. The primary goal is relief from “suffering” (*dukkha*). The Buddhist path to achieve this, personally and collectively, lies in the recognition and appropriate mental and behavioural responses that recognise some universal principles or “laws” that explain the “effect” (on suffering/wellbeing) from their dependent source origins.

Pervasive, profound inter-connectedness between all phenomena is probably the mainstay of Buddhist thinking and the notion from which most of its principles and practical wisdom are derived. This “Indra’s net” of cause-effect relationships connecting all things, clearly accommodates, or actually demands, the careful consideration of intent and consequences of intent and resultant action. Despite a tendency by humans for optimistic reductionism, we can never “do just one thing”; there are no singular causes or effects.

In Buddhism, the law of dependent origination explains how all outcomes, results or effects (*vipaka*) of speech, action or body arise from multiple causes or actions with intent (*kamma*). In turn, these causes arise from other *vipaka*, and phenomena cease when the pre-conditions change. This is basis of the law of *kamma-vipaka*. It adds the qualitative aspects by identifying how ignorant action with “unskilful” or bad intent will lead to adverse results across the three realms of existence (from individual, to society, to nature and back on the self). “Skilfulness” is gauged by the extent to which craving, greed, delusions or aversion are embodied in the underlying motive and intent of the original action (Attwood 2003). The law of *kamma-vipaka* suggests that disruptive action, with selfish intent, will inevitably result in adverse wellbeing consequences back upon the instigators. Hence, there is a need for accepting a kind of “universal responsibility” to guide one’s presence in this world. This is a result of the highly inter-connected effects of actions on all others (sentient beings, and arguably all of nature), as well as the re-assessment towards a rational of “intelligent self-interest” where actions to improve one’s wellbeing consider consequences on other’s welfare, given dependence of the former upon the latter (Dalai Lama 2001).

This is also closely tied to the need to minimise intervention or at least disturbance, harm or violence to the natural world, manifest

as environmental pressures or ecological footprints (and also social impacts). Empathetic actions founded on inter-connectedness will unavoidably be based on compassion, loving-kindness and care for others will help bring us what we really want from the 4IR – wellbeing.

The Four Noble Truths and notions of impermanence also explain why there will always be limits to craving and clinging to material sources of selfish demands and desire, and the positive outcomes of science, technology and economic systems predicated upon such goals.

It is not possible to provide a more detailed overview of relevant underlying general Buddhist ideas here but there will be more elaboration in the subsequent discussion of some specific potential contributions inspired from this ancient wisdom.

Moving back to 4IR social and nature disconnection impacts proposed as a major potential cost of the 4IR, many of the negative effects in Table 2 can be linked to this general proposed outcome (for example impacts (3), (5), (6),(9),(13), (17)). As noted, it can't be denied that the last two IRs have dramatically increased the capability for broadcasting information about oneself and, conditionally, two-way communication for social and economic purposes. It seems odd to propose that disconnection can be a major consequence of such technologies. However, the main justification for this proposition is that the social and nature-related interaction facilitated by the 4IR tends to indirect, and can often replace more direct forms. The tools people use to interact in the 4IR often use social or virtual constructions (e.g. see the social media negative effect) that can be image or status-based and focused upon perception building rather than reality. The complexities of these technology effects can't be explored in detail here but one important outcome can be increased connectivity (visual, word, audio), but reduced connection in a deeper sense where there is physical interaction, immersion, body language and full sense awareness, empathy and warmth – some of these factors also applying to natural environment connections. Arguably, direct physical person-person and person-nature interaction and the associated slow immersion promotes deeper bonding and “deep

brain” experiences.

The range of interaction media vary in terms of these capabilities but simplified, insipid symbolic communication modes would promote more shallow, peripheral, “incomplete” and short-term friendships and relationships (such as from online social media or gaming worlds) (Henderson et al 2010; Kidslox 2018) and possibly loss or poor development of social skills for face-to-face and other more complete interaction activity. This could easily be seen to lead to loss of wellbeing and social isolation, and mental health and other lifestyle and evolutionary “mismatch” problems that increase suffering.

The 4IR can also provide so many other distractions and options that change time use or encourage deferral of more real contact and social interaction. Meaningful relationships have been consistently shown to be critical for wellbeing and this is likely to depend on people’s shared real world experience (Henderson et al 2010). Digital “villages” are probably poor replacements for the lost tribal closeness, stability and animal connection of the 100,000s of years of human existence.

Hence, the 4IR can help people connect and communicate on many levels and in many roles in their daily life, but there is danger in the “ghostly” or shadow nature of this contact *modus operandi* diffusing through livelihood, family and social world dimensions of personal reality. It can increase separation in many important physical and psychological ways and this is troubling given the evidence and case for social connection (and increasingly nature connection) for mental health, emotional wellbeing, and physical healing (Bristow 2017; Wilson 2017).

Buddhist wisdom would explain this deep connection loss as increasing our suffering (*dukkha*) in at least two ways.⁵ Firstly, such

5. *Dukkha*, in Buddhism, is a difficult concept to translate into English. The popular meaning of the “suffering” that permeates life has often been deemed as somewhat inaccurate with more appropriate descriptions like “unsatisfactoriness”, dissatisfaction, or pain in the form of bodily discomfort and mental distress (Jones 2017). However, even these are often considered lacking and better replaced by metaphors like an ill-fitting grindstone wheel that continues to give imperfection and niggly annoyance and disruption to one’s expectation of comfort, security and freedom from pain and distress.

disconnection can intensify *dukkha* from our internal belief that we separate from other people and the natural world (rest of the universe). Thus delusion of ego-separation and an objective external world (subject-object dualism) where we act to manipulate the world to fill desires, with simple cause-effect relations, is considered to be the essence of samsaric existence and attendant suffering. As inferred from the Second Noble Truth, attempting to appease our craving and clinging with sensual fulfilment, distraction and acquisition in the objective world, will intensify *dukkha* and feelings of alienation (Loy 2003).

A second reason for the 4IR disconnection reducing our wellbeing may be that virtual worlds or cyberspace may remove or reduce causal sequence or (at least immediate) apparent consequences of one's choices and actions. This is akin to nullifying feedback and awareness of the law of *kamma-vipaka* – a Buddhist principle that is key to reducing inter-connected suffering. However, this is not necessarily the case as the information access power of the digital age can also greatly increase awareness of the impacts of one's actions and may alter behaviour in a positive way.

Actual wellbeing outcomes depend on many factors including the intent and motives, balance and underlying wellbeing or “happiness” theories that guide markets, and technology change and adoption, and the choices of people who face these new technological worlds. The character and extent of 4IR effect will be guided by the nature of demand and desires. In Buddhist thought, motives based on selfish greed, ill will and delusion will shape the 4IR and have very different impacts from motives and goals based on generosity, inter-connected wellbeing, compassion, loving-kindness and wisdom. As with most of the 4IR impacts identified here, the new technologies underway present both problems, *and* opportunities for community wellbeing.

Now we look at how Buddhist wisdom can help modify or offset negative effects, or enhance the benefit potential of some of the major 4IR effects identified.

Buddhism can help **offset deeper-level disconnection impacts** of the 4IR in many ways – especially in relation to building awareness

and acceptance of the virtues of tangible social and nature interaction focused on direct contact and the realisation of inter-connected wellbeing. We will introduce other relevant factors in remaining discussion in this section.

One major contribution to the 4IR from Buddhist wisdom would be to ***promote the environmental sustainability potential of its associated technologies***. The resource efficiency gains, emissions and transaction cost reductions, and alternate energy and other sustainable economic activity offerings of the 4IR are enormous (as discussed). Minimising environmental pressures and footprints is closely aligned with one of the fundamental derivatives of Buddhist conceptions of profound inter-connectedness and the law of *kamma-vipaka* – the virtue of minimum intervention or disturbance, and non-harm to the social and natural worlds in which we act. In Buddhist wisdom, less resource-intensive and disruptive lifestyle choices, and the often under-estimated potential enjoyment from untransformed, natural reality are favoured in the situation of inter-connected wellbeing (Daniels 2008).

Of course, reduced nature and social impacts assume that material and energy-intensive (and even time-intensive) “consumption” does not grow with productivity savings (the “rebound effect”) or change into forms that lead an increase in overall levels of harm or violence to the external world.

Buddhism would also favour viewing the 4IR as a “techno-economic paradigm” (TEP) rather than an “industrial revolution” given that such technology clusters have very extensive and profound external effects (beyond industry) across the social, cultural, economic, and environmental realms. Hence, the importance of a “green TEP” has been promoted as a major potential Buddhist-inspired contribution for real gains in community wellbeing (Daniels 2003; Hayter 2008). A green TEP would soften the “destruction” (social, economic and environmental) in Joseph Schumpeter’s notion of “creative destruction” in such waves of technology change. Renewable and low impact energy source technologies would typically fit well as a core cluster in the Buddhism-compatible 4IR or green TEP.

A related Buddhist contribution to shaping the 4IR for the better lies in its ability to **re-orient economic goals and underlying “theories of “happiness”** (given the failings of the growth-happiness thesis already discussed in Section 3). The major source of wisdom comes from the Four Noble Truths and the identification of wellbeing as actually been negatively impacted by increased economic activity when based on craving and clinging to objects in the external world. Moderation and restraint in desire and expectations are seen as vital for to control dukkha. A revised deep understanding and at least partial acknowledgement of this principle would help inhibit the rebound effect, alleviate both work obsession and lack of free time, sensory overload and stress, and loss perception for those afflicted by 4IR economic restructuring. Acceptance of the virtues of moderation and consumption and moral restraint, would also help relieve the disappointment and suffering from habitualised instant gratification.

Another area where Buddhist wisdom offers great promise to improve 4IR outcomes would be its **practical techniques for achieving inner peace, stillness and awareness** as balancing means or an antidote to the mental exertion and strain associated with dealing with the ocean of information available for education, problem-solving, entertainment, communication, and distraction. These include a wide range of mindfulness, breathing, mantric and other general contributions to positive psychology. Mindfulness has also been directed towards increasing empathy (and hence connection) (Bristow 2017) and can be seen to be highly appropriate to offset the rush, overload, and disconnection of the 4IR by creating awareness and joy from the fullness of existence in the moment, helping people slow down amidst the pressures of instant information and immediate response and service, and acquire contemplative practice skills to consider the interconnected consequences of our intent and actions on ourselves and others. Meditation is also proposed as a means of managing desire (Smith 2015) and the massive array of temptations to induce craving in the 4IR.

Buddhism can also be a major fountain **to engender and disseminate some of its primary ethical guides that would enhance**

4IR outcomes – notably compassion and loving-kindness. Combined with empathy and wellbeing inter-dependence, these ethical guides would promote the equitable distribution of the fruits of the 4IR and counteract emergent inequality problems. These ethical underpinnings would have a wide range of influences such as deepening social connections, promoting non-violence and non-harm to nature, and support and care for those suffering from other pressures of the 4IR.

If we acknowledge that the 4IR is unlikely to ever really bring complete control and a predictable external world life full of material and sense-based pleasures and perfect social relations, then Buddhism can make another positive contribution. This derives from the essence of Buddhist understanding about the nature of *dukkha* in *samsara* and the inevitability, and hence need to **accept peacefully and with equanimity, that everything in the external world is impermanent, imperfect and ultimately beyond our control.** This stands in marked contrast to the general goals and promise of the 4IR, but the evidence for its technologies' success in being able to provide control and permanence, so as to enhance wellbeing, is unconvincing. Acceptance of impermanence and lack of control of external world object desire fulfilment has a wide range of wellbeing resilience effects to help deal with other vulnerabilities of the 4IR – including the induced expectation of ease and comfort, and ability to avert pain, ill-health, aging, loss of loved ones and death, as well as the limits to economic accumulation theories of wellbeing.

5. CONCLUSION

The Fourth Industrial revolution (4IR) will continue to bring enormous social, cultural, economic and environmental changes. While there are many undeniably positive outcomes from such developments, oddly, there is limited evidence for the success of the digital revolutions to date in terms of ultimate goals and wellbeing for humans (Sunstrom 2015).

This promotes the case for caution and careful scientific scrutiny of unconditional technological optimism, and “solutionism” ideology (Morozov 2013; Jones 2017) that assumes that technol-

ogy change will naturally involve to solve past and new problems. Hence, there is a need for careful anticipation, recognition, study and assessment of socio-technical impacts of the 4IR – what are its goals, do these goals translate into actual wellbeing improvements, and how have changes to date performed in terms of achieving laudable wellbeing goals?

Buddhism has much to offer towards this exercise. This paper has discussed some of social, economic and environmental effects of the Fourth Industrial Revolution most relevant to Buddhist wisdom including:

- disconnection – of a direct and immersive form; from other people and nature (and related physical and health problems)
- the questionable link between material standard of living, abundance, comfort and convenience and sustained physical, and especially mental, wellbeing
- natural environment impacts and related non-violence, minimum intervention, peace and harmony
- enormous increases in distraction, diversity and entertainment options and capability
- profound growth in information and indirect communication access and knowledge potential
- information overload versus mindfulness
- inequality and economic redundancy
- expectations of control and the permanence of desirable life situations.

A primary goal has been to identify how Buddhist perspectives can help contribute to creating better outcomes from these and other more positive effects. Some of these main actions and goals have included:

- offsetting deeper-level disconnection impacts
- promotion of the environmental sustainability potential of the 4IR's associated technologies.
- re-orientation of economic goals and underlying “theories

of “happiness”

- practical techniques for achieving inner peace, stillness and awareness
- engendering and dissemination of some of Buddhism’s primary ethical guides that would enhance 4IR outcomes – notably compassion and loving-kindness
- help people accept peacefully and with equanimity, that all external world phenomena are impermanent, imperfect and ultimately beyond our control.

As noted by Chansoda and Saising (2018, p104), the outcomes of the 4IR will surely “all come down to people and values” and Buddhism is well-suited in providing its ancient and enduring wisdom to help inform personal choices and related assumptions and theories about wellbeing.

It is easy to be cynical about whether humanity can broadly adopt new sources of wisdom so fundamental to our motives and actions. For hundreds, or perhaps thousands, of years the dominant social system models that have propelled us into the 4IR have been founded on the maxim that personal and isolated actions for self-interest and material accumulation are good, and that this is the path to real wellbeing. However, there are good reasons for optimism and hope for a new age of wisdom. For instance, while a large part of the world’s population races into middle class consumerism, there also clear signs of disenchantment and loss of faith in economic accumulation with trends towards “new age” post-materialism, environmental awareness, voluntary simplicity, and other movements that have much in common with Buddhist principles or world views (Delhey 2009).

There is certainly one simple but very significant realisation in terms of societal goals that does not seem to be acknowledged in the 4IR techno-optimism. Although “intelligence” is a complex concept with limited consensus on its real meaning, artificial intelligence (AI) and the core motives for the 4IR seem to be predicated upon the ultimate virtue of being able to make effective rule-based decisions utilising (maximum quantities) of data. If the rule-based

decisions are devoid of actual dimensions known to generate wellbeing then machines can be considered, in the words of Lennon and McCartney, very “Nowhere Man” (who “knows not where he is going to”). There is no real defined target for the rules for intelligence to operate. The “intelligence” of an individual, social unit or society, surely means the ability to problem solve and get what really gives us desired beneficial changes in lifestyles, possessions and environments. Presumably these involve change that lead us to improved wellbeing.

Hence, the critical aspects of true intelligence are to (i) know what we want and will give us higher (sustained) wellbeing, and (ii) to be able to effectively assess how our actions and their flow-on effects will affect this goal.

This absolutely fundamental question has been grossly simplified to the economic growth assumption in neo-classical economics, and is largely forgotten, with some neo-classical economic basis as a subtext, in the technophilic world.

Buddhism can play a great role in helping to enhance the benefits of the immense and potent changes that will come with the progress of the 4IR. An important starting point will be more integration of contemporary social, economic, political, and environmental developments and responses into Buddhist analysis and dhamma (as is taking place in this conference). This will require the presentation of Buddhist wisdom with a strong scientific, empirical and non-doctrinal secular outlook and respect. This approach is very compatible with Buddhism. Trans-disciplinary perspectives that consider the full range of potential effects and wellbeing impacts will be critical. The communication and analytic power of the 4IR can certainly provide a very powerful vehicle for disseminating this wisdom.

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