

BUDDHISM AND THE FOURTH INDUSTRIAL REVOLUTION

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BUDDHISM AND THE FOURTH INDUSTRIAL REVOLUTION

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FOREWORD

In 1999, the General Assembly of the United Nations adopted the resolution to recognize the Vesak Day as an International Day of Recognition of Buddhists and the contribution of the Buddha to the world. Since then, the people and the Royal Government of the Kingdom of Thailand, in general, and Mahachulalongkornrajavidyalaya University, in particular, were very honored to have successively and successfully held for twelve years the United Nations Day of Vesak Celebrations in Thailand.

From 2004 to date, we have come a long way in the celebrations, and we are happy to be the host and organizer, but it is time for the celebrations to grow and evolve. The United Nations Day of Vesak is coming to maturity, with twelve celebrations under our belt, much experience gained, and it is time now to share this with others. There will always be room for growth and development, and we are elated to see it grow.

In 2006-2007, having joined the International Organizing Committee for the UN Day of Vesak as Deputy Secretary General, Ven. Dr. Thich Nhat Tu has played a crucial role in building strong relationships between the National Vietnam Buddhist Sangha and the International Council for Day of Vesak in particular and the Global Buddhist communities in general.

We have supported and congratulated Vietnam on organizing successful UNDV celebrations and conference in 2008 and 2014, respectively. We have full trust in Vietnam being the host of UNDV 2019 for the third time. We like to thank all those who have contributed to the success of previous celebrations and wish all future celebrations be successful.

The teachings of the Buddha see no boundaries; the minds of all are alike; the sufferings of all are similar and truly; and the liberation

of all is the same. We are happy to initiate the process, develop the scope, and now it is time for others to follow in similar footsteps, evolve the celebrations into a truly international event that can be shared with Buddhists and Non-Buddhists alike.

Let the Dhamma of the Buddha be the beacon to the world, shredding away the ignorance within our hearts, bringing development into sustainable capacity for humanity and more importantly, peace and harmony to the world.

Most Ven.Prof. Brahmaphundit

President, International Council for Day of Vesak (ICDV)
President, International Association of Buddhist Universities (IABU)

PREFACE

The history of mankind records how the Buddha achieved enlightenment and showed a path which not only leads but also guides the world till date. That is solely to emanate wisdom and offer insights which help us to overcome numerous challenges and foster wellbeing for all of humanity.

Recognizing the Buddha's pragmatic approach, as well as the values and contributions of Buddhism to society, the United Nations in a resolution in 1999 decided to celebrate the Triply Blessed Day of Vesak (Birth, Enlightenment and Passing Away of Gautama), falling mostly in a lunar calendar in the month of May. The first celebration was held way back in the year 2000 at the United Nations Headquarters in New York, and subsequently the day has been celebrated remarkably in different countries.

Today our planet is confronted with a number of crises and unprecedented natural disasters. The paramountcy of mitigating imminent threats of terrorism and ethnic violence, tackling poverty, providing education, and ensuring sustainable development leads us to strive for social justice. There is an urgent need for concerted and constant planning and right effort at an international level to foster permanent peace in societies and in the lives of individuals.

Against the backdrop of such widespread misery and strife leading to complex issues and crises, Buddhism with its rich heritage of tolerance and non-violence can contribute immensely and inspire people with the Buddha's message of loving-kindness, peace and harmony in today's world. The United Nations Day of Vesak (UNDV) 2019 is a testimony to this fact.

Vietnam got the opportunity and responsibility to host this international Buddhist event in 2008 and 2014, respectively. The event proved to be an amazing spectacle of religious and

spiritual festivity, with thousands of Buddhists from around the world converging in Vietnam, to spread the Buddha's message of peace, love, and harmony.

This is the third time that Vietnam is hosting this important international event which is viewed by Buddhists as an opportunity to spread the Buddha's message and values of love, peace, non-violence, tolerance, and compassion across the world.

It is a great honor for Vietnam, the Vietnamese people, the National Vietnam Buddhist Sangha and Buddhists all around the world to participate in the UNDV celebrations and spread the rich Buddhist heritage, especially its teachings of equality, social justice, respect, and understanding for the benefit of all humanity. Buddhists around the world and Vietnamese people in particular are thrilled about their country hosting this auspicious and important event for the third time. This international religious, cultural, and academic event would also certainly promote interactions and exchanges of Buddhist cultural and intellectual values among diverse countries.

The international Buddhist conference with the main theme of "*Buddhist Approach to Global Leadership and Shared Responsibilities for Sustainable Societies*" during the celebrations could not have been more befitting and timelier. The present book contains conference papers pertaining to the first sub-theme of the conference, that is, "*Buddhism and the Fourth Industrial Revolution.*" Other sub-themes of the conference include: (i) Mindful Leadership for Sustainable Peace, (ii) Buddhist Approach to Harmonious Families, Healthcare and Sustainable Societies, (iii) Buddhist Approach to Global Education in Ethics, and (iv) Buddhist Approach to Responsible Consumption and Sustainable Development. This international conference aims to foster co-operation among Buddhist communities and institutions, and to develop Buddhist solutions to the global crisis.

Papers selected for this volume are those that combine thematic relevance, familiarity with the main theme or sub-themes, significant research in primary and secondary sources, innovative theoretical perspectives, clarity of organization, and accessible prose. Accepted

articles in this volume are determined by the Academic Peer-Review Committee.

UNDV 2019 certainly is an opportunity for Buddhists around the world, the National Vietnam Buddhist Sangha, and all the members of the international community to benefit from the rich traditions, values, and spiritual ideals of Buddhism. The pragmatic path shown by Buddha can make the world a better, safer, and more peaceful and harmonious place to be cherished and enjoyed by all sentient beings.

As the Chairman of the United Nations Day of Vesak 2019 in Vietnam, on behalf of the Vietnamese people and the National Vietnam Buddhist Sangha, I extend my warmest welcome to all respected Sangharajas, Sangha Leaders, Buddhist Leaders, Sangha members and Buddhist Scholars from 115 countries and regions, participating in this international celebration and conference. Let me thank all of you for your contributions to this celebration and conference.

I take this opportunity to express here my profound gratitude to Most Ven. Prof. Brahmmapundit for his continuous support of Vietnam to host this international event. I also profusely thank all members of the International Council for Day of Vesak (ICDV), the Conference Committee, and the Editorial Board for their devotion.

I am grateful to Mr. Xuan Truong for his generosity and other donors, sponsors, volunteers and agencies from the public sector and the private sector for their excellent contributions.

This publication could not have been possible without the persistence, hard work, and dedication of Most Ven. Dr. Thich Nhat Tu. Special words of appreciation are due to him for his experience and continuous assistance in ensuring the successful coordination of the conference and celebration.

I extend my warmest and best wishes to all the delegates and participating countries on this special occasion which strengthens our resolve to improve the world by walking the path shown by the Lord Buddha.

Whatever merit there is in publishing this book may be dedicated

to the welfare and happiness of all sentient beings. May all sentient beings be happy and released from suffering.

We wish the celebration of the United Nations Day of Vesak 2019 in Vietnam every success.

Most Ven. Thich Thien Nhon
President of National Vietnam Buddhist Sangha
Chairman of the United Nations Day of Vesak 2019 in Vietnam

EDITORS' INTRODUCTION

BACKGROUND

Currently, we are living in the fourth industrial revolution by which computers, automation, robots and people will work together in entirely new ways. Applying technological innovations will help the production process faster, less manpower and more fully collected data. Product quality is ensured by controlling raw materials to forming and transferring to consumers.

However, it may have raised many issues for humans. One of its drawbacks is many workers will lose their jobs due to replacement machinery, while businesses may face difficulties in recruiting human resources to meet the requirements of the job. This can lead to inequality, even to break the labor market. Economic uncertainties will lead to instability in life and even politics.

In addition, new technology will cause changes in power, security concerns, and a big gap between rich and poor or the way of communication through the Internet which challenges information security for both people and political systems. These problems have urged the world to find the right solutions urgently to attain sustainable development which is favor of the Buddhist philosophy. In this theme, we highly focus on the Buddhist approach and response to the Fourth Industrial Revolution to generate happiness and peace for humankind.

REVIEW OF CONTENTS

Peter Daniels deals with the issues of “*The 4th Industrial Revolution: A Buddhist Perspective for Sustainable Societies and Wellbeing.*” The focus of this paper is to analyze the development of the 4th industrial revolution, the emerging of the physical and digital world (eco, socio, environment) in the perspective of Buddhism for a sustainable society 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. 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.

Geoffrey Bamford focuses on “*Reacting to the Fourth Industrial Revolution: Side-Stepping Determinism.*” The Fourth Industrial revolution is more or less equal to the digital revolution of the world in the late twentieth century. This drastically influenced everything in the world, and Buddhist heritage is not an exclusion. The Fourth Industrial Revolution can be seen with advanced technology in all sections, such as retrieval of artifacts, recording of objects, storage, exhibiting, transportation and marketing of artifacts with digital technology. This is highly utilized by the dealers of antiquities in Asian countries and Auction Houses in the West, especially in London and New York. The present paper will survey into how it has been utilized in all these phases and show how Buddhist antiquities are being sold in the Western Market by looting and illegal trading of Buddhist antiquities. The present paper is a survey on how it has affected to Buddhist Heritage and an attempt to suggest some solutions to protect Buddhist Heritage from this malaises situation. Further, the Newspaper articles and Websites related to the aspect will be scrutinized. Finally, a practical solution to minimize illegal trade of Buddhist antiquities and proposal to reduce looting and trading of Buddhist heritage will be proposed by the present paper which is a necessity in the age of the Fourth Industrial Age.

Ven. Thich Nhat Tu looks at “*Understanding the Impact of the Fourth Industrial Revolution.*” The author highlights the prospects and impacts of “Understanding the Impact of the Fourth Industrial Revolution” to recognize its positive and negative effects, as well as identify the opportunities and challenges of this Industrial Revolution. The nature of the 4th industrial revolution is a high-tech revolution to generate the era that pleases human’s audio-vision. In the past, if we had to be in direct contact with real objects and persons, then the Fourth Industrial Revolution has allowed us to experience illusive visions through smart devices. The most outstanding thing is the Internet of Things (everything connected),

which has been described thousands of years ago in the sutras of the Mahayana and Theravada Buddhism. From the concept taught by the Buddha 26 centuries ago, scientists have generated a theory of the interactive network of all things that are called briefly as “all things connected” in the Vietnamese community. Buddhism visualizes a phenomenon or an event to identify clearly its utilities and drawbacks by analyzing the causes, favorable and adverse conditions that generate immediate or long-term consequences.

Simerjit Kaur and Satyendra Kumar Pandey present the “*Role of Buddhism in the Era of the Fourth Industrial Revolution.*” The paper present and hypothesize the role of Buddhism in the era of the fourth revolution when the AI has become overly developed and start overtaking humanity. As per Klaus Schwab, ‘it will fundamentally alter the way we live, work and relate to one another. In its scale, scope, complexity, the transformation will be unlike anything humankind has experienced before’; what is worrisome is that if Artificial Intelligence begins to imitate our brains, sooner or later, it may learn to ‘to dictate and make us slave’. In such a scenario, the principles and values enshrined in Buddhism could be of immense help to the world; as we know it deals mainly with existential problems of human being and strives to establish the regime of happiness and peace in the world and the application of the Buddhist approach to resolving the human-created issues along with the execution of the Fourth Industrial Revolution.

Rev. William Beaumont Edwards discusses “*Buddhism and the Fourth Industrial Revolution.*” Launch into a discussion of the effect of artificial intelligence in the Fourth Industrial Revolution, concerning how each industrial revolution caused massive shifts in the dynamics of human civilization. The author addresses the resiliency of Buddhism could obligingly adapt and easily survive any change in those dynamics with which it is presented. By referring to a religious text, he wants to emphasize Buddhism is not based on faith; it’s based on reason. Faith or confidence comes later. The ability to approach this new era of the Fourth Industrial Revolution with logic, reason and understanding is of paramount importance. Simply, because it is rooted in reason, the Buddhist religious tradition can provide that.

Waruni Tennakoon deals with the topic of “*Fourth Industrial Revolution: Both as an Ironic Cover-Up of Dukkha (Suffering) and Effective Means of Practicing the Dhamma.*” The paper discusses the concept of the fourth industrial revolution as well as its effect on society compared to the other three revolutions. The present paper expects to discuss the ways and means of applying the fourth industrial revolution to be blissful to the humankind by not being blinded by its concealment of the essential dukkha (suffering) of the beings, with reference to the Dhammacakkpavattana, saccavibhanga and avijja suttas. The paper mentions the fourth Industrial Revolution “seems” to provide solutions for the birth, aging, sickness and death with better life conditions the human history has ever experienced, ironically it enriches the craving of the man with all such luxury invented day by day in the name of the industrial revolution. It neither facilitates the moderate kind of living of people and nor supports the path suggested in Buddhism to be free from suffering. However, the same unrealistic world that seems to be devoid of dukkha which is created by the advancements of the industrial revolutions hinders people from understanding the suffering and thus they are made to be heedless to be free from it. But the same could be converted to be blissful by using it effectively as a vehicle to practice the path for eternal freedom suggested in Buddhism.

Prof. David Blundell overviews “*Buddhism in Monsoon Asia: Digital/Spatial Humanities and Conservation of Heritage.*” The paper brings together studies that illustrate digital/spatial approaches for the conservation of heritage across regional economies and bridging distinctions between cultures. Geography continues to play an essential role in dynamic global environments of multicultural diversities ranging across very different regions that increasingly find heritage as common denominators. The paper also highlights early historical evidence of trade networks of Austronesian navigators circulating in the dharma in the Indian Ocean, mainland and island Southeast Asia, and China. This coincides with work on Lewis Lancaster’s Atlas of Maritime Buddhism as a project of the Electronic Cultural Atlas Initiative (ECAI) with Jeanette Zerenke and our other Austronesia Team member utilizing geographic

information systems (GIS).

Prof. D. Dayalan discusses “*Digitalization of Buddhist Sites in India.*” In the chapter, the author explores the topic of Digitalization of Buddhist sites in India. Being the homeland of Buddhism, India is boosted with a large number of Buddhist sites where every spot associated with Buddha is immortalized and turned into a center of pilgrimage by his followers who erected structures in the hallowed memory of the Master. Of them, the Four Great Places namely Lumbini where the Buddha was born, Bodh-Gaya, which witnessed his Enlightenment, Sarnath, where the First Sermon was delivered and Kusinagara, where he attained parinirvāṇa (deceased) are embellished with monuments of varied kinds. The spread of Buddhism from India to Śri Lanka, China, Korea, Japan, Vietnam, Myanmar and other Asian countries triggered a profusion of cross-cultural exchanges between India and those countries. The Buddhist monks from those countries were quite often visited India on pilgrimage right from the day of introduction of Buddhism in their soil.

Alex Amies details the aspect of “*Building Blocks for Open Ecosystems of Online Resources Serving Buddhist Communities.*” The paper gives an overview of the state of the art of the software building blocks for the development of online resources serving Buddhist communities and how those are driving new capabilities and broadening access. The central theme described is the huge scale and rapid evolution of the open source movement and modular package management systems that are built on open source. The author hopes that the evolving technologies can bring more improvements to Buddhist resources, including large scale translation of the Chinese Buddhist canon and the collected works of Venerable Master Hsing Yun to English. An additional impact is the broadening of access to high-quality scholarly resources beyond the academic community to the monastic and lay Buddhist communities.

Miroj Shakya looks at “*Impact of Digital Technology on Buddhist Education.*” The paper focuses on the impact of digital technology on Buddhist education. As the technology advancement improved on a daily basis, it’s offering a lot of new convenience as the accessibility

of the educational contents via multiple devices as well as the shift from traditional physical class to a more timed flexible digital class. However, it is still a tool and needs to be used with consideration.

Khanh T. Tran explores “*Sutra Translation Using Recent Advances in Artificial Intelligence.*” The paper introduces and emphasizes the importance of AI or neural machine translation (NMT) by google brain in translating Buddhist sutras from Chinese into English. This paper will review the recent advances in machine learning, especially the neural machine translation (NMT) compare to the traditional translating methods process such as google translate, word substitution and manual editing and point out the benefit of these such technological innovations can help into this important Buddhist work.

A.T.Ariyaratne A.T presents the topic of “*Dhamma for the 4th Industrial Revolution.*” In his thought-provoking article entitled Dhamma- For the 4th Industrial Revolution, he forewarns us for the over usage of the technological “advancement” where the modern age is going bereft of the spiritual life. To overcome this onslaught of the latest high-tech Revolution, he suggests seeking refuge in the Buddha’s Teachings.

Ven. Jeongwan Sunim examines the topic of “*Religious Education of Buddhism and the Fourth Industrial Revolution.*” The author explores the problem of Buddhism religious education which is faced in the era of the Fourth Industrial Revolution according to the trend of such time. While the educational environment is changing in the age of the Fourth Industrial Revolution, changes in methods and media for the religious education of Buddhism are inevitable. Based on the teaching of Buddhism, the content of education reflects the characteristics that analyze and interpret the aspects of the Fourth Industrial Revolution era. The purpose of religious education of Buddhism should include cultivating human ability necessary for the era of the Fourth Industrial Revolution.

Most Ven. Thich Duc Tuan highlights “*The Fourth Industrial Revolution and Buddhism*”. The author has raised the question of what is the Fourth Industrial Revolution, whether the Fourth Industrial Revolution optimistically improves the human condition or will it

lead to greater inequality, disruption of the labor market because of “low-skill/low-pay” and “high-skill/high-pay” workers and other negative consequences. The paper addresses how Buddhism could contribute its part to reduce the adverse.

Most Ven.Dr. Thich Nhat Tu
Dr. Thang Lai

4.0 INDUSTRIAL REVOLUTION: ADVANTAGES AND DISADVANTAGES

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	

11	<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>	1-8, 10	<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>
12	health diagnostics, treatment, ill-health prevention		
13	creativity potential		The 4IR can enhance the skills, means and possibly the time for greater creativity for people
14	governance improvement – feedback, coordinate, engage with governments		

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.

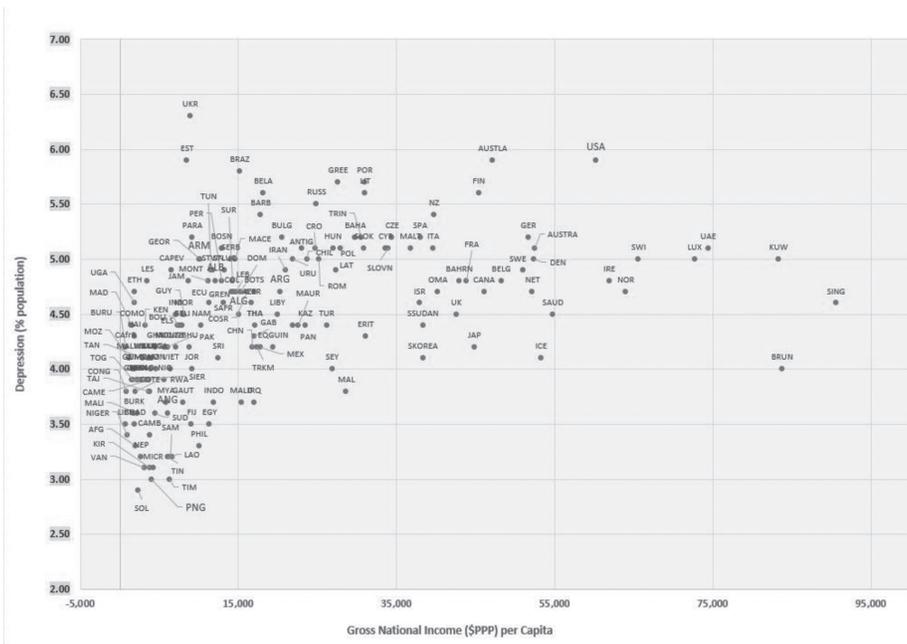
One “objective” indication that suggests that the benefits of the IRs are failing to deliver in terms of alleviating overall inner personal suffering, can be identified in Figure 1. While there are sure to also be measurement biases involved here, this evidence shows that depression rates (per capita) 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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REACTING TO THE 'FOURTH INDUSTRIAL REVOLUTION': SIDE-STEPPING DETERMINISM

by Geoffrey Bamford*

ABSTRACT

The Fourth Industrial Revolution ('4IR') is a conventional label for some new technologies. A complicated discourse about our human future has crystallised around it.

This paper touches in passing on the ill effects of the smartphone/social-media combination, but is not so concerned with such details. It focuses on the discourse of techno-economic determinism.

This is not new. Since civilisation began, humans have felt themselves dependent on mechanical systems, both technical and administrative. Their resultant suffering has come out in discussions of fate and free will. The 4IR reiterates an old story.

In the Buddha's time, the wound was fresh. Wandering teachers depended heavily on personal charisma, but all had to offer a story about how people's fates were decided and whether/why/how to try to be good.

Bauddhas have always distrusted questions about determinism. Plenty of wrong answers are current, but few good answers. Why keep worrying how predetermined our lives? The point is not to decide the facts but to make choices, to choose and develop our behaviour in helpful ways. Some choices, some ways of thinking-

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and-feeling, are helpful, and others are not.

Still, causality was a hot topic. Did your actions affect your future experiences, and if so how?

The Bauddhas focused on the continuity between the agent and the person experiencing its effects. Is there some permanent Self? No! Will there then be nothing left when we die? Again, no.

Such speculation does not help us in what matters. What matters is to break the causal chains that bind us.

That is how we can understand and react to the 4IR. It may take a lot of work.

1. INTRODUCTION

This paper presents the ‘Fourth Industrial Revolution’ (“4IR”) in a long-term historical context, It sees the 4IR as emerging from the Scientific Revolution and ultimately from the project of civilisation itself.

1.1 Civilisation And Science

Coeval with civilisation is the great human project to understand the physical environment so as more thoroughly to exploit it. Since before the Buddha’s time we have been developing technically — and we have had to make sense of each new level of technical understanding, and of what it allows us to do.

The 4IR emerges from such historical processes. It is infused with a sort of Futurism, like the techno-modernism current in Europe over a century ago. Going further back, it seeks to reproduce the intellectual experimentalism of early-modern science. Ultimately, this is a civilisational project, a continuance of what was started in the first millennium BCE.

It reflects an ideology, whereby humanity triumphs, and progresses towards a scientific utopia, by mechanically subordinating itself to certain mathematisable laws (algorithms, roughly). This is deeply entrenched in our global society — it is hegemonic in economics and in policy-making generally, for instance in the management of science. It is mechanistic and determinist, and it encourages people to be self-seeking and self-absorbed. Many espouse it, eager to believe that this will justify and secure their

enjoyment of technology and of consumption generally.

It has drawbacks. Industry, intended to liberate humanity by mechanising drudgery, also enslaves people, turning them into mechanical drudges. The 4IR represents a culmination of this trend.

1.2 Bauddha reflections

We then relate this historical analysis to reflections on the early Bauddhas. Their civilisation was taking off, the economy was booming, but people were quite messed up. Language and life alike were more prosaic than they used to be and people felt unsettled. The complexities of production and administration in a civilised society imposed new constraints. There were some hard-core materialists around — today's most simplistic philosophers and most self-absorbed oligarchs would have felt at home. The Buddhists were keen to avoid that thinking — and they were equally keen to avoid the standard alternative, which was to take flight into idealism

Humanity easily gets caught in binary traps. For instance, either you see yourself as eternal (*sassatāvāda*) or you think you are due for the chop any time (*ucchedavāda*). Our ideas of causality, in particular are geared to one or other of those assumptions, both of which Bauddhas reject.

Their idea was to get some perspective on these questions, to see them in context. The context was the way we all of us fill our lives from moment to moment, and can do so more or less helpfully. One thing we can usefully do is to try not to respond automatically, and so we pay attention to how we get tripped in to such automatic responses — the up-front reason to be interested in causal sequences is so as to be able to break the ones that can trap us.

2. THE FOURTH INDUSTRIAL REVOLUTION

2.1 Long-term Context: Science & Scientism

The Buddha-dharma emerged, with the Sāsana, when civilisation (also known as history) started to take off in a big way. People call that time the Axial Age¹.

1. Jaspers (1953). Eisenstadt (1986) Eisenstadt (2005)

In places, population densities increased sharply, and socio-economic systems became stratified, (and knowledge systems likewise) — cities developed, and writing. People used language more denotatively, and also more abstractly — so the world was now fuller of things and concepts than it was of beings. In that great economic boom, a certain materialism took hold, both philosophical and practical, and also a countervailing tendency towards abstract idealism.²

In the two-and-a-half millennia since, settlement patterns, social organisations, power structures, and so on have developed steadily — as has culture. Materialistic/idealistic thinking has been a recurrent theme.

In the last 500 years, human efforts to understand and control the physical environment have crossed a threshold. Culture has been dominated by science, society by industry.

Gradually, our species has been transformed. The complex of thinking, behaviour and institutional forms that many now refer to as STEM (Science, Technology, Engineering and Mathematics) has been important here, as has Economics. Computers have reinforced our resultant algorithmic bias.

There can be a place for all this. If, by making judicious measurements, we build data sets that we can analyse to identify regularities, then we can hypothesise causal connections, which we can test. In this way, we can find out what works, i.e., what happens if we do this or that, and so how to produce specific effects. We can, in effect, form *if...then* statements, masses of them, nested in complex ways³. Taken together, these can offer a valid description of the universe — a picture of the world, which is true inasmuch as it does reliably help us to manipulate elements of our physical environment.

Still, no picture gives a complete understanding of what it

2. See on. For Materialism, refer to the *Sāmaññaphala-sutta* and the *Pāyāsi-sutta*; for Idealism, the *Upaniṣads* etc.

3. This is, roughly, what philosophers of science call an instrumentalist view, as associated for instance with Pierre Duhem — see Duhem (1962). It seems to the present author eminently compatible with a Buddhist approach.

represents. Also, though mathematical modelling helps us to deal with the material world, it is less relevant, (and certainly not sufficient), when it comes to living our lives — to monitoring and modulating our behaviours, individually and in society.

That is a great truth. Unfortunately, since is quite unlike Newton's Laws of Motion, we tend to lose sight of it — to our detriment. All too easily, we get locked in to mechanistic, deterministic, alienated thinking, whereby I am as I am because of my DNA⁴ and because of how the species evolved⁵, and if I think I experience a particular quality of living (an 'emotion', say), then that is an illusion — two chemicals are just mingling in my brain.⁶

We deny and so cramp ourselves. Projecting our deterministic vision onto our material and social environment, we then create for ourselves a technical world which assumes that humans lack agency, and so ensures they will lack it. Finally, we take this to be the natural order of things.

This is a problem for us. It has been creeping up on us for ages.

Since the first stirrings of civilisation, the social and cultural change associated with what we now call science and technology has seen humans lose touch with experiential processes and become less capable of making wise choices spontaneously. This degeneration has accompanied the advances that we have made in short-term control over the physical environment — what from one angle is progress appears from another as regress. We are split, and that split is becoming ever more marked — it now threatens the survival of our species, indeed of the entire biosphere.

The trouble is, we have tried too hard. Europeans, for instance, had a struggle at first to motivate people to apply their blessed Scientific Method, so forced themselves to disregard all else. Now, across the globe, educated people repress the subjective dimension of lived reality — and, in so doing, we surrender much of our ability to mould our own lives.

4. See Dawkins (1976) and the memorable critique in Noble (2006)

5. See Wilson (1975)

6. See Crick (1994)

To develop our industrial and consumer society, we have abandoned those skills, (cognitive and physical, natural and conditioned, ‘moral’ and ‘religious’), which, through earlier history, used to prevent us from harming ourselves — so we are hitting barriers. Externally, this appears in the ecological crisis. More fundamentally, we are discovering that there are limits to our psychological adaptability.

2.2 Short-term context: revolutions and singularities

Those steering our development are dimly aware of this, though rarely unwilling to acknowledge it openly. That may help explain why they are keen on the 4IR.

Ideologies of science, etc, have often encouraged élitist denials of what most people know as their humanity — but it is happening on a grand scale now. Humanity, as so far known, is officially no longer fit for purpose — incapable of adapting fast enough, we are now to be supplemented by quasi-human machines with Artificial Intelligence (AI). Indeed, we are to be transformed by continually closer and more intense interaction with these robots. That, in a nutshell, is the 4IR⁷.

It seems to some to offer an escape. Perhaps we need no longer strain so hard to sustain our scientific-technical project — instead, we can transfer responsibility to the very machines that our efforts thus far have produced. Instead of struggling to adapt ourselves to the machine environment, we will now have the machines change us directly.

The first Industrial Revolution was no fun — ‘dark, satanic mills’ spread over the land, while malnourished children worked themselves into squalid, early graves. The second, which involved electricity, chemicals and production lines, proved still more disquieting — needing some distraction, humanity was prepared to do almost anything, so invented World War. The third, with its computers and internet, has offered many glittering baubles, but stories of increasing depression and dissociative disorders will not go away — and of how the smartphone/social-media combination

7. See on

saps our capacity for subjective experience.⁸

The global consumer society has seduced many people into living life as a series of multiple-choice tests/surveys. Now, however, that appears no longer to be enough — instead of seducing, it is now time to force people. Welcome to the 4IR.

Till now, our efforts to quantify social processes, to reduce them to a game we could score, have all involved some sort of interpersonal exchange. When a customer rings a call centre, or when Facebookers decide to cross-post their videos, humans are involved with one another — albeit distracted with their individual machine-environments, nonetheless they try somehow to communicate humanly. No longer — now, it is time for widespread, unmediated human-machine interaction. Or, perhaps that ought to be: machine-human interaction. Progressively, the machines are being programmed to take the initiative, so as to produce desired behaviour changes — changes in our, the users' behaviour. This is likely to put people under pressure in ways that no one may at first recognise, let alone understand.

As more and more of our lives unfold in the world of algorithmic eye-candy, we become more self-absorbed, bored and obsessive. At the macro level, our society fails to address glaring anomalies in finance, ecology and so on. It is as if some collective psychological crisis were brewing.

Hence the rhetoric of 'singularity'. Towards the turn of the millennium, well-known figures in IT began to wonder what evolution might hold for humans. Given our triumphal progress thus far, they expected something big — we would come to exist in some totally new sense, intellectual and abstract.

The 'hive mind' created by brains linked across the internet might somehow take on a life of its own. Or, with judicious use of genetics, AI, chip implantation, Virtual Reality (VR), and what have you, we might consciously direct our evolution so as to produce a new superhuman race. In any case, a dramatic evolutionary leap was in prospect — a 'singularity'.

8. See on

This naïve thinking was baked into Silicon Valley and remains remarkably influential. People have commented how it resembles the fundamentalist-Christian doctrine of the Rapture, whereby True Believers will suddenly be snatched into Heaven to prepare Christ's Second Coming.⁹ It is interesting how the two belief-systems complement one another — just as the Bible-thumpers imagine Believers' bodies being snatched from their cars while they drive along, so techno-fundamentalists long for the day when their minds will be absorbed into some quasi-mechanical mental heaven in a similarly inexplicable way. Just as Believers will leave behind what used to be their minds, being instead filled with the Holy Spirit, so the nerd élite will no longer be encumbered with a body. This has something to do with the mind-body split, evidently.

2.3 Current developments

The expression 'Fourth Industrial Revolution' ("4IR") has been popularised by Klaus Schwab, a German economist who is the moving spirit behind the World Economic Forum.¹⁰ It describes the confluence of ... artificial intelligence (AI), robotics, the internet of things (IoT), autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing..."

This "revolution", we are told,

... entails nothing less than a transformation of humankind.

Professor Schwab says

... [the 4IR] is fundamentally changing the way we live, work, and relate to one another".¹¹

That last formulation is striking. It attributes agency to an abstract entity. We are told this entity will change us fundamentally, and are invited to approve. It is almost a formula of worship.

Schwab would doubtless claim that this is a mere rhetorical appearance, and that in truth he is simply following the conventional

9. Lanier (2010)

10. held annually at Davos in Switzerland

11. Schwab (2016) p7

principle that we must adapt to our environment. Still, some barely explicit 'refinements' of that principle are in evidence here.

It is assumed that the environment changes with our developing technical capacities, so we have no choice but to go wherever the latest technical innovations may lead. The development of new techniques is seen as a process which goes by itself.

It is not subject to human choice — to the choice of those who do the developing, or of those who fund and direct it. This is how we come to understand ourselves as surrendering our human agency to an abstraction like the Fourth Industrial Revolution - for thinkers like Schwab, scientific understanding is beyond human discretion. It unfolds according to its own dynamic, and technology follows automatically.

There is some truth in this, of course. There is hype as well.

Top-flight researchers, doing original work, are often surprised at the results of their scientific enquiries - and, if so, they follow where the newly revealed facts lead. Yes - and, at the same time, most scientists work to orders from the funding agencies.

Those agencies may claim to allocate funds 'objectively', i.e. in line with a developing scientific consensus (which, again, is said to follow where the findings lead) - and this may even be true, sporadically. Often, though, the consensus reflects political processes in professional institutions, which in turn respond to external pressures from the wider political arena, above all from corporate interests. Even the best, most original researchers may be constrained — as when Barbara McClintock was prevented from continuing her work on 'jumping genes', work which 30 years later attracted a Nobel prize¹².

If even work we classify as pure science does not just follow the facts, then we can imagine how much less that is the case when scientific findings are applied in developing new technical devices and systems — commercial products. In discussions of the 4IR, this process, too, is assumed to be automatic, subject to human choices only peripherally — we have some scope to steer

12. Spangenburg, R and Moser. D.K.(2008)

the autonomous forces driving the revolution, and to compensate for some undesirable side-effects, but in the main we must simply submit to the logic of the market.

Like science, the economy is conceptualised as a force which follows its own inherent, inexorable laws, and moves us with it, willy-nilly - a monstrous divinity, effectively, which holds humanity in its maw. The 4IR, similarly, starts to look like a dark deity, potentially helpful yet threatening.

We have had a foretaste of what we can expect. The last gasp of the Third Industrial Revolution, we are told, was the simultaneous advent of the Smartphone and of 'social media'. There is evidence that this development has adversely affected the mental health of the generation who grew up since.

They lack a sense of sense of autonomy — well, fancy that! Going on from there, it seems that we are raising people less and less capable of intimacy, and hence of producing further generations, (a remarkable comment on the promise that social media would make it easier for like-minded folk to connect).¹³ Progressive infantilisation seems the Order of the Day.

The problem thus revealed appears still more acute when we read that the 4IR is not just seen as an independent force, beyond human agency, but in fact, according to the prevailing view,

[n]ew ways of using technology to change behaviour... offer the potential for supporting ... natural environments.¹⁴

Those steering this process evidently want us all to embrace change imposed by means of AI-driven quasi-autonomous, quasi-personal machines — in this way, they hope to make people accept reforms supposedly dictated by ecological imperatives.¹⁵ (This has something in common with the drone story).

13. See for instance *The Atlantic* magazine *passim* e.g. <https://www.theatlantic.com/magazine/archive/2017/09/has-the-smartphone-destroyed-a-generation/534198/> <https://www.theatlantic.com/technology/archive/2017/08/a-sitting-phone-gathers-brain-dross/535476/> <https://www.theatlantic.com/technology/archive/2016/01/the-convenience-surveillance-tradeoff/423891/> and follow links

14. Schwab (2016) p 63 ff

15. Schwab (2016) It is necessary to piece his argument together carefully here.

The change in prospect is presented as non-discretionary, a historical given. All are urged to join the best minds in making it work. To make it work, we must first overcome our difficulties in accepting the pre-determined course of events, and then must channel the 4IR's capacity for re-engineering humanity in appropriate ways, managerially expedient ways. This programme generates tons of media output, like what surrounds the launch of a new electronic device only bigger.

Behind the brouhaha, what is really at issue? The current combination of AI high-profile product launches and intensive discourse management, (4IR in embryonic form, so to say), serves to lock us in to certain unstated assumptions:

- human life is
- a product of material factors, and hence
- determined by forces remote from our experience; and that
- those forces drive an evolutionary process;
- so our current social and economic arrangements approximate to the optimum — the status quo is the culmination of:
- human progress through civilisation,
- intellectual progress through science and
- material progress through technology/industry.

It is obvious that things are as they are because they have to be that way - and the same goes for us. *Ergo*, we are fated to experience what the 4IR has in store for us.

That is the story. Let us consider that in the light of Bauddha traditions - and consider how humanity could learn from this episode.

Would we then be better able to address the deterministic ideology which holds us all in thrall? If we try to follow and emulate Bauddha thinking, could we even undercut it entirely?

3. WHAT CAN WE GET FROM THE TĪPIṬĀKA?

3.1 General reflections

3.1.1 Traditional resources

The ideology of techno-determinism masks patterns of economic and political power. That helps to explain why the 4IR is presented as fact, something outside ourselves, to which we must react. Still, that problem is in a sense secondary.

It is true that people manipulate and exploit each other, and civilisation encourages it. Equally, survival is a stronger imperative than any — and, as human civilisation reaches this flexing-point, we are all in many ways similarly confused about how to want to survive. That goes for exploited and exploiters alike.

The 4IR is a social/political/economic project, subject to human agency, which serves particular interests and reflects specific attitudes and assumptions. At the same time, many of the relevant assumptions are deeply embedded in everyone's thinking — they are common to all sorts of people.

It is useful to notice those assumptions, and, where necessary, to pick them apart. Bauddha traditions offer resources we can use in so doing.

3.1.2 Linguistic

In responding to the challenges of civilisation, Bauddhas have focused on states of mind. This has led to a concern with language, and how it can misguide us.

Language usage shapes the way we think, and the way we experience our lives. It often encourages us to divide reality into discrete entities, things and people with essential characteristics which (we assume) cohere and persist and can be relied upon. The archetypal entity is 'me' — I think of myself as permanent, fixed, irreducible, a given, a unique feature of the world, a landmark to steer by. Other entities then seem to follow the same model.

If we have a name for something, we suppose it must exist in this substantial way. Bauddhas were among the first in history to suggest that this might be a problem (Lao-tzu and his people may be compared).

Have all people at all times been subject to these same

compulsions? Perhaps not exactly. Consider those who lived a few hundred years *before* the Buddha's time — they may not have been so focused on fixed entities.

That is at least plausible in view of what we know of their language usage. We have oral records from the Indo-Aryan speech-community of that time. It comes to us in the Vedic verses.

Vedic language compares strikingly that of the Pali canon. It favours verbal forms, and it is overtly polysemic — allusive and associative, poetic and symbolic. By the time of the Pali, conventions of language usage had evidently changed, and become less fanciful — substantival constructions, unfamiliar from the earlier period, are common, and the language is generally much more clear-cut and denotative. Binary categorisations are more in evidence.

It makes sense. The Vedic peoples led a more mobile, extempore life, herding and foraging, but Magadha/Kosala in the Buddha's time was becoming more settled and organised. They were using metals to clear forests and irrigate valleys, so output exploded, with population not far behind — and state structures and administrative systems were of course developing too. People were focused on manipulating their material and social environment to gain wealth. Substantial economic advances went along with a substantialist metaphysic, reflected in substantival language and thought processes.

This was the situation Gotama was addressing. Language was less and less well adapted to non-material human needs.

In that context, some wanted to reject the practical idiom of everyday contemporary life and to cleave instead to those magical Vedic verses. The Buddha understood that those people were deceiving themselves, for that magic was gone — whatever it may once have been, it was now just an idea.

The only thing left, it seemed to them, was to say what you can. Say what you can — and no more. Significant silences convey much that is important.

3.1.3 Civilisation, materialism and practical discourse

In some ways, people of Gotama's time had it easy compared

with their Vedic predecessors,. Civilisation was thriving in the early-historical Ganges valley.

There was a cost, though. Their language reveals a world of things rather than of forces, entities rather than processes, fixed ties rather than fluid associations — a world of determinate, quasi-mechanical relationships rather than of interactive, negotiated, quasi-personal relations.

Then as now, clearly, many felt that reality is out there. It follows its own rules, independent of us - and it governs our lives, so our role is to fit in, to pursue self-interest modestly as best we can.

Then as now, this thinking evoked mixed reactions. People went with it on a practical level, almost out of necessity no doubt - populations of such density could sustain themselves only if everyone followed the programme, so techno-economic development was clearly top priority. At the same time, the market for psychotherapy, spiritual sustenance or what have you was booming - so we may deduce that, as today, people were feeling the strain.

It all seems weirdly ‘modern’. The Ājīvikas and others reflect a strong climate of determinist thinking. The protagonist of the Pāyāsi Suttanta is a caricatural, hard-line materialist - if reincarnated in contemporary California, once can imagine him as a strong promoter of the 4IR¹⁶.

To preserve productivity and consumer gains, the general idea was to keep civilisation progressing - and that meant minimising individual and collective mental disorder, and coping with what could not be minimised. That in turn meant developing new patterns of thought and behaviour, and new framework-stories, new ways to speak and to think about the context of human life.

In the public discourse, two poles emerged. We see them in India.

There are theorists and practitioners of power who are recognisably materialist.¹⁷ Then we also see idealists - abstract/speculative thinkers in a Vedāntic style.

16. Pāyāsi sutta Dīgha Nikāya 23 See Note 27

17. Lokāyatās and carvākas were theorists, and among practitioners of power we can cite Pāyāsi and the courtly readership for whom the Arthaśāstra was composed.

The Bauddhas claimed a middle ground. Closely considered, their aim was, actually, to undermine the whole discourse.

3.1.4 Practical anti-binarism

The Middle Way (*majjhima-paṭipadā*) appears in the Dhammacakkappavattana Sutta, traditionally the Buddha's first teaching. The Buddha recommends avoiding extremes of sensual indulgence and self-mortification¹⁸.

That is the context for other usages, for instance in relation to *uccheda* and *sassatā*. It is not about how you understand the world - it is about how you handle yourself.

It is true that there are theoretical aspects to these teachings. Yes, the Bauddhas want to say that continuity, for instance between one life and another, does not imply an entity that continues, and that is quite a theoretical point - and, at the same time, in practice the key is not to get too puffed up or brought down. Sometimes, your life will suggest to you that the world is for your eternal benefit, sometimes that there is nothing worth relying on - and neither impulse helps. If drawn too far towards one pattern of thinking, you may perhaps entertain the other so as to steer back towards the middle.

Effectively, in every contrast like that between materialism and idealism, both alternatives are rejected. So is the choice between them - neither option applies, and to select is meaningless.¹⁹ Anyhow, it is a question of practice, not of philosophy. It is not so much that some arguments are right and others wrong - it is more that some ways of thinking help us stay in a good place in our minds. It is worth avoiding conceptual habits which pull us in directions where we do not properly want to go - and developing more helpful habits instead.

This basic Bauddha approach applies widely. It extends to all binary contrasts.²⁰

18. Saṃyutta Nikāya 56:11 (in the Sacca Saṃyutta)

19. The only thing to say at this point would be the logic-defying *catuṣkoṭi* — 'it is neither so nor is it not-so, nor is it both-so-and-not-so, nor neither-so-not-not-so'. The same would apply to all too-simple binary choices — determinism *versus* randomness, for instance (order *versus* chaos).

20. The understanding of *vedanā* presented in e.g. the Satipaṭṭhāna Sutta, for instance,

Often, our language almost forces us to think in terms of a two-state logic, and this sets up tensions, (which may be partially resolved by taking sides, but only at the cost of sinking further into the binary trap). It is not helpful to assume that, in a debate, one side must be right and the other wrong. When it comes to what matters, neither ‘eternalists’ nor ‘annihilationists’ are ‘right’ - and the point is not to argue correctly, it is to live life so we learn from it.

That is not something we can readily pin down in referential, denotative language. It is, if you like, a qualitative standard that, implicitly, everyone is aware of, and tries to apply. We might call it dharmic.

3.1.5 Anti determinism

The problem of deterministic thinking is connected. If everything is determined by external, material forces then at some point those forces must cease to apply, so we think of annihilation.

añño karoti, añño patisaṃvedīyatīti ...
paraṃ kataṃ dukkhaṃ ti.

Iti vādaṃ
ucchedaṃ etaṃ pareti²¹

One (being) acts and another experiences (the consequences) ...

Suffering is produced by someone other (than the sufferer).

If we put it that way,
it is the same as (believing in) annihilation.

This suggests why deterministic thinking attracts us. It offers an excuse for the lack of confidence that leaves us alienated from our own lives, unable actively to live our own momentary experience. It does not matter what we do, we tell ourselves — nothing can change (my suffering). This would seem to reflect a social world in which people feel a lack of control over their lives.

3.2 Buddhist Causation

centres round a basic like/dislike contrast, although a third position is then added, indifference

21. S 2 20 Kalupahana (1975) p 43

3.2.1 Connectivity

The S 2.25, we read:

Uppādā vā tathāgatānam
 anuppādā vā tathāgatānam
 thitā va sā dhātu
 dhammatthitatā dhammaniyāmatā idappaccayatā

Kalupahana comments²²

[T]here are no accidental occurrences; everything in the world is causally conditioned or produced

Certainly this passage suggests that our experiences are not isolated, but instead are all intimately connected in complex ways. That is not precisely what it is talking about, though. It focuses instead on *dhammas*.

Dhamma is a complex term. One important usage is in the Satipaṭṭhāna Sutta²³, which outlines four stages in a key meditative practice called *sati*. *Dhammas* are what the meditator focuses on in the fourth stage.

So it hardly seems likely that we are not dealing here with causality in any straightforward sense. In the Pali literature, for instance, the basic metaphors for connectivity are organic

Just as a seed that, when sown in a field, will grow if it is supplied with the essence of the earth and moisture, so that [five] aggregates, the [eighteen] elements and the six senses come into being on account of a cause and disappear when that cause is destroyed.²⁴

'Cause' is the accepted rendering of the Pali here — and yet earth and moisture are not necessarily what we might ordinarily think of as causes for the growth of a seed. They are conditions under which the other causes operates, which arise from the molecular and cellular structuring and functionality.

One point we might take from this is that mechanical, 'billiard-ball' causality is a special case. Then there is the wider category

22. Kalupahana (1975) p 89

23. M A 19

24. S 1.134 hetum paṭicca sambhūtā hetubhaṅgā nirujjhare

of causal-or-conditional connectivity to which that special case belongs.

3.2.2 Chains of origination

Consider next the classic formulation:

Imasmiṃ sati
idaṃ hoti,
imassa uppādā
idaṃ uppajjati.

Imasmiṃ asati
idaṃ na hoti,
imassa nirodhā
idaṃ nirujjhati²⁵.

‘This being so, that happens’, it say - events are chained. What does that imply?

Does it imply ‘closed-system’ thinking - was the Buddha concerned with situations where, ‘all else being equal’, a single input variable can be seen as responsible for changing a single target variable? No, that is clearly not the sort of causal analysis that the Bauddhas were offering.

Where the scientific impulse is to isolate specific causes, the Bauddhas look at how influences pile up, as when *bhikkhuni* Selā says that the body grows only if a whole pattern of causal factors are in play at the same time - so you cannot straightforwardly put it down to the way bodies are in themselves, nor to remote actors or forces.²⁶

The overriding Bauddha project was that people should be able to follow the subtle movements of their own minds (so as not to get carried away). A causal connection in this context would be if a certain cognitive behaviour tends to induce unhelpful experiences. Understanding it will help you to avoid falling into that behaviour - if you notice when that behaviour is starting, then you will not get trapped in it. The point, therefore, is not to anatomise how

25. M 1.262-64; S 2.28, 70, 96; Ud., p. 2.

26. S 1.134

such-and-such a behaviour may produce its effects, just to avoid behaviours unlikely to be helpful.

So the classic *imasmiṃ sati* formula can be understood without any causal connotations:

Whilst this is in existence,
that comes into being

After this has emerged,
that emerges

For as long as this is in not existence,
that does not come into being

After this has broken up,
that breaks up

Yet it is commonly seen as an example of advanced, causal thinking. Kalupahana is typical here.

Consider his comment on the Saṃyutta text which says:

Avijjāpaccayā bhikkhave sankhārā.

Iti kho bhikkhave
yā tatra tathatā,
avitathatā anaññathatā idappaccayatā,
ayam vuccati bhikkhave paticcasamuppādo

He says

Causality or causation (*paticcasamuppada*), as described in the Saṃyukta, is synonymous with the causal nexus, for example, as between 'ignorance' (*avijjā*) and 'dispositions' (*sankhāra*). This causal nexus is said to have four main characteristics,

- (1) 'objectivity' (*tathatā*),
- (2) 'necessity' (*avitathatā*),
- (3) 'invariability' (*anaññathatā*), and
- (4) 'conditionality' (*idappaccayatā*).²⁷

Is the Buddha here talking of causality in a modern sense? Is he even presenting an analysis of the world? Or is he offering tips for

27. S2.26 Kalupahana (1975) p 91

how to handle our human attitudes and expectations? Another way to take this passage would be:

Our dispositions (all) go back to the way we lose our understanding (of what is happening with us). That is what we call conditioned origination — it happens that way, it doesn't happen differently, and nothing else happens.

This would hardly seem to be about abstract causality.

Yet the scientific method was alive and well in the Magadha/Kosala of those days - the Pāyāsi sutta describes an impeccably Popperian test of whether any non-material vital spark (*jīva*) exists in a human.²⁸ This was an increasingly administered and technically progressive society, so mechanistic models of causation were all the rage - they even invaded the sphere of psychology/philosophy/religion, as we see in the Sāmaññaphala sutta, where the doctrines of the various teachers cited focus quite closely on ideas of straight-line causation. Some accept it - others reject it. Some say strict causal laws determine what happens to us, and how we react - for others, however well or badly people behave it has no influence on how well they get on.

In the middle, the Bauddhas resist false dichotomies. For them, material/mechanical patterns of causation are all very well, but not so important. What matters, they suggest, is the causal understanding that can help a person to live life more fully, moment to moment.

It is one thing to achieve instrumental control over external circumstances. It is another to develop psychological resilience by weighing your states of mind in full awareness of how they have developed.

You look at what is there. It happens that way (*tathatā*), so why kick against it, complaining it is random or rigged? Instead, we can look at how it happens (*avitathatā anaññathatā*) — and, in particular, at what purchase we may have on it.

28. Pāyāsi sutta Dīgha Nikāya 23

CONCLUSION

The point of causal chains, in a Bauddha perspective, is to *break* them. A cause is not a distinct, measurable input to the system, such as may be applied so as to produce a specific output. Instead, it is a combination of factors, not measurable but otherwise available to experience, which a person can watch out for, and can *counteract*.

The teachings constantly come back to the same point - humans have agency, if they can only think straight. Unafraid to be accused of circular argument, the Buddha also explicitly justifies his approach precisely on that basis - we know this must be right because it leaves scope for human agency²⁹.

Now, we face a powerful, global movement to fill our lives with robots and robotic thinking (4IR). How do we understand this?

First, let us think of the people running this campaign. They had a dream, but it is not working, so now they push too hard.

Business-friendly technocracy was supposed to be the magic formula. Suddenly, the formula does not work anymore. What do they do, the technocrats and their business friends? They get scared and try too hard - there is an edge of desperation in this 4IR story.

The big money has spoken, so something will happen - but no one knows how the story will develop. People may be talking of the 4IR for some time, alas - freighting this construct down with all sorts of meanings.

What sort of problem are we dealing with here? People are getting too closely focused on an obsessive, decontextualized understanding of cultural, social, and economic processes.

The context they lack is, if you like, practice. Or, if you like, it is how we all struggle to get by, to cope with boredom, exhaustion, demons or even undeserved good luck. Or, it is the understanding that the perfect plan is no good unless people will go along with it.

The causes-and-connections that matter are those that describe and affect how people actually behave, whatever their stated rationale. Lived realities matter - more than abstract analyses.

29. A 1.174; cited Kalupahana p 22

The causes and connections that matter most of all are those that trip you up - the ones you can break. There may be work to do, though, to break them.

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UNDERSTANDING THE IMPACT OF THE FOURTH INDUSTRIAL REVOLUTION¹

Thich Nhat Tu

In the summer retreat season in 2018, I presented the topic of Buddhism and the 4th industrial revolution, sharing the Buddhist views on the technological development, no matter whether we have admitted it or not. There were many positive and negative impacts of this industrial revolution. In this chapter, I have tried to put emphasize upon the impacts of the 4th industrial revolution to help you all to understand clearly what we are coping with the advancement of physical world.

Buddhism visualizes a phenomenon or an event to identify clearly its utilities and drawbacks by analysing the causes, favourable and adverse conditions that generate immediate or long-term consequences.

The Fourth Industrial Revolution and resulted in the breakthroughs in technologies for gene sequencing and editing, nanomaterials and 3D printing, renewable energy and energy storage, big data and automated knowledge work, mobile Internet and the Internet of Things, artificial intelligence and augmented reality are pervaded all aspects of life and all regions of the world. These developments combine to make our environment, and especially our social infrastructures, more amenable to technologies capable of blurring boundaries between nature and machine, the

1. This talk delivered on December 16, 2018 at Buddhist School for Dhamma Propagation, is transcribed from Vietnamese by Giác Minh Duyên and translated into English by Lai Viet Thang.

physical and the artificial, the biological and the digital.²

Early examples of fourth industrial revolution are relatively rare but it tends to focus upon likely four major trajectories which are; birth, aging, sickness, and death that are suffice to motivate the relevance of it to Buddhism. *The Dhammacakkappavattana Sutta* or Discourse on Setting in Motion the Wheel of Truth explains that the first noble truth of Buddhism that birth, aging, sickness, and death are the sources of dukkha.

Hence, by virtue of their promise for ameliorating badness associated with premature birth, sickness, aging, and death, Fourth Industrial Revolution presents itself as a vehicle for freedom from dukkha. Buddhist tradition tends to focus upon transformative practices, rather than technological supplements, as vehicles for fostering the six perfections (*pāramitā*) and achieving the ultimate goals of awakening (*nirvāna*) and various other freedoms (*vimutti*).

Moreover, as a Buddhist monk of practice, I am of the view that the first noble truth surely know, we would remain exposed to dukkha even in the absence of our biological frailties, by virtue of remaining exposed to clinging (*upādāna*) and the sources of clinging—such as craving (*taṇhā*) and the three “poisons” of lust for pleasure (*rāga*), aversion to pain and insecurity (*dosa*), and delusion about cause and effect (*moha*). So, from a Buddhist perspective, it seems that the most we should expect from it is help in cultivating habits and mental states that release us from dukkha. The least we should expect, by contrast, is outright animosity toward such release.³

1. THE PRINCIPLES OF THE INDUSTRIAL REVOLUTIONS

Before entering to the main topic, I tried to review the nature of the industrial revolutions that have been taking place for nearly 250 years.

The first industrial revolution began around 1780 - 1840. It was a boom period of steam engine that led to large-scale production,

2. See file:///C:/Users/1234/Downloads/Fourth_Industrial_Dukkha_A_Buddhist_Case.pdf

3. Ibid.

and smart machines were replacing manual labour.

The steam power had developed during the industrial revolution. I often argue that if Buddhism had spread widely to Europe and America by proactive monks and nuns since the first century BC, the global technology would have been made earlier at least 500 - 1000 years than the present. This is because the doctrine taught by the Buddha emphasizes on the law of cause-effect that can be applied practically in the field of science including space science, physics, biology, etc. Unfortunately, Buddhism has approached to Western intellectuals since the 19th century.

Some people may have thought that I am unrealistic to advocate such argument. They ask why science and technology were less developed in Asian countries where Buddhism used to be the national religion but they have been developed inventively in the USA and Europe? In other words, they believe other religions than Buddhism have contributed to the modern science and technology. This is only true in terms of appearance but wrong in the nature. White ethnics are very intelligent, innovative and creative but the Roman heretical courts often condemned death sentences or put up a cremation of any scientist who declared scientific truths which were contrary to the Bible. One of greatest example was the case of Galileo Galilei, who declared that the earth is round and not flatten, and the universe is endless but not having a cap. He was taken to a cremation pyre, closing the status of a prominent scientist. In addition, many Western scientists had been hindered by the heretical courts. If Western science had not surrounded by this obstacle, it would have been superior than several hundred years.

In such situation, if Buddhism had reached to Western culture in the first century, the Buddha's teachings would have created a solid foundation for science and technology to grow rapidly. Just as in Cambodia, local people had not recognised the value of gold in a period of time, so they exchanged gold for salt. No matter how local people are aware of gold, its value is not losing.

The second industrial revolution began around 1870-1914. This was a period of electrical energy which replaced the use of candles

and torch lights. Nguyen Truong To⁴, after returning from France, reported in front of the court of Nguyen Dynasty⁵ that France was using light globes with hundred times brighter than candles of Vietnam. Many people considered him a liar. This industrial revolution promoted the massive productivity and improved rapidly economic efficiency.

The third industrial revolution had occurred from 1945 to 1970 or 1973 according to the views of some scientists. This was the period of electrical inventions, information and technology that aided for automatic process of production.

The starting point of the 4th industrial revolution has different theories. It was believed to start in 2000 by some leading German scientists, but 2010 by others, while few people proposed around 1983 along with the appearance of the Internet. Despite this, the 4th industrial revolution has visualized clearly since 2010 with the biggest development of new technologies. This is a period of technical growth that has led to technological applications in every field including biology, digital or physics by which are much more efficient than the previous industrial revolutions.

The nature of the 4th industrial revolution is a high-tech revolution to generate the era that pleases human's audio-vision. In the past, we had to be in direct contact with real objects and persons, we are now experiencing with illusive visions through smart devices. The most outstanding thing is the Internet of Things (everything connected). This concept was described thousands of years ago in the sutras of the Mahayana and Theravada Buddhism, especially the law of inter-dependence of natural phenomena that everything exists in dependence on something else. From the concept taught by the Buddha 26 centuries ago, scientists have generated a theory of the interactive network of all things that is called briefly as "*all things connected*" in Vietnamese community.

The major development that took place under the banner of the

4. Nguyen Truong To (1830-1871): a celebrity, architect and a reformer of Vietnam in the 19th century.

5. The Nguyen Dynasty overpowered by King Tu Duc, the last sovereign Emperor of Vietnam under which the French colonial forces colonized the country.

4th industrial revolution is artificial intelligence (AI), smart machines and robots or driverless-vehicles and auto-mini airplanes. They have been successfully testing and just waiting for the regulatory approvals to serve publics. In such case, public transports will be replaced by automated vehicles, just like aircrafts that can be operated automatically when they reach the certain altitude. We have seen marvellous innovations such as software, data storage, 3D printing technology, nanotechnology, biological engineering, quantum computers and lots of new inventions. A machine connected directly to people enhances the efficiency of work.

2. THE OPPORTUNITIES AND CHALLENGES

Opportunities

The 4th industrial revolution will contribute to improve the human's life in terms of possessions and worldly pleasures. Those who adapt to specialization of technical knowledge will have the opportunity to be awarded high salaries. Of course, it will lead to exclusion like the pyramid diagram that only few prominent engineers are reserved and the rest will be terminated.

Regarding productivity, the 4th industrial revolution has created new lines of products and services that stimulate the growth of all fields, particularly construction which is the priciest sector among manufactures.

In market, the 4th industrial revolution has enhanced supply chains because it allows to produce massive products with high quality.

In summary, the 4th industrial revolution has created new ways of market, opened up new form of economy and influenced entirely every aspect of humankind.

Challenges

One of the challenges of the 4th industrial revolution is to generate injustice globally and labour market can be heavily disordered. Other problem is to increase social tensions among individuals because a minority of people who are adaptable and updated can keep their jobs, while those who are missing new technologies will

be eliminated.

Standing on business perspectives, this revolution will change the methods of investments, profits, and how businesses recruit employees.

In terms of sociology, the 4th industrial revolution has gradually declined the proportion of the middle class. It will generate a big gap between the rich and the poor people, so causing the imbalance in social structure.

Positive effects

When identifying the opportunities and challenges of this industrial revolution, we also need to recognize its positive effects. It has actually altered how people live, work, communicate and execute online-markets. E-commerce sector did not exist before the 3rd industrial revolution. Nowadays, the largest e-commerce giants are Alibaba of China and Amazon of the United States.

The media have changed spectacularly. Social media network such as Facebook and Twitter have replaced the traditional communication media such as newspapers and magazines. For example, the New York Times of the United States had to be bankrupted twice. Social networking sites allow users to share ideas, exchange information quickly, that will bring enjoyment and entertainment.

The important impact of the 4th industrial revolution is to reshaping the governments. For example, Vietnam with 95 million people has 12 million of servants and officers, so Vietnamese government is bulky but inefficient. Vietnam is now restructuring from national committee to district and commune levels.

The 4th industrial revolution had affected positively schooling models to improve the educational quality. In addition, it also affects health care and generates social relations to contribute to the growth of material world, in particular to the audio-visual functions. However, the positive effects of the 4th industrial revolution make people easily attached the pleasures of earth, according to the Buddha. The more entertainments and enjoyment people have, the easier stuck in pragmatic and short-sighted views they will get.

The 4th industrial revolution has brought an outstanding development of biological science, especially genetic modification, which were not mentioned in the previous industrial revolutions. Today, scientists can make mutant genes to generate plants and vegetables that differ completely to those grown from sowing and transplanting in the past.

The development of biotech has contributed to improve human's health and longevity due to the application of stem cells in the treatment of diseases. Following this pattern, I think people may live longer in the future than the present since many kinds of cancers and HIV would be controlled successfully within next five decades.

The development of modern techniques and new technologies helps to improve people's life. Modern people get lots of opportunities, new concepts of power or new identities that will replace the old patterns. It may upset the traditional values, forcing people to adapt and become familiar with new ones.

The 4th industrial revolution would help to reduce traffic accidents if automated vehicles were allowed to serve publics by the governments. In such case, people would have more living spaces and the speed of traveling would be faster than the present.

3. THE IMPACT OF THE 4TH INDUSTRIAL REVOLUTION

Pressure on the government

The government and the leading party must face big pressure from taxpayers, because a modern government relies on AI for governing its population and public administration. Of course, the taxpayers do not want to see a bulky government which takes largely their taxable money. An efficient government is compulsory, so taxable money can be used for genuine purposes.

Changes of running business

The ways of running business and productivity will be turned upside down. Business is the application of economic theories into trading sectors associated with production and consumption. As the economic theories and practical implications have been

influenced by this revolution, people must cease old models to adopt new ones. The quicker a nation is adapting to this, the more developed it will be. When Vietnam advocated bauxite exploitation in the Western Highlands, the intellectuals including scientists had alerted that group interests in this project would be very high, so threatening national security and ruining national economic. Vietnamese government put out of this warning and the project fell into big losses. Vietnamese Coal and Electricity Group have been inefficient because they imported outdated technologies from China. All these kinds of activities make the national budget weak. It is a situation where we do not see the economic disturbance.

VINFAST is Vietnam's pride in the field of car manufacture, although it was just established two years ago. This is because VINFAST purchased German technology. This technology was ranked at 4.0 in term of environmental safety, while Germany and other EU countries has achieved 5.0. If we do not understand the economic disturbance, Vietnamese investors willingly buy waste products of outdated technologies which are costly but low economic efficiency from other nations. In other words, without a wide view of economy, they will cause significantly losses to our nation.

Ownership of personal data

The 4th industrial revolution has disturbed the ownership of inventors. Hackers can earn a lot of money by attacking Facebook's users. Facebook pages of Giac Ngo temple was hacked by anonymous group. I had to pay several tens of millions to recover each page. However, one page containing the Buddhist music and movies has not been recovered yet because someone has offered to get it at higher price than me.

Ownership in the digital age is at risk because the current laws fail to manage it efficiently. Vietnam passed a cyber-security the law that protects ownership in the digital life. A Vietnamese person who wants to create his/her Facebook account must use legally his/her national identity number or passport number for the registration. Just like purchasing a flight-ticket to avoid the interference of black markets. Thus, this revolution makes a difference in how people consume. One's career can grow rapidly but potentially collapse

within hours. It also has the negative effects on inter-human relations.

For example, the billionaire Hoang Kieu⁶, who had been attacked by fake news through the digital media, causing him to lose billion of dollars and getting out of the list of American's richest billionaires. A young girl who lives in Nghe An⁷ and likes to shake her body suddenly became a famous celebrity when the media reported her performance abusively. So, in the digital life, celebrities can be dropped down, and those who are unpopular can be outstanding. The 4th industrial revolution also put the investors under pressures to satisfy their expectation.

These are the social downsides of the 4th industrial revolution, no matter whether we expect or not. It creates a process of 'impermanence' in two ways: negative and positive side. In the past, a disagreement with the policies, people just got out street for protesting locally, while a community's view now can be passed quickly through the social networks such as Facebook, Twitter, etc. For example, there were many protests against the president of France and his cabinet in December 2018 to protect their rights from the tax-reform although it may be beneficial France. The protests caused violence, burning, destruction, injury or even deaths. The wave of protests was strong enough to make the president paused the implementation of this reform or ceased it. In Vietnam, when the government advocating to establish special economic zones, the protests occurring on 10th June 2018 forced the government ceasing this program.

Social inequality

The 4th industrial revolution likely generates inequality in society. I previously mentioned the inequalities among people who work effectively and those who are inefficient. However, the point I'd like to discuss here is an inequality between people and machines in terms of laws, social issues and morality. Although

6. Hoang Kieu is a Vietnamese- American billionaire with a net worth of \$3.8 billion (2015), \$2.9 billion (2017) and \$1.6 (2018), according to the Forbes.,

7. Nghe An (Nghệ An in Vietnamese) is a province in the North Central Coast region of Vietnam. It is Vietnam's largest province by area bordering Laos and the Gulf of Tonkin.

the 4th industrial revolution helps a minority of people have high incomes, improving their lives but automatically brings injustice for the rest of society. The gap between the rich and the poor people is getting wider than ever before.

In the powerful nations such as the United States, Germany, France and the UK, the GAP between the rich and poor people is not high because the middle class occupies dominantly. I have been in many European cities for preaching and experienced this GAP. When I were at the border between Germany and Czech - Slovakia, I did not see the difference in infrastructure. Houses and the quality of life of people living in the border areas and countryside were not much different from those of central cities. The population and land of Germany almost equalizes to those of Vietnam but German population has been distributed evenly the entire nation, so we don't feel of being crowded.

Social inequalities have their deep roots from the differences in the adaptive ability of people. A few minority people who adapt to innovative technologies will be greater and wealthier than those who fail to adapt this revolution and become slow, frustrated, disturbed in their personal and family lives.

During the 3rd industrial revolution, people just needed to attain skills to adapt to their jobs. The 4th industrial revolution not only requires skills, but also a high level of technological expertise. Otherwise, people will be excluded. For example, the traditional taxi industry in Vietnam, if they do not change the way of operating with new technologies, bankruptcy likely happens due to fierce competition with Grab and Uber, two young taxi companies using modern technologies in their services. This problem happened in Europe 5 years ago but Vietnam seems to not learn any lessons. Traditional taxi industry in France, England and Germany went to bankrupt because of using outdated technology which is still being applied in Vietnam. In the traditional model, when the operator announces the address of a guest, the taxi drivers often rush to the destination, only one driver out of ten picks up the customer due to coming soon, leaving the rest of drivers with waste fuel and time, disappointed. Taxi companies have to spend too much money on vehicle maintenance, bulky staff at the operating offices, while

using the innovative App applied by Grab and Uber, customers just notice their addresses and destinations, they will be served within five minutes. These taxi companies started operating in Vietnam two years ago.

Similarly, the traditional models of business will be excluded if they fail to adapt to new technologies. It seems that some businessmen are of inferior opportunities for growth. According to the assessment of German scientists, at least 600 million people living in the developed countries do not have the opportunity to interact with the 4th industrial revolution. This situation is much worse in poor countries. An estimated of 4 billion in a total 7.3 billion people might not be able to keep up with the 4th industrial revolution. Among these people, Asia and Africa account for approximately 3 billion people. Vietnam is ranked as one of the top-ten countries having high ratio of the Internet users with 67% of people using smartphones and the Internet.

Unfortunately, most the users take advantage of the Internet for playing games, online gambling, betting, watching the news, or entertainment instead of studying and running business. If people change their Internet habits, towards the virtuous activities such as online-purchasing like Amazon or Alibaba, Vietnamese economy will grow intensively. The unhelpful entertainment breaks our minds because they cause nerve damage, according to the Eastern medicine. A person who often watches movies or plays games for four hours per day will get emotional disturbance, while who do 7-8 hours will have a mental or paranoid disorder.

I am working as a spiritual consultant from 5:00 pm to 7:00 pm every day at Giac Ngo temple. The young adults who came to seek my advices are mostly depressed, heart-breaking, mental disorders, emotional disorders, multi-personality disorder due to improper using the Internet. It is worth for all of us to think about.

An estimated of 2.4 billion people worldwide don't have access to clean water and about 1.2 billion people still lack electricity for daily usage. The 4th industrial revolution cannot solve these problems, although it motivates people to use the renewable energy solutions such as wind and solar power. Vietnam is one of the most

hydroelectric countries but associated technologies are the most outdated. Currently, Binh Thuan and Bac Lieu provinces are testing the efficiency of wind power. The sea and massive mountains of Vietnam have not exploited effectively due to the benefits of individuals, groups or short-sighted vision of the leaders.

The inequality between people and machines can be seen through the pattern of how investors make decisions to maximise their productivity or service. No matter how much they like people A or a group B, smart machines and AI rather than A or B are being selected by the investors for profitable purpose because of higher efficiency in productivity of AI than that of humans. Many tasks and occupations have been replaced by a series of robots, leading to job losses worldwide. Japan is the most developed nation in robotics, followed by the United States and Israel.

The United States can produce different kinds of robots such as assemble robots, reception robots, etc. Japan succeeded in manufacturing robots to recite the Dharma. Japan is also the first nation to produce robots for all services in hotels, such as taking a guest from the reception desk to an assigned room, unlocking and inviting the guest into the room, taking the guest's suitcase, or greeting the guest. Regarding emotional robots, the United States is on the top when their robots can express their feeling exactly as humans.

Millions of workers would be at risk of being replaced by robots. This is the biggest humanitarian drawback. The robot will be gradually incorporated the capable of solving problems generated by humans, while if those who are the prominent psychologists or pure monks considering the Buddhist doctrine and practical experiences to deal with complicated issues like the problems of marriage, legal actions will achieve virtuous consequences, regardless of occupations for all subjects and ages.

The moral problems

In recent decades, several prestigious universities have incorporated a new course called 'Life Sciences' that teaches students the values of life skills, how people interact with each other and solve problems by nature.

As mentioned before, the 4th industrial revolution has promoted the development of biotechnology, allowing the biologists to modify the variety of genes. This creates marvellous changes that had not thought in the previous revolutions. Hypothetically, if the Lord Buddha were alive, the biologists could mimic his genes to generate many the Buddhas.

Generally, genes play an important role in forming lifestyle and behaviour along with living and educational environments. If genetic modifications were allowed by the laws, it would generate the clones of humans. Another issue of how cloning would alter is a very complicated story. Around 15 years ago, an American movie producer released a film describing a virtuous person was cloned.

Unfortunately, it generated a non-virtuous person as influenced greatly by his habitats. Currently, an American robot named Sophia was granted her citizenship. As people who are closely related to their parents and grandparents, families and communities have a sense of shame, fame or fear to pursue them becoming better. By contrast, those who are cloned do not process such characters and traditional values, so the crimes in society would increase.

The 4th Industrial Revolution has generated the concept of *Designed Baby* made by technologies. The genetic modification on humans would cause a complex problem that makes the judiciary, executive and legislature in troubles. Perhaps, it would take at least two decades to reach a conclusion whether this modification is allowed to applied or not.

As long as AI thrives, robotism will occupy dominantly social life. Using the biotechnology, robots can produce highly dangerous weapons that are beyond human's creativity. Without a proper management, the emotional robots potentially possess such weapons, threatening to all human beings. In such case, the risks of society, laws and civilisation affect intensively people's morality.

If more than 200 countries on earth were allowed freely using of the emotional robots and they were granted citizenships and possessed guns like people living in the United States, what would happen? Of course, this circumstance may take several decades to become reality but its deteriorated morality can be a hypothesis

and human beings need to paid attention.

In terms of the digital life, network-security is now a big issue for nations that are poor in technology and becoming the victims of hackers raised by some political groups. Cyber-attacks are increasing and have become a global concern as they maybe destroy election's outcome, economic and national security. But it is very difficult to prosecute these to the International court. China, Russia and North Korea are warned by the United States the most serious hacker threats in the world, influencing negatively the political systems, national security and economic conditions of many nations.

Cyber security and international governance should maintain international peace and stability in the cyber context. Users should have moral responsibility for their actions. Unfortunately, Vietnam's cybersecurity law is just emphasizing on the issue of controlling and managing dissidents while the national cyber security strategy is to ensure the security of networks and devices, anti-hacker system of developed countries that consider Vietnam as a rival. Therefore, Vietnam needs to focus on network security from that perspective.

Bad culture and faith loss

The modern media are generating social differentiation widely from global to individual. Everyone now can have his/her own social pages which act as the media channels like newspapers or TV. Those who are being followed by a several tens of thousands or more can function similarly TV channels. It seems to be more effective than TV channels in communicating. The digital pages always have two groups: the supporters and the opponents for each issue, so provoking hate words. Also, spreading fake news and information can be completely out of control. While the traditional media are being controlled tightly by the laws, the digital media escape from such supervision.

For example, in the case of the North Korean leader's brother who was assassinated at the Malaysian airport, a Vietnamese woman involved in this assassination, influencing Vietnamese profile and economic growth. Just few days ago, the North Korean representative who came to Vietnam to learn experiences of building a model of economy and market officially apologized this issue.

The social media can magnify a small thing into a big problem, a statement made by the leaders of powerful countries to a wobble effect on monetary policy, economic policy and stock market. The United Airlines lost nearly \$ 6 billion USD after their staff behaved badly with a doctor who is Vietnamese-American but apologized the victim dishonestly. In addition, fake news may cause severe losses and instability of social and family.

In 2017, the Buddhism's opponents that are mostly located in the United States posted a fake photo on the Internet. The photo showed monks and nuns who studied at the Vietnam Buddhist University in Hanoi, stading on the stage received the certificate of "safe contraception for monks and nuns". As a result, the forum was overwhelmed by negative comments, making social restless. People cursed against monks and nuns due to fake news.

I contacted the university boards and committees to have access the original photo which I strongly believed that it was be edited. The original photo was the same to the edited one, except the title of the scene. The original title is: "*Military Week for monks and nuns of Vietnam Buddhist University in Hanoi*". Of course, the quality of the original photo was higher than that of the edited one. I then posted the original photo to the forums but anonymous posters were silently ignoring, neither correcting nor apologizing. Their purposes were to attack Buddhism by fake news, declining people's faith in Buddhism. So, fake news on the social media are extremely serious.

The digital war should be a big problem if we don't respond properly. Having faith lost may take few decades for a person to get out of restless by a false information. Social networks may have made people faithless in others, confused and fearful in life that may direct them to be pragmatic. They lose faith in the truths, spiritual values, moral values, so they no longer believe in the law of cause-effect. The impact of misperceptions makes people more socially dangerous while using the digital media.

Destruction of human rights and privacy

Western countries are the leading nations where data protection and privacy is highly respected. People do not want to be bothered, so even a neighbour knocks on their door, if they refuse to welcome him while he continues knocking and has words, he may get in trouble. Just call 911 in the US, the police officers will come quickly and arrest the annoying person.

Human rights and privacy are extremely prioritized, according to the laws of the US and European countries. There is a concept of ‘noise pollution’ in the US. We only knew three major types of pollution are soil pollution, water and air pollution but the noise pollution has been added to the list. This type of pollution was taught by the Buddha in the Majjhima Nikaya that noise is a thorn to meditation. In a noisy environment, the meditation practitioners are difficult to meditate as it either distracts or pollutes their views and hearing, which will lose the mindfulness. In other words, Buddhism and science were “correlated quite closely”.

Western people are not generally talkative, while Asian people, especially Chinese, are noisy, no matter where they are. Like Chinese, Vietnamese and Thai share a similar habit of noise everywhere just by chatting and gossiping something that are mostly worthless. Human’s privacy is easily vulnerable to get hurt when Facebook and other social networks with intelligent algorithms can identify a user’s gender, no matter whether he/she provided or not. His/her social career, marital status or the assessing contents can be leaking. These data then can be sold to the analytical companies for advertising or political purposes.

Facebook, for example, had to appear before the Congressional in the US and European Parliament about selling nearly 100 million data of Facebook users to the Group of Political Analysis, overturning the 2016 US presidential election, and helping Donald Trump become the 45th president of the US. There are hundreds of selling the user’s data to business corporations but this action is merely serve for advertising, so the law is not care yet.

Smartphones allow the analysts to know where the users are, even if we attempt to select somewhere else. A few Apps on

smartphones have only access to the historic locations of the users if permitted. Generally, most producers of smartphones can be able to know exactly our historic locations and associated times.

Similar to the Apps, a spyware installed on the smartphones can collect all data of what we have access and use or what we consume. For example, the Huawei's CFO was recently arrested in Canada because Huawei was considered as a Chinese spy for collecting the digital life. So, several governments calls to boycott the Huawei's products.

The analysts enable know the history of customer's purchases, type of products, the payment methods and consumerism. Using such data, they then advise the manufacturers to introduce new line of products in the market to meet the customer's expectations. Therefore, selling these data to the analysts is an easy way to make money in this era.

Exposing personal information of customers also affect the happiness and your families when a piece of one's personal information such as using black websites or disloyalty can disturb their partners and the ability of concentration on their career or duties. Psychological warfare and cyberwar affect every aspect of life that makes human's privacy no longer secured.

The fact that people like talking about themselves, sharing their personal lives indicates the instability of emotional and family life. In the UK, 6 million surveillance cameras installed nationwide, they are used to monitor citizens' movements. China even has more surveillance cameras than the US does. And China is a world leader in facial recognition technology . A criminal who is captured by the security cameras in city A, if integrated into the national system, the policeman can locate exactly the location of the criminal within 6 minutes.

China is still stealing intellectual property. Its spies are everywhere. Anything that belongs to new technology invested in Europe and developed countries can be imitated in China and its quality is almost equivalent but much cheaper. This leads to the loss of incomes of many corporations and commit intellectual property theft.

In summary, the topic presented today helps you get some clues on the disadvantages and negative effects of the digital revolution. As a spiritual master, I wish all of you to update knowledge in this field.

In October 2018, Pope Francis of Roman Catholic Church was broadcasting to guide all his priests how to use Facebook and other social networks to encourage them to keep undated a part of the digital life. Of course, everything has duality, when we abuse it, our emotional and mental stability will be damaged by black-websites, making us difficult to control properly our six senses for entering into levels between the Guru master and Saints.

Weighing the harm and benefits of the 4th industrial revolution, the users need to control themselves to use its positive aspects. The destruction may be millions of times more than benefits but we cannot refuse to use it. The lesson is that we must understand its nature to take advantage of benefits without influencing by negative aspects of this industrial revolution.

ROLE OF BUDDHISM IN THE ERA OF FOURTH INDUSTRIAL REVOLUTION

by Simerjit Kaur*
Satyendra Kumar Pandey**

ABSTRACT

Human civilization throughout the course of its journey up to now has witnessed several revolutionary changes, effected by several Industrial Revolutions. The Fourth Industrial Revolution is one of them, which is based on the fruits of previous three industrial revolutions. World expects much from the Fourth Industrial Revolution, as it is likely to bring forth a drastic change in the world. As per Klaus Schwab, 'it will fundamentally alter the way we live, work and relate to one another. In its scale, scope, complexity, the transformation will be unlike anything human kind has experienced before'. Its functioning being based on the cyber systems that works on Artificial Intelligence, in a way, intends to replace Human Intelligence, in every facet of our life like business and other arenas, by Artificial Intelligence with sole objective of benefitting the humankind. Once the reality is replaced by virtual world one can't just alter the situation by pressing CTRL+ ALT+DEL, rather it will harm the human beings in several ways, such as by eating jobs, moral values and etc. In addition to these what is worrisome is that if Artificial Intelligence begins to imitate our brains, sooner or later, it may learn to 'dictate and make us slave'. As per the estimate of World Economic Forum, the possible impacts of the Fourth Industrial Revolution from economic point view are expansion of trade, reconfiguration of factory system, increase in standard of living, massive employment and unemployment,

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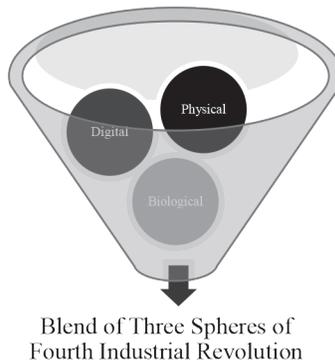
redistribution of wealth, and inequalities. Similarly its societal impacts are growth of cities, increased in leisure time and population, social challenges e.g. urban slums, frustration, drug-addiction, fear of security, decrease in human skilfulness, emotional discriminations and etc. The net result of this could more or less be marked as an atmosphere of unrest, inequality, unhappiness, stressful life, violence, conflict, mistrust etc. all over the world. In such as scenario, the principles and values, enshrined in Buddhism could be of immense help to the world, as we know it deals mainly with existential problems of human being and strives to establish the regime of happiness and peace in the world. Hence, in the background of Buddhist principles consist of ethical norms and values, and etc., this paper purports to discuss various issues relating to the Fourth Industrial Revolution such as, its background, objective, operational scope, functionalities, challenges and prospects (especially in the field of economy and society), and the application of Buddhist approach to resolve the human created problems along with the execution of the Fourth Industrial Revolution.

1. INTRODUCTION

Human civilization throughout the course of its journey, is filled with revolutionary changes, marked by the discoveries of fire, agriculture, money, wheel, cities, manufacturing and trading companies, steam engine, electric power, mass production, chemical productions, super computers, internet, DNA editing, artificial intelligence (AI) and so on. These discoveries are basically the outcome of the inquisitiveness of man to explore new ways and means for his comfort and development. Evidently such discoveries made a lasting impact on human life bringing in transformative change in his living standard. Therefore, such dynamic change in man's life is, generally, termed as revolution. Till date, human history has witnessed three (Industrial) revolutions, in addition to present one 'the Fourth Industrial Revolution', a termed coined by Klaus Schwab, the founder and Executive Chairman of the World Economic Forum (Min, David and Kim 2018).

The first three revolutions brought forth irreversible changes to human life and as a result of it our existing pattern of living has been fully submerged in changes brought about by these revolutions

whether it is concerned with the use of new machineries and technologies or to adopt the new sources of earning or to follow the new life-style. In fact, they provided the human world not only with much needed comfort and facilities, but also gave impetus to its further development. However, at the same time, these discoveries propelled the human beings to make indiscriminate and unrestricted use of natural resources, causing problems like climate change and depletion of natural resources. In such a scenario, the seed of the Fourth Industrialization is supposed to be planted.



2. BACKGROUND

As the historical evidences suggests that each of the previous three industrial revolutions started at different times as a separate event and continued for a long time, they should not be seen as isolated events from each other; rather, they should together be better understood as a series of events building upon innovations of the previous revolution (Min, David and Kim 2018). The mechanical and technological scenario (especially in the field of electronics and information), created by the previous industrial revolutions, particularly the third industrial revolution ushered in the new revolution, called the 'Fourth Industrial Revolution' (FIR). Thus the FIR is said to be based on the fruits of Third Industrial Revolution.

3. WHAT IS 'FIR' AND ITS OBJECTIVE?

The FIR unlike the previous three Industrial Revolutions would grow at the speed of light year with one objective to bring changes in the world for the betterment of human beings by

means of advancement of technologies, which will reconfigure the entire graphical design of our cosmic existence by blurring the lines between physical, biological, and digital spheres and would necessarily put forward impact of difference (Schwab 2017). Therefore, the objective of this revolution, as Klaus Schwab (2016) claims, would not be limited like other previous revolutions to the changes in the society and creation of new opportunities, but, it will drastically “transform the entire world’s economy, human communities, even the human identities, i.e., the way we live, work and relate to one another” (Schwab 2017, Introduction). In other words, it describes a world where individuals move between digital domains and offline reality with the use of connected technology to enable and manage their lives (Top 2016).

4. OPERATIONAL SCOPE

According to World Economic Forum (WEF) and other such councils the driving force behind the functioning of the FIR will be the new megatrends set by the assimilation of physical, biological, and digital spheres . These three clusters are deeply interconnected and supporting for the growth of one another, leading to mass production of best quality designed hi-tech products and automated machineries, 3 or 4D (Dimensional) printing, robotics, new (re-usable) materials, digitalization of working system (through networking or internet), promoting healthy living (by early detection of diseases and proving better health facilities) and etc. (Schwab 2017).

5. PROSPECTS AND CHALLENGES

As apparent from their functionalities the flare of these technologies are modifying our ways of living, communication, behavioural patterns and its response for self and others, different methods of production, consumption, and its application in various other systems such as healthcare, regeneration and preservation of habitats and the natural environments, integration of systems for supply of goods or energy, interconnectedness and expansion of sectors - academia, business, and etc. besides opening the doors for new advancements of fresh air, water, integrated supply of energy, 3D-replacement of disabled organs, automotive processes

of working, ease and quickness of data management, access of data at any moment from any place and etc. All these outputs of the FIR has given the green signal for reshaping of economical, social, political, technological, physiological, biological, cultural and other spheres of humankind. And, thus, it is about to transform the globe to the flip of 180°.

Though human quest has always been looking for transformation, but, as customary to man change is not easily adaptable, because it is accompanied by various challenges, consequences prospects, and side effects as well. As per the estimate of WEF, the economical impacts of the FIR may be the expansion of trade, re-configuration of factory system, luxurious standard of living, massive employment and unemployment, redistribution of wealth, and inequalities. Similarly its societal impacts are growth of cities, increased in leisure time and population, social challenges e.g. urban slums, frustration, drug-addiction, fear of insecurity, moral degeneration, decrease in human skilfulness, emotional discriminations, migration of people from rural areas to urban centres and etc.

In this background the projected instant positive and negative impacts of the FIR from the scope and operational point of view could be enumerated in tabular form as under:

Cause - (the implementation of FIR) - Effect (Effect of Implementation of FIR impacts in two ways Positive and Negative)		
FIRTHREE SPHERES	INSTANT-POSITIVE IMPACT	INSTANT- NEGATIVE IMPACT
1. Physical	Reduce road fatalities, insurance costs, carbon emissions, pollution; liberate workers; produce new tools; improve health; create new jobs, and etc.	Loss of Jobs (cause repression, depression, increase mental illness), growth of inequality (due to low skill, low wages or no jobs even and high skill, high wages), prone to physical, disparity among people, expensive life and no social life, even threatening to life -due to use of new tech in deploying weapons (Autonomous weapons 2017) and etc.
2. Digital	Beneficial for sectors like retail, finance, banking, hospitals, manufacturing industries, sales and distribution, army, vehicles, service industry, and etc	Prone to cyber attack, end of privacy, hacking frauds, misuse of technology (stealing through drones, hacking etc.) fear of trust, internet for things and etc.,
3. Biological	Cure for physical disease, precise diagnoses, 3 D - i m p l a n t a t i o n of organs (hip displacement, liver t r a n s p l a n t a t i o n), enhanced sensing, processing, and action information (improved hearing, vision, restoring memory, and etc.), human like Robots, Good health, and etc.	Take over the place of doctors, end up specific qualities to comfort humans (such as empathy, sympathy, help and understanding), wrong treatments (as one disease may have various symptoms corresponding other disease or dysfunctional organs or due to reactionary bodies, and etc.

The Global Risks Report 2017 published by the World Economic Forum also cites about these prospects and challenges while describing the Global Risks and Trends and Emerging Technologies 2017. It has displayed all these aspects comprehensively in a map,

which is not being presented here due to paucity of space, however it may be consulted vide the web link mentioned in this report.

It is, however, remarkable that world expects much from the Fourth Industrialization so far as betterment of human being and this planet is concerned, as in the words of Klaus Schwab, 'in it scale, scope, complexity, the transformation will be unlike anything humankind has experienced before.' A fundamental change in the way products (goods and services) being produced, delivered and consumed is expected by means of using cyber physical systems. Since the cyber systems work on Artificial Intelligence, in a way, the FIR intends to replace Human Intelligence, in every facet of business and other arena, with it in order to achieve the obvious (so-called) goal of mitigating human problems, and to upgrade their life. Once the reality is replaced by virtual world one cannot just alter the situation by pressing CTRL+ ALT+DEL, rather it will affect the human beings in several ways, such as by eating jobs, moral values and etc. In addition to these what is worrisome is that if Artificial Intelligence begins to imitate our brains, sooner or later, it may learn to 'dictate and make us slave'. It has already started indirectly controlling and dictating our minds in silent mode. Incidents related to Blue Whale, and MOMO games, which impelled their several users for committing suicide, could be cited here as the brilliant examples of how can the latest technology base on AI could control the mind. In addition to it AI can also be associated with some other problems like its failure, software issues, human illness -e.g. change of the pitch of sound due to tooth filling (Amazon Alexa 2018), detection of children prohibited website (Amazon, Alexa 2017) due to child speech detect (wrong suggestions), sorcerer's apprentice (Berger 2017), excess of power supply, power failure, too much integration or load, and devalue subjects and courses (education). These problems result respectively in slowing down of process, errors, wrong commands, wrong response, and no acceptance of asking direction or not open to feedback, damage of the whole circuit, shutting down of all the systems, environmental harm (sudden climate change, natural disaster stimulation possibility, and devaluation of subjects of other streams apart from science, math, and engineering. In the backdrop

of aforesaid description apart from projected benefits the net result of this could be marked signal of atmosphere of unrest, inequality, unhappiness, stressful life, violence, conflict, mistrust, sense of insecurity etc. around the world. All these aspects caution us of the fact that FIR is required to be implemented under intensive care with utmost moral responsibility. Acculturation of Buddhist principles and values with envisioned ideas of FIR could provide this care and responsibility.

6. ANALYSIS OF FIR FROM BUDDHIST PERSPECTIVE

When we analyse the operational aspect of FIR from Buddhist perspective, it appears that it also operates similar to the principle of Dependent Origination (*paṭiccasamuppāda*), which works on the maxim of “*Imasmim̐ sati idam̐ hoti, imassuppādā idam̐ upajjati, imasmim̐ asati idam̐ na hoti., imassa nirodhā idam̐ nirujjhati*” (*Saṃyuttanikāyapāli*, 1.3.1.22, VRI.1.25) i.e., “*This being, that becomes; from the arising of this, that arises; this not becoming, that does not become; from the ceasing of this that ceases*” (Davids, 1921-25, p.439). Ostensibly, the implementation of FIR begins as a simulative cause for further rolling of the effect on society and, thus, it not only portrays the positive and negative impacts but also throws light on the cause and effect relationship, which explains the process through which ‘A’ becomes the cause of ‘effect B’, wherein the effect ‘B’ becomes the causal seed for ‘effect C’, and then this effect ‘C’ becomes the causal seed for ‘effect D’, and goes on rolling like a wheel and entangling man in the web of suffering. To testify this aspect of FIR, the reflected and actual picture (i.e., prospects and challenges) of the FIR with special reference to artificial intelligence could be presented in tabular form as under.

Reflected Picture	Actual Picture			
A	B	C	D	E
Effect/Cause	Effect/Cause	Effect/Cause	Effect/Cause	Effect/Cause
	Results	Change	BANE	Increase/ Birth of

1. Bring New Jobs	Removal of Previous Jobs	Change in Standards of eligibility of Jobs	Low Skill or High Skill Disparity in wages	Stress, Dislocation, Repression, Social Tension,
2. Continuous Working by AI	Comparison of human working with AI	Change in the duration of Hours	No leaves or compensatory off	Sickness, Tension in human Relations
3. Jobs by AI	Replace Man Jobs	Survival at cost	Unemployment	Disparity in Society
4. Quick jobs with AI	Dependent life	Lifestyle	No human exert	Lethargy
5. New Enterprises	Waste of existing resource	Closure of smaller ones	Loss of wealth	Unemployment
6. Ease Access	Freeness to Access	Terms of Use	No Privacy	Lack of Trust
7. AI Algorithms	Software control	Controlling System	Loss of Man control	Cyber-attack
8. Integrated Environment and making of AI	Emissions/usage of fossil fuels	Ecological Balance	Degradation of Environment	Extreme weather events, Sudden Climate Change, Water Crisis
9. World with AI	Interference in Human Life	Lifestyle	No Rules for AI in Constitution	AI may be used to commit Crime

7. BUDDHIST APPROACH AND ITS APPLICATION

So, before stepping forward with this new revolution projecting innumerable benefits for the society, we must keep in mind that

the innovations of AI, biotechnology, robots, and various other upcoming technologies will certainly redefine the way of our living, particularly what it means to be human, our ways of engaging with one another and our surroundings. The technologies what we are creating would act as our replica i.e., it would be representative of our inherent traits, capabilities, our identities, our potentialities, and etc. No doubt, the implementation of FIR promises that it is and will be for the benefit of all humankind in the times to come, but the historical evidences and the experiences of the past three Industrial revolutions make us apprehensive to regard this revolution wholly beneficial. In pursuit of this one may say that ‘Yes’ this revolution has immense potential to bring about much prospects in human life but, at the same time, it challenges the sustenance of human life. Its pursuance leads to the establishment of ‘Hi-tech Society’, that may incur the hi-tech risks, threats or crimes’ as well which might go beyond human control, and eventually convert it ‘bane from its expected boon’. And herein the incorporation and application of Buddhist approach to lead a happy, healthy and peaceful life may save this Fourth Industrial Revolution from becoming (an era of) ‘bane’ and, thus, transform it into (an era of) Bliss.

Remarkable to note, here, that Buddhism itself appeared as a revolution, (even before the advent of revolutions as mentioned above) against then existing materialistic (indulgence in sensual pleasures) and nihilistic (self-mortification) views (*Brahmajālasutta*, the first *sutta* of *Dīgha Nikāya*), which had confounded the people and were the subject of great worry for them in relating to what is the realistic attitude of life. In such a situation Buddhism suggested the people to avoid these views and prescribed a path, known as middle path to enable human beings to save themselves from the clutch of such fearsome confounding situation and to enjoy peaceful and happy life (*Mahāvagga*. 1.6. 13, VRI. 13). The Buddha clearly exhorted the audience to follow middle path, as it leads to insight, wisdom, conduces to calm, to knowledge, to enlightenment (*sambodhi*), and eternal peace (Müller, 1.6.18, pp.94-95).

Now, some of us may ask that if it were so, ‘why man is still prone to various aspects of suffering, like poverty, social and economic disparity and so on in the countries Buddhism is being widely

practised.' The answer to this could be traced in three propositions of Buddhism, that suffering exists in the world, firstly, due to its inherent characteristics of being subject to origin-growth-decay-end; secondly, due to not understanding the real nature of world and its constituent entities; and thirdly, because of the inherent characteristic of a human being to constantly devise and develop a means to quench his insatiable desires. All these factors constitute a contemptible state, to be endured with difficulty (*Paramatthadīpanī Saṅgahamahāṭīkāpāṭha*. 1.32, VRI.42).

Extraordinary Features of Buddhist principles (*dhamma*) being *akāliko* (timeless), *sandiṭṭhiko* (empirical), *ehi-passiko* (verifiable), and *viññūhi* (known by the wise) may be adopted as a standard parameter to testify or evaluate any subject or event or plan, made with the perspective of welfare of all (*Dīghanikāya*.2.3.159, VRI. 2.73). Buddhist *Suttas* deal with the various aspects of world such as science, philosophy, medicine, education, and etc. besides offering answers to the problems in the past and even at present. It, indeed, offers us the correct way to live in harmony and happy state while throwing light on social, political, cultural, physical, and biological, and etc. aspects of man. Therefore, in this backdrop, it appears appropriate to evaluate and analyse the efficacy or projected benefits and possible challenges of the FIR.

Now, let us understand both perspectives as to 'how', they initiate for the attainment of same goal i.e. the welfare and happiness of man, but, there is a big line of difference in opting the respective path to realise the goal. Both (the FIR and Buddhism) are the domain of teaching which provide us the knowledge of understanding the working of things in great detail, and thereby man develops the perspective of seeing the world. The New Revolution (FIR) educates us about the world of lucrative material products, made up of composite things whereas the world of Buddhism enlightens us that composite things are impermanent i.e., "*Sabbe saṅkhārā aniccā*" (*Dhammapada* 20. 277, VRI.48), and this as per *Dhammapada-atṭhakathā* (20.277, VRI. 2.233) refers to constant change. This connotes that all composite things, existing in this cosmos, have the characteristic of rise and fall - "*Aniccā vata saṅkhārā, uppādavayadhammino*" (*Dīgha Nikāya*. 2.3.221, VRI.

2.117) and, thus, they pass through the process of ‘origin, growth, decay, and end’ (*Ṭikā-Co-Pāli/Abhidhammatthasaṅgaho* 6.15, VRI. 42). This stipulates that “a thing is replaced immediately with its origin by other almost similar or better thing. This should be understood like the renewal of older cell by new cell or turning of flower into fruit (i.e. the biological phenomena). Similarly, old material products are continually replaced by new material things, and thus do not provide everlasting happiness. However, if such replacement is conducive for the welfare and happiness of man, it is good; otherwise it is bad, similar to the excessive or un-routine growth of cells, which are detrimental to health. Evidently, the Buddhist concept of ‘Impermanence’ clearly shows that a thing, which goes through the process of ‘origination, growth, decay, and end’ is neither permanent nor blissful forever, as it, owing to be made up of component parts, exists only up to the presence of the conditioning of its composition. Thus, from Buddhist point of view, those things, which are impermanent and insubstantial in nature yield suffering either because of their inherent characteristics of destruction or because of causing undesirable effects.

In this background, it is but natural to question as to whether the products of FIR, due to being composite products are able to take the man out of the web of suffering or mitigate man’s suffering, or what could be done to maximize the benefit of it, and minimize the side-effects of its implementation. To find out the answer let’s evaluate and analyze the projection and challenges of the FIR with the perspective of fundamental principles of Buddhism. Buddhism, as we know, prescribes ‘Four Noble Truths (*Cattāri Ariya Saccāni*)’ as standard parameter to discern the existential problem ‘suffering’ and the ‘cessation of suffering’- (*Majjhimanikāya*. 1. 3.2.246, VRI. 1.194). Remarkable to note, out of Four Noble Truths, the first two exposit on problem (*dukkha*) and its cause (*dukkhasamudaya*); and the last two enumerates the state of no suffering (*dukkhanirodha*) and the path leading to the cessation of suffering (*dukkhanirodhagāminī paṭipadā*), also known as ‘Noble Eightfold Path (*ariya aṭṭhaṅgikamagga*)’ (*Mahāvagga* 1.6.14, VRI. 13).

In the light of the first two Noble Truths, the aspects of the Fourth Industrial Revolution could be illustrated as the followings:

Buddhism: Noble Truths	Truths of Fourth Industrialization	Functioning of FIR	Outcome of FIR
1. Truth of Suffering	Change of World in the sense that H.I is likely to be replaced with A.I.	Natural Phenom- enal living to Artificial Living	Suffering
2. Truth of Cause of Suffering	Desire to make World of Composites	Subject to Ori- gin-growth-de- cay-end, will increase further	Realiza- tion of the cause of Suffering

7.1. Truth of Suffering

The First Noble Truth, the Truth of Suffering in postulates the universality of suffering (problem), which we bear with difficulty, and manifests in one’s life in many forms such as birth, decay, disease, death, attachment of undesirable, detachment with desirable, not-getting what we want (Mahāvagga 1.6.14, VRI. 13). In all Buddhism places the suffering under seven categories. On comparing these categories to the projected challenges with the flare of new revolution (i.e. Fourth Industrial Revolution) one may clearly perceive despite its benefits numerous side effects (challenges), which could be tabulated as under:

Comparative analysis of the various aspects of FIR in the light of the 1st Noble Truth

Categories of Suffering	FIR Categories of Suffering
1. Birth	Birth of (possessing) new technology
2. Disease	Disease because of addiction or breaking down of technology
3. Decay/ old Age	Decay due to gradual deterioration of technology
4. Death	Death because of replacement or expiry
5. Association with undesir- able	Forced to adopt the new technology despite unwillingness to replace the old technology

6. Separation from the desirable	Replacement of Human Intelligence by Artificial Intelligence, leading to detachment from empathy, man to man relation
7. Not getting what we want	Not getting what we want

The aforesaid analysis clearly portrays the picture of problems or suffering, we would be facing with the incoming flare of Fourth Industrialization. This does not imply that the effort and product of FIR should be overlooked or ignored, as its implementation has undoubtedly benefited the masses in certain sectors to a great extent. Since the world is, as evident from Buddhist Scriptures, is composite of mind and matter (man and matter), the growth of matter only may lead to the cosmic imbalance. This implies that stagnation at any of the extremes of total materialism or no materialism (nihilism) would not lead to the growth of man or regulate cosmic cycle. Henceforth, one may say that the FIR with its flare will bring numerous pleasure (benefits for some) and problems (sufferings for some) for the masses.

Interestingly, the riddle still remains unanswered with regards to the implementation of FIR. The answer lies in the riddle itself. The problem does not lie behind the implementation of FIR rather with the changes that may occur in existing norms of living. Note, any kind of revolution or change would certainly leave its pros and cons both favouring one over another leading to division of society into the groups of beneficiaries who will be happy on account of fulfilment of their desires and ease of work. In other words, there will be the 'Happy' group of people, mostly benefited of (A.I) FIR and other against the race for bringing (A.I) FIR i.e. the sufferers those who are either not benefited much or be at total loss. This group will obviously have much grief and pain. As a result of this the chances of division in society would be quite legible in kind of 'haves and have not', which may possibly draw the invisible dark line in the society and would certainly sow the seeds of superiority and inferiority leading to disparity, social conflicts, and etc. not only digging the deep pool of suffering for sufferers, but also dragging in the 'Happy' people as well. 'Happy' people are the future potential sufferers, due

to impermanent nature of things and hence, are subject to suffering. This implies that Problem (suffering) lies at both the ends one with the beneficiaries: who want to please enjoy the comforts of sensual indulgence and other who are the victim of self-destruction (mortification). These two groups may be understood in the light of Buddhist concepts of two extremes. Attachment to any of these extremes [indulgence in sensual pleasures (*kāmasukhallikānuyogo*) and indulgence in self-mortification (*attakilamathānuyogo*)] yields suffering, as the Buddha enunciated in his very first sermon 'Dhammacakkapavattana' (*Mahākkhandhaka*, *Mahāvagga*, *Vinaya Piṭka*.1.6.13, VRI.13).

7.2. Truth of Cause of Problem (Suffering)

As evident from the Buddhist scriptures that root cause of Suffering is attachment. In other words, it may be said that 'attachment underlies the desire to hold on with something'. In this respect the Second Noble Truth clearly outlines that the root cause of suffering is craving (*taṇhā/trṣṇā*) that leads to recurrent existence, accompanied by pleasure and lust, finding its delight here and there (*Majjhima Nikāya*.1.8.91, VRI. 1.61). It is of three types, namely, desire to enjoy sensual pleasure (*kāma-taṇhā*), desire for continuity in existence (*bhava-taṇhā*) to enjoy sensual objects, and to earn the fame and prosperity (*vibhava-taṇhā*). *Vibhava-taṇhā* also refers to the desire to annihilate self or other that comes in ones way to hinder the enjoyment of worldly pleasures. Basically all the three types of craving are more or less associated with the enjoyment of sensual pleasure. Man always craves for gratifying his sensual pleasure at any cost. Consequently, he indulges in various kinds of moral and immoral activities, which yield results accordingly. That is, on account of performing good action, one yield good result and enjoys happiness while the doer of immoral action yields bad resultant and hence suffers. Even the state of happiness, being impermanent in nature causes suffering, and, thus, we remain unsatisfied. In fact craving is insatiable, as the sensual objects, being variegated, sweet and pleasant disturb the mind in diverse forms (*Suttanipāta*. 1.3.50, VRI. 93). Just as a monkey jumps from one branch of tree to other, the man also craves for enjoying the new objects. In a sense, his desire always renewed itself. Consequently,

there is no end of suffering or existential problem. Hence, the Buddha says, “From craving springs grief, from craving springs fear” (*Dhammapada*. 16. 216, VRI. 40).

When we analyse the projected benefits and challenges of the New Revolution, it would not be out of context to say that the FIR itself is the product of human desires, which by its nature always perforce man to devise new means to satisfy his cravings. None can deny that the FIR is improvisation over the outcome of Third Industrial Revolution. This, in itself, testifies the fact that one desire is replaced by other desire. So it can be said that even the benefits, apart from its challenges, would in long run create problem on account of being composite and impermanent. The basic problem, which would emerge with the flare of FIR is that the beneficiaries will crave more and more comforts to all best possible extent, and, get indirectly attached much to the comforts, they would acquire from its products. The FIR would also deprive a large number of people from their existing jobs, or would perforce them to seek new means of livelihood. This would create an unbearable condition for the adversely affected persons (sufferers) who would hardly like to support the FIR. Notable that the people, due to delusion, entangles in the grip of greed that leads to the development of hatred, if hindered by someone from possessing other’s thing, the one is looking for. This attitude drives a person to indulge in the immoral deeds like killing, stealing, sexual-misconduct, lying, and taking intoxicants, which ultimately result in social discord, mental unrest, depression, crimes, violence etc.

In this background the possible negative impact of the FIR could be illustrated as under:

FIR THREE SPHERES	POSSIBLE NEGATIVE IMPACTS (Suffering/ Pain/Problems)	LONG-TERM NEGATIVE IM- PACT (Boon will become Bane)
<p>Causes (Effect of Implementation of FIR)-----Effect of (FIR's three spheres) that in turn becomes the cause for negative effects-----Effect of negative impacts of implanting of FIR results in the activation of immoral actions through pursuance of Immoral deeds to grab its products at any cost.</p>		
Physical	Loss of Jobs (repression, depression, increase in other mental illness), inequality (due to low wages to low skill or no jobs, and high wages to high skill), prone to physical, disparity among people, and threatening of life, and expensive and/or no social life, etc.	<p>Activation of Three Immoral Roots at great speed i.e. Greed, Hatred, and Delusion.</p> <p>This will continue to dig the hole of great evil and create disharmony in life and eventually burn everything into ashes.</p>
Digital	Prone to cyber attack, end of privacy, hacking frauds, misuse of technology-stealing through drones, fear of trust, and etc.	
Biological	Take over the place of Doctors, without specific human qualities – empathy, sympathy, help and understanding, wrong treatments - one disease may have various symptoms corresponding other disease or dysfunctional organs or due reactionary bodies, and etc.	

7.3. Truth of Cessation of Problem (Suffering)

After identifying the root cause of suffering, the Third Noble Truth enjoins to get rid of that cause. It clearly states that the complete detachment or abandonment of or doing away from (this) cause ends the suffering. The *Majjhima Nikāya* states that “*Yo tassāyeva taṇhāya asesavirāgaṇirodhā cāgo paṭinissago mutti anālayo – ayaṃ vuccatāvuso dukkhaṇirodho*” (1.8.9.135, VRI.1.90). And that is there is no grief and fear for him who is wholly free from craving. Does this mean that we should not desire to make effort for the improvement of the existing state of technology to ensure the welfare and happiness of man? Of course, we should proceed with this, if we wish to lead a mundane life or remain in this world. It is evident from the history of human civilization that it is the desire of man to lead a better life brought him gradually in the present state of FIR from his past pastoral and agricultural existence. Obviously, the FIR would greatly affect the mankind, as Klaus Schwab says. What is needed in such scenario is to take lesson from our past heritage, and adopt and blend it with the FIR. In order to this we may take cue from certain principles of Buddhism. By adopting these principles, particularly the Noble Eightfold Path along with FIR, we may create a happy blend of the two, which would certainly help in minimizing the projected negative challenges of the FIR.

8. TRUTH OF PATH LEADING TOWARDS THE CESSATION OF PROBLEM (SUFFERING)

As per the instruction of Buddha, we should follow the middle path (*majjhima paṭipadā*) to avoid the two extremes of self-indulgence and self-annihilation in order to detangle oneself from the web of suffering or to avoid suffering from both ends of beneficiaries and sufferers. This implies that the possible solution with regard to the problem relating to the implementation of FIR is to walk on the middle path i.e. applying Buddhist principles and practice with the process of FIR, as stated above, to create a ‘Happy Blend’ of both and thereby, mitigate the possibility of ‘Suffering’. Since the present era is being dominated by the science and technology and much importance is not attached to the religious outlook with regard to the betterment of human life, it enjoins upon FIR to take care

of those religious principles, as enshrined in Buddhism, which ensure the welfare and happiness of human beings. That is to say that FIR will have to take care of the possible sufferer groups that would come into existence on account of implementation of FIR. Apparently the FIR may take care of suffering humanity as MNCs do while opening its plants promotes local industries/ companies and thus would help the less skilled worker or non-skilled worker in earning their livelihood, though such help does not bridge the possible economic and social gaps. However, its blend may act as an effective system to bridge all the cosmic gaps.

Happy Blend

Noble Truths	Truths of Fourth Industrialization	Functioning of FIR	Outcome of FIR	Applicable Buddhist principles
3. Truth of Cessation of Suffering	Delineate the Suffering	Practicing Buddhist Principles	Happiness	Elimination of Desire the root cause of Suffering
4. Truth of path leading towards the Cessation of Suffering	Path leading to Blend of Buddhism with FIR	Learning the ways to make a blend while practicing Buddhist principles	Happiness	Path leading towards the Cessation of Suffering

The Middle Path, also known as Noble Eightfold path consists of eight factors, namely; right view, right resolve, right speech, right action, right livelihood, right effort, right mindfulness, and right concentration (*Dīgha Nikāya*. 6.375, VRI. 1.139; *Majjhima Nikāya*.1.1.10.135, VRI.1.90) enables a man to live happily and peacefully; though, its idealistic approach is to end the repeated existence. These factors work as directive principles or act as the

lever of social equilibrium in maintaining the balance of life while avoiding the two extremes of suffering – indulgence in sense-pleasure and self-mortification. The eight factors of Middle Path from the standpoint of FIR could be discussed as under for the better understanding of the efficacy of their functioning.

Right View (*Sammā Ditṭhi*) refers to the knowledge of Four Noble Truths, suffering, the cause of suffering, the cessation of suffering and the path leading to the cessation of suffering (*Majjima Nikāya.1.1.10. 135, VRI. 1.90*). It focuses on the practice to develop the right perspective/vision to understand the real nature of all component things i.e. impermanent, suffering, and insubstantiality. With regard to FIR, it applies to understand the right perspective of ‘need’, of its implementation in the areas where man’s life is subject to suffering or is having least potential of benefiting many. This view also entails that understanding the problem, its cause and possible cessation one should follow the path that leads to the minimization or end of human suffering.

Right Resolve (*Sammā Saṅkappa*): With the right perspective, it enjoins one to resolve to renunciation, goodwill and non-violence (*Majjima Nikāya.1.1.10.135, VRI. 1.90*) In other words, it refers to the right thought of abandoning objects of sensual pleasure, harming other, and violence. The implied meaning of this is that one should not indulge in those activities which are harmful, rather should develop the tendency to be compassionate to others. Buddhism perceives sensual pleasure as full of vices. So the FIR should act in a way that does not promote materialistic culture and produce harmful things.

Right Speech (*Sammā Vācā*): It refers to discard the practice of all sorts of falsehood (*Majjima Nikāya.1.1.10.135, VRI. 1.90*). It implies that fake projection of the benefits of the products or implementation of FIR should not be made. The FIR should focus to work on those aspects which could mitigate the impact of suffering, likely to happen on account of full implementation of FIR.

Right Action (*Sammā Kammanta*): It speaks of refraining from performing the immoral physical deeds - killing, stealing, and sexual misconduct (*Majjima Nikāya.1.1.10.135, VRI. 1.90*). This entails

that the FIR should produce such products or be implemented in such a way that it does not promote the killing (of old companies on account of sophisticated instruments and technologies), stealing (hacking, fraudulent appropriation of wealth from banks etc.), and sexual misconduct (by producing human-type instrument (such as sex-toys, robots etc.) to be used for sex.

Right Livelihood (*Sammā Ājīva*): The right livelihood enjoins to earn livelihood through wholesome means and fare dealing. One should not earn livelihood by means of trade in weapons, intoxicants, slaughtering animals, and human trafficking (*Majjima Nikāya*.1.1.10.135, VRI. 1.90). So the implied suggestion of it for FIR is that it should offer such sorts of, employment or means of job that would not promote activities, which are hazardous to the welfare of human beings. For example, A.I, one of the essential ingredients of FIR may be used to put our lives in danger i.e., in deploying weapons, stealing from banks etc. through hacking etc., transgressing others privacy, killing others, and etc. In other words, it should not be used in promoting harmful professions (like the strictly prohibited aforesaid five professions).

Right Effort (*Sammā Vāyāma*): It enjoins to endeavour for the non-origination of unwholesome thought that has not arisen, the abandonment of the unwholesome thought that has arisen, the growth of arisen wholesome thought, and the origination of wholesome thought that has not arisen as yet (*Majjima Nikāya*.1.1.10.135, VRI. 1.90). It implicitly recommends man to apply his mind and efforts towards the realization of good, and to consider the outcome of the correspondingly bad idea if allowed to develop into action. That means all our efforts should be oriented towards developing the thought, aimed at solving the problems faced by man. Similarly, the endeavour of FIR should be directed to expand its benefits for the well-being of humanity and discarding or demoting the factors affecting the life negatively. The passions, related to FIR must be overcome; sinful thought should be suppressed; existing goodness should be stimulated and augmented; and goodness not yet manifested must be produced.

Right Awareness (*Sammā Sati*): It refers to man's constant mindfulness or attentiveness in respect of the various activities of

body (*kāya*), feeling (*vedanā*), mind (*citta*) and mental states i.e. *dhamma* (MN.1.1.10.135, VRI. 1.90). One should always be attentive to get rid of grief, greed, lust etc. This attentiveness is similar to the watchfulness of a doorkeeper who maintains constant vigil over the gate and does not allow any unwanted person to enter the house. Likewise, the FIR's implementation should be made with proper attentiveness in order to promote the good (bliss) and discarding the factors converting FIR to be bane from boon so that its negative impact or misuse could be avoided. This will help in promoting compassionate and harmonious attitude of man and would act as great tool to resolve the problems if occur or has occurred.

Right Concentration (*Sammā samādhi*): It refers to the one-pointedness of wholesome mind i.e. "*Kusalacitttekaggatā samādhi*" (*Visuddhimagga*. 3.38, VRI. 1.83). This state of mind is attained by developing the factors (of *jhāna* i.e., absorption) of reasoning (*vitakka*), reflection (*vicāra*), joy (*pīti*), happiness (*sukha*) and one-pointedness (*ekaggatā*) that cast away the desire of sensual pleasure (*kāma-chanda*), ill will (*vyāpāda*), sloth and torpor (*thina-middha*), flurry and worry (*uddhacca-kukkucca*), and perplexity (*vicikicchā*), the five obstacles hindering the path to attain wisdom. The mind, having shunned all evil thoughts and desires, ceases to be distracted and becomes tranquil; evil thoughts are replaced by a love of truth and righteousness. In fact, a concentrated attitude is required to do the good. So, while implementing the FIR concentration must be towards the execution of work that ensures the welfare of human beings in all respect, not intended to towards the attainment of one's vested interest. One should develop the practice of self-introspection i.e. focusing and delineating the factors that leads to the development of selfish attitude of mind.

It is notable that the Buddha prescribed this path 2600 years ago to get rid of suffering and realise the state of no suffering. The proper practice of it enables one uproot not only the individual suffering but also helpful in establishing peace in the world. As apparent from the above mentioned description of the Middle path, it entails that one should develop right understanding towards the FIR, while realizing its inherent characteristics of blurring the lines between Physical, Digital, and Biological spheres. The understanding of Four

Noble Truth is essential, as without its understanding one would not be able to grasp the idea of suffering, an individual as well as world faces. If there is suffering, it does not happen without any cause. Hence, once the reason of suffering is known, its eradication is possible, and its eradication is possible by following the aforesaid path, as prescribed by the Buddha. This reflects that projected challenges of the FIR or the Global Risks, attached to it could be resolved or minimized to great extent if we implement it by blending with aforesaid Buddhist principles, and ensuring its application only in those areas where human intelligence i.e., human-mind is either ineffective or does not carry the potential to complete the task or the working over particular field is hazardous to human health. Such implementation of FIR would for sure mitigate the ratio of suffering.

However, this requires the collective effort of every human being and the initiative should be taken by leading authorities like government, policymakers, academicians, civil workers, citizens, employees, investors and etc. to shape 'Happy Blend' of the FIR and Buddhist principles, and to ensure its execution. This will also help to deepen the relation of our self, with others and our surroundings especially in the areas of equality, employment, privacy, and trust, which are the major concerns of this revolution. To conclude, the FIR is full of positive and negative potentials, however, its utility could be harnessed in a better way by adopting a method consists of scientific as well as humanistic outlook as enshrined in the solemn teachings of the Buddha, the founder of Buddhism, renowned in the world for its vitality of creating peaceful and harmonious environment for all, particularly human existence.

Lastly, if we do not make the FIR blend with Buddhist AIM, then FIR would fail to fulfil its AIM and would play the wrong Game.

In order to win the game we should not forget to learn from past revolutions whose victims belonging to the categories of sufferers still exist in the various part of the world. "Even the authors shaping the FIR point out, at least 600 million people live on smallholder farms without access to any mechanization, living lives largely untouched by the first industrial revolution. Around one-third of the world's population (2.4 billion) lack clean drinking water and safe sanitation,

around one-sixth (1.2 billion) have no electricity—both systems developed in the second industrial revolution. And while digital revolution means that more than 3 billion people now have access to internet, that still leaves more than 4 billion out of core aspect of the third industrial revolution” (Salesforce 2000-2019).

Having all said we may conclude that the Era of Fourth Industrialization with its working style and great prospects will fulfil the very need and the very objective of its birth and carries the power to change the world with positive wave for the welfare of all keeping in mind/consideration that the ‘grass is always green at other side’ this implies that this positive revolution may turn out to be negative. And as an outcome of its birth it would necessarily face the challenges with the new prospects it adds. “We build what we value. This reminds that we need to remember our values as we’re building with these new technologies. For example, if we value money over family time, we can build technologies that help us make money at the expense of family time. In turn, these technologies can create incentives that make it harder to change that underlying value. At present and in coming time people will establish a deep relationship with technologies. That is how we are intending to create our world, and we have to develop them with care. More than ever, it’s important that we begin right. ***We have to win this race between the growing power of the technology, and the growing wisdom with which we manage it. We don’t want to learn from mistakes.*** —Max Tegmark, *Life 3.0*” (Salesforce 2000-2019).

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BUDDHISM AND THE FOURTH INDUSTRIAL REVOLUTION

by Rev. William Beaumont Edwards*

What is the Fourth Industrial Revolution? Who says that such a thing even exists? And if it does exist; what factors, if any; indicate that we are already in it. So, before I launch into a discussion of the effect of artificial intelligence in the Fourth Industrial Revolution, some background is in order concerning how each industrial revolution caused massive shifts in the dynamics of human civilization.

I think we can all agree that the resiliency of Buddhism, unlike many of the world religious traditions, has had the ability to obligingly adapt and easily survive any change in those dynamics with which it is presented. An example of what I mean by that is a comment by the Dalai when an interviewer asked him, “What would Buddhists do if something in science proved something in the Buddhist texts to be incorrect?” The Dalai Lama simply said, “We would go with the science.”

We would go with the science: The Buddha said that the first of the five signs of a fool is someone who believes in the infallibility of a religious text (Panca Ligani Jayde: *Vedapramanayam Kasyacit,kartivadah, snana dharmeccha jativadavalepah, sanatapraambhah papahanaya ceti, dhavasttaprainam nam panca ligani jadye.* Vedas was the term he used, but it applies to any religious text; that includes our religious texts. Remember? The Buddha said not to accept His teachings until you have first hammered them out on the anvil of reason.) I realize

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this particular concept is rather controversial. And it may seem that bringing this up is out of the context of the topic at hand. But I maintain its importance, and include it, because I want to emphasize the fact that Buddhism is not based on faith, it's based on reason. Faith, or confidence, (Saddha) in Buddhism comes later. Faith based on reason is shatterproof. The ability to approach this new era of the Fourth Industrial Revolution with logic, reason and understanding is of paramount importance. And, simply because it is rooted in reason, the Buddhist religious tradition can provide that.

A further example of this uniqueness is that Buddhism indicates that sentient beings exist not only on planet earth, but 'permeates the entire universe,' a claim which is, tragically, rejected by many other major world religions. Once again, this uniqueness pertains to Buddhism's natural preparedness to accept the Fourth Industrial Revolution's civilization changing dynamics, which will in the very near future, bring us in contact with other civilizations in the cosmos due to the human technological advances such as the quantum computer's ability to plow through billions of bits of data entry supplied by "smart" telescopes. So, if this is to be the case, what is to be the response and responsibility of the world's Buddhist community?

A notable grandparent of all four industrial revolutions is the ancient trade between our early nation states, in particular the silk trade. The silk trade was an industry, which originated with the Han Dynasty in 207 BCE, about 280 years after the passing of the Buddha. By 114 BCE, the trade routes of this early industry extended from China into Korea, India, Japan, South East Asia, Africa and Europe. Different cultural and religious ideas were exchanged as silk merchants moved their wares from nation to nation. Prior to that time, most religious traditions were of local character. Therefore Buddhism, being a religion of Asian origin, was extended out of its locale due to these merchants move westward, even as far as Europe.

In any event, the first, supposed, industrial revolution years were characterized by the creation of more intricate mechanical devices and power generated by water and steam. And, in this era, the burning of coal, the soon-to-be, first, extensively used fossil fuel, began to replace wood, as a more efficient energy source.

Just prior to the First Industrial Revolution, early water turbines, known as water wheels, were built near fast flowing streams or waterfalls. Their drawback was their dependency on this fast flowing water source. But, by the time of the First Industrial Revolution, individuals like John Smeaton and Benoit Fourneyron addressed this problem with more modernistic and efficient water turbines. These water mills finally fell into disuse in favor of coal fired energy. However, in the 20th century, large water turbines like those in the Aswan Dam and the Hoover Dam began to be used to generate gigantic amounts of energy to power not only towns and cities, but entire countries. (Incidentally, water power, in the form of tidal forces, is being used again as an alternative to the burning of fossil fuels.)

I don't want to give the impression that the First Industrial Revolution was the first time coal was used as an energy source. Coal has a fascinating history. The Roman Empire, albeit to a lesser extent, used coal as a fuel in the 2nd Century ACE. The British began mining coal in the 18th Century. This practice soon spread to Asia and the Americas as well as the rest of Europe. By the 19th Century underground coal mining operations came into being, and the many common people were employed by this new industry; but not without serious occupational dangers and health risks. The coal moguls oppressed their workers (some of whom were children) with unbearable hours of hazardous work for less than adequate wages, as they, themselves, became astonishingly wealthy. These coal moguls created credit based "company stores" which provided the coal workers, or coal miners, with goods and services, but at a substantial cost; so that the credit could never be paid off; thus forcing the miners and their families into an economic slavery. The rise of labor unions began to reverse the tide of virtual slave labor in these coal mines; but not without the loss of the lives of many mining-labor leaders, who became targets of the coal moguls who refused to provide their workers with a livable wage and safer working conditions.

The years of the Second Industrial Revolution were characterized by scientific innovations, mass production through Henry Ford's concept of the assembly line, and the expanding use of electricity. Also, a large part of this second industrial revolution was the

introduction of gasoline – a volatile, unstable fossil fuel – used mainly for fueling automobiles. The telegraph, the first source of mass communication, came into being. And railroads, the first truly viable source of mass transportation, were developed. In December of 1903, Orville and Wilbur Wright created the first gasoline-powered aircraft, which would in the future become an enormous source of mass transportation as well.

Also in the later part of this second industrial revolution, a new and frightening power source was discovered, “nuclear energy.” Unfortunately, its first use was in the form of a devastating weapon which was dropped on the Japanese cities of Hiroshima and Nagasaki. Although this form of energy was considered to be clean and efficient, one mistake and this efficiency and cleanliness are gone, e.g. Chernobyl, Fukushima and Three Mile Island.

Thus the Third Industrial Revolution (often referred to as the ‘Nuclear Age’) was characterized by the creation of nuclear power plants, with the continuing promise of newer more efficient nuclear power plants on the horizon. In spite of that promise, the inherent dangers still exist. Hopefully, we will soon see the introduction of cold fusion power plants to replace the fission power plants, an enormously less dangerous energy alternative. In addition to the fission and cold fusion power plants; solar, wind, geothermal and tidal force energy sources offer safer seemingly endless sources of energy, as opposed the recognized risks in fossil and nuclear fuel sources.

With the creation of computers and automation, the third and fourth industrial revolutions seem to overlap. (Indeed, the first seems to overlap with the second; the second seems to overlap with the third.) So at this point I’ll jump ahead and discuss the Fourth Industrial Revolution – keeping in mind it overlaps somewhat with the Third.

The late Ven. Dr. K. Sri Dhammananda wrote a chapter in his book, What Buddhists Believe called, “You are Responsible.” The Buddhist Educational Foundation deemed the message in that chapter so significant that they printed that chapter into a small booklet and distributed it as such. So, you are responsible, I am responsible, we are responsible, humanity is responsible; not a god or a goddess who lives in the clouds above us. If we are

irresponsible with this amazing, but volatile, new frontier, we will destroy ourselves. So this responsibility is imperative as we embark into this new adventure called the Fourth Industrial Revolution, which is, for the most part, characterized by “artificial intelligence.”

In a book, appropriately named, The Fourth Industrial Revolution, Claus Schwab characterizes this fourth industrial revolution as *cyber physical systems and; smart factories, the factories of the future*. Therefore, the Fourth Industrial Revolution is exemplified by the rise of artificial intelligence. This fourth industrial revolution, although fascinating, presents a moral dilemma for the world Buddhist community due to this rise of this artificial intelligence.

The wonders of the 3D printer’s ability to replicate virtually anything one could put into it has the potential to fundamentally change the very foundations of human civilization. Indeed, the 3D printer’s ability to replicate food from waste products has the potential to make starvation, the scourge of centuries, virtually non-existent. According to an article in the February 21, 2018, issue of USA Today, if; in the near future; someone is in need of a heart transplant, a process called “bio-printing” can be used to 3D print the patient a new heart. The blood cells of the patient are fed into the printer and then, using the measurements from an MRI of the patient’s heart, the new heart is replicated by the 3D printer.

However, as with all great scientific industrial advances, its hazards walk hand in hand with its miracles. So I’m going to coin a term: “ASB;” which stands for “Artificial Sentient Beings.” Scientists have even been able to 3D print models of the human brain. In fact, instructions can be found on the internet on how to 3D print a model of your own brain. Which begs the question: If a 3D printer can make edible food, and a new useable heart, how long will it be before a useable human brain can be printed; assuming that it hasn’t already been done? A team of neuroscientists at the University of Wollongong in Australia are developing brain cell tissue to combat degenerative brain conditions.

Apparently, one of the challenges of developing an artificial human brain is being able to mimic the electro-chemical processes of an organic brain. But in an article by Bridget O’neal, in 3Dprint.

com, the use of nanotechnology with electricity could solve that hurdle. However, the organics of a human brain are a slower form of electricity than electricity in general. It would appear that if such a brain could be created, it would function more quickly than our organic human brains, probably at the speed of light.

If the ability to create a useable human brain can be 3D printed; wouldn't it follow that the ability to 3D print a human body in which to put the brain could also be created? This 'Frankenstein narrative' appears to no longer be science fiction, but soon to be science fact. How will we, as Buddhists, handle it? The implications for us are stark. The end of the Metta Sutta reads: *As a mother would risk her own life to protect her only child, even so for all living beings one should cultivate a boundless heart ...* This passage from the Metta Sutta would seem to suggest that any intelligent being, artificial or not, should be respected as an equal.

Therefore, would it not follow that if a human ASB is created and contains the five aggregates of 'form, feeling, perception, mental formations and consciousness' wouldn't it, also, be deserving of the same veneration which we would afford to a human being of organic origin? Interesting questions begin to arise: Will this ASB have the same potential to attain nirvana (nibbana) as an individual of organic origin? If, in fact, it follows the organic human schematic, would it not have a sense of self and the power of conceptual thought as we do? Could it laugh and weep as we do? Could it enjoy and create music and art as we do? These are questions society should ask itself before we go much further with this technology. We may be stepping into a realm where we, organically originated human beings, will, for lack of a better term, have become creator gods. The implications are astounding.

Consider the next generation of electronic automobiles, which is now in development within this fourth industrial revolution. The fear of anthropomorphic climate change, due to the burning of fossil fuels, sparked the search for other sources of energy with which to drive our vehicles, heat our homes, etc. With the dawn of this innovation came automobile computer technologies, which are developing to the point that cars are becoming self-driving. Soon people won't be driving the cars at all; the artificial intelligence of

the vehicles will do the driving and the people will just sit there. How intelligent should our cars become? We can already talk to our cars; that is, ask the dashboard for directions to our destination and the dashboard will answer back. Will a person one day get into an argument with his or her artificially intelligent dashboard making the car get angry, so that it pulls over to the side of the road, in a temper tantrum, and refuses to move? Although a humorous thought, it's also a worrisome possibility.

If intelligent automation – in Clause Schwabs, *smart factories* – takes over that which we call “work,” we, humans, could possibly see working become a thing of the past. If artificial intelligence, or the ASBs, eventually dominates all the workplace environments, what would we have to do? It would seem that we would have a lot more idle time on our hands. Would our next occupations become categorized by activities like perpetual education and exploration?

Enter the moral issue: Will the ASB humans become slaves to the organic humans? If that turns out to be the case, will the ASB's revolt, as the coal miners did with the coal moguls? Slavery has a vicious stain in our human history. In some areas of the planet the scourge of slavery still exists. The subjugation of another intelligent being, be it an ASB or otherwise would be an ethical issue.

On the other hand, will the ASB's with their quicker, more efficient electronic brains, than our slower organic brains, begin to see us, organic human, as a nuisance and decide to get rid of us, causing a war between the ASB's and the organics? It brings to mind the Terminator movies, in which, Dr. Miles Dyson who invents a military satellite with artificial intelligence called “Skynet,” turns on humanity, and creates its own ASB's; called terminators; which it sends out to destroy the organic humans. This is science fiction, of course. But, once again, science fiction often becomes science fact; as in the writings of Jules Verne and H. G. Wells.

There have been warnings about this particular technology by scientists such as the late Dr. Steven Hawking who has said in an interview with the BBC that efforts to create thinking machines poses a threat to our very existence; he said, “The development of artificial intelligence could spell the end of the human race.” He

urged those developing this technology to proceed with a great deal of caution.

Is the only other alternative to not allow the further development of artificial intelligence technology? We all know that won't happen. If there is a way to do something, the inherent nature of human beings is to do it. So this technology is coming whether we like it or not; it's unstoppable. So we will have to learn to live in peace and harmony with the soon to exit ASB's.

Along with that caution of which Stephen Hawking spoke, it may be wise to instill in artificial intelligence a sense of love, empathy and generosity; human emotions. On the other hand, the human emotions such as anger, hatred and jealousy are emotions which creators of ASBs should avoid; but is that even possible? Since positive and negative emotions are triggered by their polar opposites would it be prudent to avoid, if possible, introducing emotions into ASBs? In addition to that, consider that most of our scientific advances have come about through military needs in wartime, as with nuclear weapons. Would a rogue nation attempt to create legions of emotionless killer ASB soldiers?

This is an area where, in contrast to the doctrines of other world religions, Buddhism and Buddhists can be the stalwart moral leaders of the direction taken by the intricacies of this Fourth Industrial Revolution. We can put forth a doctrine of equal rights for the artificial sentient beings. And we, as Buddhists, would be well advised to begin the effective advocacy for such a task.

That, of course, begets the obvious question, "how?"

Let's start by considering this issue with regard to the Three Marks of Existence and the Mahayana concept of the Four Dharma Seals. The Three Marks of existence are defined as suffering, impermanence, and not-self. The Four Dharma seals are defined as suffering, impermanence, not-self and nirvana. (I should point out that another Mahayana term "Three Dharma Seals" is synonymous with the Three Marks of Existence.)

Suffering, or dukkha, is a universal experience. Any creature that possesses a body, feelings, memories, thoughts and consciousness

experiences dukkha, whether it's a small experience like stubbing your toe or a large experience like the loss of a loved-one or a serious life illness or accident. I don't want to side-track and bore you with a remedial discussion about dukkha; but, for the sake of clarity in this discussion, it should be remembered that dukkha – suffering, unsatisfactory conditions, unfulfilled wishes, and insecure feelings – is a universal experience. And it will be experienced by the ASBs. So the scientists who are engineering the creation of the ASBs would be well advised to take dukkha into consideration while doing so. And be sure to install in the ASBs the psychological tools with which to deal with it.

Impermanence is another issue which tends to plague the human experience; nothing remains the same; everything is in a state of flux, everything. As we age and lose our youth, we experience the dukkha within this loss; we become unable to perform the tasks which we were able to perform with ease when we were younger. And we begin to visualize the coming of our own demise, death.

How will the ASBs deal with impermanence? Obviously their physical forms, their bodies, will be more durable than our organic ones. They could be in existence for a thousand years or longer; depending upon their karmic actions. Would they fear damage to their bodies, or short circuits in their electronic brains, leading to their demise? Would impermanence inflict pain as they experience the emotional loss of a loved-one. And, if the loss of a loved one is caused by a malicious organic individual, would the ASB seek revenge? Care should be taken to establish in the ASBs an ability to deal with the psychological implications of impermanence.

Not-self, the last mark of existence is, according to Venerable Nyanatiloka, the central doctrine of Buddhism on which the entire structure of Buddhist teachings stands or falls. Will the ASBs have this concern, and if they don't, should they? A self, as such, is an illusion. We organic humans are colonies of cells all working together for survival. The early life on our planet was comprised of simple one celled organisms. But these organisms began to work together for each other's benefit thus evolving into creatures, such as us. But, of course, the colonies of cells within us eventually fail to replicate themselves and we die. For an ASB this scenario would

probably not be the case; unless, of course, an artificial aging process is introduced into their initial programming.

Consider their electronic brains, which would move and analyze more quickly and efficiently than our slower organic brains. Would they have a more realistic and deeper grasp of the Buddha's doctrine of not-self than us? Should we enter the doctrine of not-self into their programming (artificial DNA) as an unsolvable philosophical puzzle, but a puzzle in which the implications can eventually come to fruition for them?

Nirvana, Nibbana or enlightenment is the last in the series of the Four Dharma Seals. The Dhammapada says:

*Rare is birth as a human being,
Hard is the life of mortals,
Do not let slip this opportunity.*

In consideration of that scripture, here is the big question: will an ASB have the ability to attain enlightenment? I now want to bring up the concept of Buddha Nature, a somewhat controversial subject between the Mahayana and Theravada Buddhist traditions.

A venerable monk, Ven. Huei Ming once told me Buddha nature is everywhere. It's in us; it's in the floor; it's in the walls. It's everywhere. That definition of Buddha nature is interesting. Of course, Theravada Buddhism rejects the Buddha nature construct, and I consider myself basically a Theravadin, but I do find that interpretation of Buddha nature intriguing. It reminds me of neutrinos in particle physics. Neutrinos are very, very tiny subatomic particles. Right now, as you read this essay, neutrinos are passing through you, they're passing through the floor on which you're standing, they're passing through the walls around you. They're everywhere. And, of course, neutrinos will be passing through the ASBs as well.

Could there be a correlation between Buddha nature and neutrinos? If there is

(and I am only postulating my unscientific observation) wouldn't it follow that any being with the power of conceptual thought have

the ability to attain enlightenment (Nirvana) whether it's human being or an ASB? I once had a dharma teacher who said that a dog has the Buddha nature; but a dog has no way to tap it. Obviously a dog has more control over its destiny than a worm or a bug, but it doesn't have the ability to attain nirvana; at least as far as we know.

Will the ASBs with their speed-of-light, electronic brains be more acute at attaining enlightenment than we are. So, another question arises: Will they ultimately become our teachers; our masters; our gurus? This Fourth Industrial Revolution postulates more questions than it does answers.

So the overwhelming question is: What are the moral implications of developing artificial intelligence e.g. Artificial Sentient Beings? The theist religions would insist that we're playing god. But, if we look at evolution, life only comes from other life. So in a sense we are by this intelligent design, simply continuing the evolutionary process. God, or gods, doesn't have anything to do with it; unless, of course, you consider life itself to be god.

In the PBS series "Nova;" a robot, with a face designed to look human and software giving it the ability to speak; was created by roboticist David Hanson. Hanson named his creation "Dick." A reporter from Nova interviewed Dick. When asked if robots would take over the world, Dick responded, "So don't worry, even if I evolve into a terminator, I'll still be nice to you. I'll keep you warm and safe in a human zoo." Does that mean that we bizarre, unpredictable organic creatures need to be controlled or exterminated or kept in a zoo? There are so many serious questions about this Fourth Industrial revolution and very few answers.

In the beginning of this discussion I spoke of our eventual contact with other civilizations in the cosmos due to this Fourth Industrial Revolution. Should our attitude toward the ASB's be equal to the same attitude we would afford to the extraterrestrials? The answer to that is definitely and unequivocally, "Yes." However, we will obviously be confronted with exactly the same serious questions we have about ASB's that we would have about extraterrestrials.

If, due to our fourth industrial revolutionary advances, we find and communicate with extraterrestrials, will we similarly be putting

ourselves in the same danger as we would with the ASB's. Dr. Steven Hawking had an impressive opinion in this area as well: "If aliens visit us, the outcome would be much the same as when Columbus landed in America, which didn't turn out well for the Native Americans." Dr. Hawking went on to say, "We only have to look at ourselves to see how intelligent life might develop into something we wouldn't want to meet." I agree. We could be putting ourselves in a position of slavery and servitude; maybe even annihilation.

The entry into our society of the ASBs could be wondrous or terrifying. The decision is ours.

With Metta,

Rev. Shi Hua Dhammaruchi

(aka. Rev. William Beaumont Edwards).

FOURTH INDUSTRIAL REVOLUTION: BOTH AS AN IRONIC COVER-UP OF DUKKHA (SUFFERING) AND EFFECTIVE MEANS OF PRACTICING THE DHAMMA

by Waruni Tennakoon*

ABSTRACT

The fourth industrial revolution has already changed our lives in an unprecedented rate in contrast to what it was in the three previous industrial revolutions that came with the steam and hydro-power, electric energy and electronics and information technology respectively. In its fourth revolution, an extreme advancement of the technology gradually developed over the course of history is apparent with smarter technologies and it has already affected almost all aspects of our lives to the extent that life seems impossible without the touch to the modern technology. Just as it was with all the previous revolutions, the fourth Industrial revolution also has its pros and cons. The present paper expects to discuss the ways and means of applying the fourth industrial revolution to be blissful to the humankind by not being blinded by its concealment of the essential dukkha (suffering) of the beings, with reference to the Dhammacakkppavattana, saccavibhanga and avijja suttas. The basis of Buddhist teaching is understanding the dukkha which primarily comes in the forms of birth, aging, sickness and death. The Buddha has preached if the world is devoid of these, there is no need to strive to set free from the samsāra. The Buddha also preaches one should strive to set free from the samsāra quicker than someone whose head is burning is trying to put out the fire. Despite the differences in religions, everybody

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understands that whoever born will necessarily undergo the above stages of suffering. Yet, ironically, the modern technological developments are concealing these stark realities from people and the people are being blinded by the sugar-coated temporary comforts of the world making them forget the need to set free from suffering. On the contrary, the Buddha points out craving to be the root cause for dukkha and freedom from craving is akin to freedom of samsāra and that has to be done by following the noble Eight Fold Path. Even if the fourth Industrial Revolution “seems” to provide solutions for the birth, aging, sickness and death with better life conditions the human history has ever experienced, ironically it enriches the craving of the man with all such luxury invented day by day in the name of industrial revolution. It neither facilitates the moderate kind of living of people and nor supports the path suggested in Buddhism to be free from suffering. Moreover, the modern technological equipment such as smart phones, computers that come to the market in various names have not supported the yoniso manasikara instead they glue the minds of their users with ayoniso manasikara that leads to avijja or the ignorance which is the basis for the cyclical journey. Thus, the industrial revolution has to be made “human-friendly” by using its inventions effectively for deeper understanding of humanity and our origins. It should be amended to help men rethink about developing the mindfulness and spreading loving kindness. The unrealistic world that seems to be devoid of dukka which is created by the advancements of the industrial revolutions, hinders people from understanding the suffering and thus they are made to be heedless to be free from it, but, the same could be converted to be blissful by using it effectively as a vehicle to practice the path for eternal freedom suggested in Buddhism.

1. INTRODUCTION

The classical story that Prometheus stole fire of knowledge from the gods on Mount Olympus and gave it to the man has probably been composed to show the vitality of knowledge that makes the magical innovations possible. Human history has undergone so many milestones with regard to knowledge and innovations by making things that had been nightmares few decades back, real. Ending the agricultural society dominant in the period prior to the 18th century, the first industrial revolution took place in the end of that century and lasted until the 19th century. The first industrial

revolution changed the agricultural society to one of the industries and the invention of the steam engine enabled the use of energy that geared many industrial work. Moreover, the transformation of the cities and many modern mechanism have their origins from the first industrial revolution.

The second industrial revolution which could be introduced as a technical upheaval took place between 1870 and 1914, starting from the US and ultimately spreading to the rest of the world. Enhancing the link between knowledge and technology, the era showed the inventions of the airplane, telephone, typewriter, light bulb, electricity, petroleum, and the construction of the rail road that replaced human labour with machines.

While the first two revolutions mostly focused on developing the physical standards of the world, the third (1969) was a digital era. Competing new software, high tech robots, web based services of variety of range, new computer and telecommunication devices and most importantly the invention of nuclear energy, made the human work much easier making most of the services at the fingertips.

The fourth industrial revolution is underway with promises of “better” prospects for the modern world. The inventions of the fourth industrial revolution is expected to change the human society unlike anything the humans have experienced so far. Nonetheless, looking back at the innovations of the previous industrial revolutions, there is a question mark as to whether we have actually progressed with such magical changes. There is no argument that the world has developed to an unmatched level in physical facilities but whether we have progressed in our spirituality is the question we need to address. A quick observation is enough to understand the pathetic side of the modern man that they are so distanced from the religions which lay the moral foundation of humans. Buddhism stands out to be unique among the other religions that provides solutions for the problems not only of this life but also for the whole samsara. It directs us to achieve a permanent solution for all our problems that occur due to the samsaric existence.

Thus, the present paper is an attempt to look at the fourth

industrial revolution in terms of Buddhism, as the new discoveries seem to “challenge” the fundamental teachings of the Buddha. A careful analysis will show that despite the advancements of the modernity, these realities that the Buddha preached cannot be overpowered by the humans even if the modernity has been able to sugar coat these stark and dark realities in the slogans of positive thoughts towards life and happiness. In a Buddhist perspective, the modern technology has, of course, made the people heedless towards achieving the breakaway from the samsara as the dukkha or the suffering of the world has been concealed by the so-called advancements of the modern technology. While exposing the realities thus concealed, the present research also aims at analyzing how the advancing technology of the modern world could be made human-friendly in the true sense of these words according to Buddhism to direct people to achieve the ultimate liberation from samsara. The true happiness is not limited only to this life. Even if someone’s death is postponed or made a person forget about the impending death, they are not solutions for the sufferings of people. Buddhism suggests a realistic understanding of the real suffering of the world and provides a path to get away from the samsara so that suffering is eradicated forever and only such a person can truly be happy. Thus, the present paper examines, how the fourth industrial revolution could be made “human –friendly” with an intelligent approach to it.

2. LITERATURE REVIEW

According to McLuhan (1964), different communications media transform the same experience we have of space and time in different ways, and can eclipse the actual content of the message being transmitted. Furthering this idea, Veidlinger (Grieve & Veidlinger, 2014) points out the psychological effects of television, radio, the internet or any other medium as they shape thought in specific ways irrespective of the content they are transmitting. He shows just as the physical architecture can change the way the people behave by restricting certain movements in some directions, the media can also affect the behavior of people, “based on the various ways they impinge the senses that can override the discursive meaning of the content that they carry” (p.4). With the second industrial

revolution, the printing developed allowing different viewpoints to be spread all around the world within a very short period. While expanding the worldview of the people, this contributed to the social changes in societies. With the development of mass media, people who are in control of handling the media channels now have the control to decide which information should reach people and which way. Today, the digital media which have enabled the two-way communication have complicated the society while they have eased the spread of information much easily. Owing to digital media, anyone in one corner of the world can easily share his/her views on a matter discussed with another in the other end of the world within few seconds. By today, there has been an information overload that the society is at a real loss as to deciding which information is needed and which is not.

The very first method the Buddha used in spreading his word is oral communication. After the establishment of the Sangha Community, the Buddha advised his first 60 disciples to wander in all the villages and towns separately: “Caratha bhikkhave carikam bahujanahitaya bahujanasukhaya lokanukampaya atthaya hitaya sukhaya devamanussanam” (Vin.1.20). Buddhism first evolved in a society in which writing was not available and thus to ease the oral communication many techniques had been used in the Suttas such as repetition, phrases for easy memorization, etc. It was during the time of the Emperor Asoka that writing came to India and he made sure that all his work was well inscribed on stone slabs for his messages to be passed on to the generations to come. In Sri Lanka, Buddhism was passed on first from oral tradition but identifying the future challenges and the difficulties underwent in memorizing, the Three Baskets of Buddhist literature was first written down on Ola leaves in the Aluvihara, Matale in the 1st century BC. Moreover, there is evidence of many Buddhist monks travelling the Silk Road through Central Asia into China and they also spread the messages of the Buddha around the world (Boulnois & Mayhew, 2012). Likewise, Buddhism was in contact with the technologies developed in each era to popularize the Dhamma. When the radio was introduced, Buddhist monks used the media to preach the Dhamma and then the recorded tapes were distributed with the

preaching of the well-known preachers so that even the people of the remote areas also could listen to the Dhamma preaching. The next step was to make the preaching available in CDs and DVDs. Accordingly, Buddhism has always gone hand in hand with the modern communication modes developed through each industrial revolution, and it will continue to adapt to any invention to come as well. There are many projects to put the teachings of the Buddha into digital form which are accessible in many languages. With this, the entire Tripitaka is accessible with one finger click to anybody in the world. Starting from websites that spread the message of the Buddha, there are virtual temples and the virtual monks who conduct various meditations programmes online. Moreover, hundreds of Buddhist forums are available on social networks such as Face Book and the apps to share the Buddhist wisdom are also numerous.

While Buddhism has been so advantageous due to modern technology in popularizing it, the issue is whether the real purpose of Buddhist teaching is met with the advancements of the world. There also seems to be a scarcity in the research conducted to examine the link between the fourth industrial revolution and Buddhism and the present research expects to fill that research gap.

3. METHODOLOGY

The current research is a qualitative research with the data collected mainly through the library studies. The books, web articles, journals and Suttas were extensively read in order to gather data for this research.

Objectives

The main objectives of the research were to understand,

- what the fourth industrial revolution means
- the effects of it upon the modern man
- how the fourth industrial revolution has concealed the life difficulties of the man
- the Suttas in Buddhism that discuss the suffering of the beings

- how heedless man has become to practice the path of Nirvana owing to the modernity
- measures to utilize the modern discoveries and facilities to the betterment of the spiritual development.

4. DISCUSSION

We are on the brink of welcoming the fourth industrial revolution and the advancements made so far by the previous revolutions have already proven that this revolution will also make our lives much easier as it has never been before. Highlighting the inability of any one of us to ignore its effects on each individual, Schwab (2016), writes that the fourth industrial revolution will fundamentally alter the way we live, work, and relate to one another. He points out the possibilities of billions of people around the world connected via mobile devices, with “unprecedented processing power, storage capacity, and limitless access to knowledge”. “And these possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing”. This era we are living in is also an age where the smartphone apps provide the necessary meditation lines to contemplate and the monks preach and teach the Dhamma online. When the Internet, mobile phones, video games, and other revolutions of digital technology have affected the lives of all the people in the world, we cannot ignore the fact that Buddhism as a subject of learning has also been undergone change in the digital era. Buddhist teachings have increasingly been spreading around every nook and corner of the world today. It is present in digital media through diverse ways including interviews with the practitioners, cyber-communities that engage in Dhamma discussions, various research and analyses on Buddhism, etc. Buddhism is also present in virtual worlds, social media, and mobile devices and various computer applications are available for those who are interested in following or learning Buddhism.

In “Buddhism, the Internet, and Digital Media: The Pixel in the Lotus” (Grieve & Veidlinger, 2014), the necessary influence the digital age has caused for Buddhism has been pointed out and it raises

the question of the philosophy in Buddhism with the contrasting values promoted by the modern era of digitalization.

Besides this history that has primed Buddhism for a rich life in the new digital frontier, Buddhist philosophy has dealt more extensively than any other religion with the question of whether or not the world of experience is real, and such is a potent source for thinking about the nature of virtual reality...The centrality in Buddhism of desire and its dangers also provides a unique vantage point into the manifold desires generated by current ways of living in our mediated, hurried, and uncertain culture, where the decoupling of production from the physical world and the empowering of imagination to call forth virtual realities has replaced an earlier needs-based society with one powered by desire and consumption”.

This points out the problem we all experience in the face of modernity brought out by the industrial revolutions. Buddhism promotes achieving the ultimate bliss of *nibbana* by following the Eightfold Path. The Eightfold Path consists of Right View, Right Resolve, Right Speech, Right Conduct, Right Livelihood, Right Effort, Right Mindfulness, and Right Meditative Absorption or *Samadhi*. Another fundamental teaching of Buddhism is the three Essential Characteristics of Existence: *Anicca* (impermanence), *Dukkha* (Suffering) and *Anatta* (non-selflessness). One who understands these characteristics in all the conditioned elements may strive to break away from the *samsara*. Thus, the Buddha preached the Four Noble Truths which includes the essence of His teachings. Four Noble Truths have been given in a number of key *Suttas* including the *Dhammacakkapavattana Sutta* and *Saccavibhanga Sutta*. There, the Buddha has preached some essential causes for suffering such as birth, sickness, ageing and death (*Dhammacakkappavattana Sutta: Setting the Wheel of Dhamma in Motion – SN 56.11 PTS: S v 420*).

“Idaṃ kho pana, bhikkhave, dukkhaṃ ariya-saccaṃ: jāti-pi dukkhā, jarā-pi dukkhā (byādhi-pidukkho) maraṇam-pi dukkhaṃ, a-p-piyehi sampayogo dukkho, piyehi vippayogo dukkho, yampicchaṃ na labhati tam-pi dukkhaṃ; saṃkhitte na pañc-upādāna-k-khandhā dukkhā”.

“Now this, monks, is the noble truth of stress: Birth is stressful, aging is

stressful, death is stressful; sorrow, lamentation, pain, distress, & despair are stressful; association with the unbeloved is stressful, separation from the loved is stressful, not getting what is wanted is stressful. In short, the five clinging-aggregates are stressful”.

In the Aniccasaññā Sutta (S 22.102), the Kiñci Sankhāra Sutta (A 6.93) and the Aniccā Sutta (A 6.98) the Buddha points out the contemplation of impermanence is essential for spiritual liberation. In order to contemplate the impermanence or the true nature of the conditioned things, one has to continuously engage in yoniso manasikāra or the wise attention. On the contrary, the Ayoniso manasikāra means “not directing the attention to the roots of things” or “directing the attention away from the roots of things,” that is, not observing phenomena as they truly are, not noticing that they are impermanent, unsatisfactory and not-self (S 5.1.6.7). As a result of Ayoniso manasikāra, the wrong view arises distancing one from understanding the suffering and annihilating the journey of samsara.

Unfortunately, all these teachings seem to be completely in contrast to the modern day of living with so much of luxury that promotes a sheer pretention of a world sans suffering. The fourth industrial revolution is intended to be more hopeful in terms of health care industry because in the course of history due to the invention of drugs, the living expectancy has been on the increase. According to WHO, life expectancy grew globally by 6 years between 1990 and 2013 (Thuemmler & Bai, 2017). According to Lindsey Washington (2018), new technologies offer the following benefits:

- The new technology will bring new medicines to patients much faster
- It will allow physicians to manage chronic illnesses more effectively.
- Universal connectivity and greater access to information will empower patients to take a greater role in their healthcare.
- Data will be the underlying theme behind changes to health-care over the next five years.
- New data will allow for large leaps forward in medical re-

search.

- New technology will improve monitoring of patients, applying personalized treatment plans, and predictive medicine.
- Faster and more widespread connectivity will have a profound impact on hospital infrastructure.
- Better data on our bodies and brains will allow pharmaceutical researchers to develop new, better medicines.
- Emerging technologies will decrease healthcare inequality.
- New technology will decrease the cost of healthcare worldwide.
- High-speed connectivity will facilitate the creation of equal quality healthcare in both urban and rural areas.
- These healthcare measures with faster care for patients have increased the level of life expectancy and as a result of that, the aged population has also increased.

In the modern world, birth is no longer seem to be painful both for the mother and the infant, as the suffering undergone by both is concealed with various external facts. Not of course for the baby, but for the mother there are so many medical facilities available and many modern mothers say they did not even feel that the baby was taken. On the other hand, there is a trend to publish the photos of the newly born baby and the mother on social media that for some people posting photos is the most awaited thing in relation to the child birth. They are so thrilled by posting photos as well as to get a lot of congratulatory messages and comments on them that they forget the suffering enwrapped with the entire process of child birth. In the *Devaduta Sutta* (The Deva Messengers - MN 130 PTS: M iii 178), the Buddha preaches that in the hell, king Yama interrogates the man whether he did not see the “tender baby boy lying prone in its own urine & excrement?” and when the man replies that he did not, the king asks whether he did not get a mature thought as “I, too, am subject to birth, have not gone beyond birth. I’d better do good with body, speech, & mind?” The man replies in negative, and the king says,

"My good man, through heedlessness you did not do what is good with body, speech, & mind. And of course, my good man, they will deal with you in accordance with your heedlessness. For that evil kamma of yours was neither done by your mother, nor done by your father, nor done by your brother, nor done by your sister, nor done by your friends & companions, nor done by your kinsmen & relatives, nor done by the devas. That evil kamma was done by you yourself, and you yourself will experience its result."

The world which is blinded by the suffering that comes hand in hand with the birth would end up in the hell if they continue to be so heedless caught up to the fantasy world created by the modern technology. Moreover, the technology has been so advanced as to create artificial wombs filled with artificial amniotic fluid, and it is connected to reduce infant morbidity and mortality associated with prematurity (Partridge et al, 2017).

The second suffering the Buddha preached was the sickness and according to the Devaduta Sutta the sight of sickness is a messenger from the gods. King Yama says, had a person been heedful by seeing a sick man by contemplating that he is prone to the same condition, he could have been mindful and followed the path suggested by the Buddha. Considering the modern situation, the sickness just as or more than birth has been sugar coated in various ways. The hospitals are more luxurious than the five star hotels and it is considered well-to-do to afford to go to such a hospital. Technology has now found that eliminating diseases once thought incurable like HIV AIDS through the genomic editing and this is of course good news (Academiaedu, 2019), but we have to understand such discoveries would not end the dukkha caused by vyadhi in the journey of our samsara.

In death also, according to the SENS Research Foundation (Strategies for Engineered Negligible Senescence) research to provide indefinite life extension through rejuvenation techniques is underway (Academiaedu, 2019). The modern innovations have made the people so heedless by the covering up of the real suffering of life. Thus, the people are blind folded by the magical innovations and they are glued to this world created by modern science without paying attention to understand life. Since the beginning of the human history, the man has never been able to conquer neither

death nor failing health irrespective of the advancement of science and technology. Various drugs to cure the chronic diseases have been found, but even the millionaires had to die of certain illnesses despite the fact that the medication for such is readily available.

Ironically, the health sector is now complaining of certain disorders possible for the modern younger generation with their addiction to the technological device to a degree hither to unknown. The younger generation is pathetically engaged in their iphones and computers providing all kinds of pleasure to their senses and they are enriching *ayoniso manasikara*. Boers (2012) records how pathetically the modern generation has deviated from the “focus” or the “attention” which is important for spiritual life. She quotes, William McNamara in defining Christian spiritual contemplation as “long, leisurely, loving looks at the real” emphasizing the importance of “attention” in praying and he says, “It is the orientation of all the attention of which the soul is capable toward God” (p. 84). Boers furthers her discussion pointing out how the “systematic distraction culture” in the modern days with a lot of technical devices that distracts the focused attention of our younger generation is deviated. She says, “We live in an age of technologically induced and reinforced attention deficit disorder”. She further quotes, Maggie Jackson, “We are on the verge of losing our capacity as a society for deep, sustained focus”. Mihaly Csikszentmihalyi and Eugene are quoted when they say that most of the psychological pathologies are characterized by ‘disorders of attention’ that show how our attention may be misdirected and malformed by technology (p. 84). Moreover, the modern TV shows, video games, YouTube videos include such content that the attention of the watcher rapidly shifts making their focus changing from one object to the other constantly. This habit, as pointed out earlier is a barrier to contemplation.

Boers (2012) shares her experience of visiting churches for a year only to find in many the Power Point, overhead screens, and loud, amplified music bands were disturbing the serenity.

“The most sophisticated churches projected nonstop videos, often of nature scenes. Many showed announcements while taking offerings; these resembles commercial ads. I had plenty of questions

about what I saw: Were these media consistent with the proclaimed Word? How do such formats shape believers? Was the use of technology in keeping with worship tradition? ... I found it discouraging and dispiriting when I discovered this in church after church... May be this is now the only way to reach out, connect, attract attention. Perhaps many people are now incapable of contemplative, slow-moving worship. I am unsure. And I am also deeply uneasy” (p. 84-5).

Even if the Buddhist temples have not yet gone to the extent described above, there is a trend that new set of monks who call themselves arahants are using Power Point presentations in Apple computers which, of course has caught the attention of the young generation. It has become a fashion or a style to follow them as they are named, “monks of the modernity”. Through random observations I have felt this a challenge to Buddhism. Moreover, thorough social media any message could be spread so fast, and the viewers are at a loss to decide which is correct and incorrect.

The mass of data bombarded through the internet leave us stressed, tired, and anxious (Boars 2012, p. 85).

“We have a hard time knowing what is true or trivial, vacuous or vital, essential or ephemeral. And we are often deliberated by what we learn, unable to take it all in, let alone act on it or respond meaningfully”.

Discussing the same topic, Vanderbilt notes that the more information one is faced with, the less respect and attention one gives. When we are inundated with information it becomes hard for a person to choose what is important, what is a priority, what is crucial and the minds are so confused without focus and distracted attention.

This is indeed a threat to a person who is practicing the path described by the Buddha. Too much unwanted information distracts a person from *yoniso manasikara* (appropriate attention) and so many unwanted thoughts that would cause a lot of *papanna* (mental proliferation) leads one to *ayoniso manasikara* (inappropriate attention) distracting a person from *nibbana*. In the *Madhupindika Sutta* : the Discourse on the Honey-ball (MN 18 PTS: M i 108) and in the *Sakka-pañha Sutta*: Sakka’s Questions (DN 21 PTS: D ii), the Buddha clearly points out how *papancha* would let a mind

of an unenlightened being go astray leading to many confusions and conflicts. In the present world, with information bombarded to our minds, we are entangled in papancha to a degree that if we are unaware of the aftermaths of thus being led away by the mental proliferation, we become so far from the Ultimate Bliss of Freedom.

Another threat of modern communication media not only to Buddhism, but also to any other region is the democratic nature of the Internet that has promoted the growth of “fringe religions” including neo-paganism and New Age Beliefs. Thus, the Internet has eased various people to interpret religion according to their interpretations and popularize them through the internet. According to Helland (2000) there are two types of Internet Faith: Religion online and online religion. Religion online has more static information and the user can only search for a piece of scripture or some information on a website, but they cannot add or delete anything there. Online religion, on the contrary allows the participation of the readers to add, delete, suggest optional beliefs, etc., which ultimately tarnish the doctrine of the original message.

The false “I” created in the social media and the sense of self-importance felt with a lot of “Like” to almost everything someone posts on social media have badly affected the young people in developing a true personality. The quality of being sincere to someone’s weaknesses is essential in correcting oneself in Buddhism, and the created fancy world in the social media gives rise to building up a fake personality with a lot of meaningless “Great” and a click of “Like”s for something very meaningless such as what someone had for lunch on a day. Millions of friends who put “Like”s and “Wow”s on a post someone shares are completely in contrast to the “kalyana mittas” that Buddhism emphasize to be important in achieving the spiritual development.

CONCLUSION

The present paper discussed the disguised danger of the inventions of the fourth industrial revolutions in achieving the spiritual freedom. The comforts gifted by the innovations of the modern world have made the people lost in a fairy-tale world pretentious to be devoid of suffering. According to Buddhism,

a genuine revulsion on the pleasures of the world is needed by understanding the inherent qualities of all the conditioned things. It is not just a temporary revulsion that the Buddha is explaining, but a revulsion as a result of deep understanding of the true transient nature. Without that realistic understanding, the people are entangled in the samsara with ignorance. The present world, with the comforts that the human history has ever experienced is pursuing a suba sanna in everything causing them to be blind to the true nature of transience. Even if the digital media has promoted the spread of the Dhamma through the inventions of various apps, DVDs, etc., they have been unqualified to promote the practical side of Buddhism.

Technology is not harmful if it is controlled usefully to create benefit and also as a means of improving the understanding of the human beings. As mentioned above, making the younger generation aware of the danger of samsara and the disguised danger of digital era is a must in order to direct them to more spiritual understanding. Even if the Buddhist teachings are spread easily around the world with the numerous apps as discussed above, the younger generation should be made aware of the importance of the monks in spreading the Dhamma as they are trained to preach and direct the devotees in the path. Rather than depending on the online research published on the internet, it is important to have live and direct interactions with the monks in getting the Dhamma facts clarified. That will not only facilitate the improvement of our qualities in behaving and treating the Sangha, it will also be important for us to acquire merit that is essential in walking in the path.

Therefore, the innovations of the fourth industrial revolution can well be used to spread the message of the Dhamma easily to every corner of the world, while making the people aware of the essential nature of the world despite the fact that the modern technology has covered it up with temporary and sugar-coated fakeness.

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**IMPACT OF 4.0 REVOLUTION
ON BUDDHSIM**

BUDDHISM IN MONSOON ASIA: DIGITAL/SPATIAL HUMANITIES AND CONSERVATION OF HERITAGE¹

David Blundell*

ABSTRACT

This article brings together studies that illustrate digital/spatial approaches for the conservation of heritage across regional economies and bridging distinctions between cultures. Crosswalks for information from multiple sources and in multiple formats of spatial humanities – a sub-discipline of the digital humanities are based on geographic information systems (GIS) and timelines – to visualize indexes for diverse cultural data and provide an effective integrating and contextualizing function for spatiotemporal attributes. Geography continues to play an important role in dynamic global environments of multicultural diversities ranging across very different regions that increasingly find heritage as common

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1. I offer my gratitude to Benny Liow Woon Khin, Vijaya Samarawickrama, and Tan Ho Soon for editing *K. Sri Dhammananda: Essays in honor of his Centenary*, Vol. 2, Contemporary Perspectives, published by Nalanda Buddhist Society Malaysia, 2018. This project encouraged me to continue my pursuit for utilizing advanced tools of geographic information systems (GIS) to chart the extent of *dharma* transmissions from earliest times in South and Southeast Asia. This coincides with work we are doing for Lewis Lancaster's Atlas of Maritime Buddhism as a project of the Electronic Cultural Atlas Initiative (ECAI) with Jeanette Zerenke and other ECAI Austronesia Team members. Thanks for their years of support. I am grateful to Shu-Heng Chen, Vice President, and Director of Top Projects in Digital Humanities, at National Chengchi University, Taipei, for editing *Computational Social Sciences: Big Data in Computational Social Science and Humanities*, published by Springer, 2018, and my co-authors, Ching-chih Lin and James X. Morris.

denominators. We are looking at anthropology as a mandate the holistic understanding of human integrity at every level and time. Therefore, we are crafting a time map meaningful to our daily lives.

As nations develop their history in the present for its interpretation of the past, we have a commonality of heritages acting as political tools for making sense in our daily life (Buckland 2004). Our models are envisioned as multi-cultural and transnational. In our globalization, peoples acknowledge one another moving in a circulation of ideas, knowledge, and goods across spatial dimensions. Merchants have traded to East Asian ports, through river systems across China and Southeast Asia (Ecom 2017), and navigated to Pacific islands, and returned with trade (Sitnikov 2011).

The research includes early historical evidence of trade networks of Austronesian navigators circulating in the dharma in the Indian Ocean, mainland and island Southeast Asia, and China. This coincides with work on Lewis Lancaster's Atlas of Maritime Buddhism as a project of the Electronic Cultural Atlas Initiative (ECAI) with Jeanette Zerenke and our other Austronesia Team member utilizing geographic information systems (GIS).

We are finding meaning and innovation to enrich what scholarly efforts have already achieved in historical mapping across time particularly interests us. At National Chengchi University, Taipei, Taiwan, in 2015, we initiated our Asia-Pacific Spatiotemporal Institute (ApSTi, <http://apsti.nccu.edu.tw>). Here we have created an environment for synergies to occur between researchers based on research and sharing advanced technologies in digital/spatial humanities (see Blundell and Jan 2016; Blundell, Lin, and Morris 2018).

INTRODUCTION TO DIGITAL/SPATIAL HUMANITIES

What is the worth and value of mapping ancient archaeological space in modern societies? Malaysia is struggling with this issue. Pre-Islamic societies are inscribed in historical artifacts and archaeological sites (Blundell 2015, 2018 a). Yet, in our contemporary civil society, there is increasing awareness and respect to the ways people lived and their aesthetic perception in their time. Are we slaves to modernity? What about the ancient legacies of a country?

Pursuits in anthropology mandate the holistic understanding of human integrity at every level and time, therefore – we are crafting a time map meaningful to our daily lives. We are looking at historical continuity, starts and stops, across time as heritage transitions and transformations in terms of modern societies. How is this done? When visiting museums, what do you expect? Museum installations, dioramas, paintings, artifacts – yes, how is historical information viewed by the public? Is this of interest to you? We suppose as history comes into daily life it's meaningful, and does it makes sense?

This article brings in studies that illustrate different approaches to regional economies, bridging distinctions between the humanities and social science using digital solutions. Crosswalks for information from multiple sources and in multiple formats of spatial humanities – a sub-discipline of the digital humanities based on geographic information systems (GIS) and timelines – creating visual indexes for diverse cultural data and provide an effective integrating and contextualizing function for spatiotemporal attributes.

As nations develop their history in the present for its interpretation of the past, we have a commonality of heritages acting as political tools for making sense in our daily life. In recent years, regional economies have expanded based on world trends and historical networks. Yet, today we have more national barriers ranging across geographies that increasingly find heritage a common denominator.

Our models are envisioned as multi-cultural and transnational. In our globalization, peoples acknowledge one another moving in a circulation of ideas, knowledge, and goods across spatial dimensions. Merchants have traded to East Asian ports, through river systems across China and Southeast Asia, and navigated to Pacific islands, and returned with wares of their trade, stories, and geographic information.

Finding meaning and innovation to enrich what scholarly efforts have already achieved in historical mapping across time particularly interests us. In 2015, we initiated our Asia-Pacific Spatiotemporal Institute (ApSTi, <http://apsti.nccu.edu.tw>) at National Chengchi University, Taipei, Taiwan (Blundell and Jan 2016). Here we have created an environment for synergies to occur between researchers

serving to facilitate studies as a home for innovative geographic information systems (GIS)-based research and sharing advanced technologies in the digital/spatial humanities.

Our institute offers a range of project services to facilitate new ways of configuring data based on geospatial tools. Interfacing of spatiotemporal systems, dynamic maps of unique informational possibilities are generated. Researchers in various disciplines contribute to dialogues about techniques, challenges, and the results of digital humanities research. In short, *we are facilitating capacity-building and innovative ways of sharing information via digital methods for visualizing spatiotemporal aspects of the human experience.*

A far-reaching goal is to further standards in cartographic strategies through the utility of digitization and animation of map content giving new possibilities in the hands of local and international collaborators. This allows the uniting of the context of environmental landscapes with cultural data for making enhanced possibilities in spatial humanities with scales of data—large and small—with humanistic and scientific results. Our information across regions is based on a commonality of symbols and motifs of unconscious mutual heritage. We track sources from prehistoric linkages into the realm of early historical connections traced through nomadic legends to the present day (Sitnikov 2011; Blundell and Sitnikov 2018). Our case studies are based on applications of theory supporting holistic approaches to understand stability across diversity.

This research shows that economies are transmitters for rapidly transforming global environments of multicultural diversification to trans-regions from very different geo-cultural areas that could increasingly find common denominators utilizing best scientific practices that produce new paradigms. We view the geographic regions by understanding local changes and global impacts across time.

Here we weave a story of Southern Asia maritime Buddhism through GIS digital and spatial mapping through Southeast Asia. I am working on projects with Gauthama Prabhu for developing a progressive paradigm of ecology and heritage that incorporates a

sense of place in South India imbued with Buddhist heritage, yet politically ignored by mainstream society (Blundell and Prabhu 2018).

Using anthropology and digital/spatial humanities, there is a potential to activate grassroots by communities to re-appropriate and link back their own heritage cultivating local leadership of farsighted outreach. Our interest is based on the ancient heritage of South India and through maritime voyaging of merchants and monks of the *dharma*.

It is widely believed that fast development of East Asia in the late 20th century could be explained in terms of the traditional Asian cultural norms, which are supposed to be one of the main factors to ease the adaptation of struggling economies to the fast globalizing world. It was often suggested that such features of traditional philosophy of Confucianism as “the close family ties, sense of social discipline and respect for hard work” were the engine of economic growth in those countries (Aikman 1986:5).

However, the philosophy of Confucianism is not the only Asian tradition. Cultural norms of many popular beliefs have played a significant role in economic and social activities across the region for centuries. Cultural norms of many faiths also had long periods of successful influences on the processes of regional integration, social and economic development, and stagnation. *Why is it that the same beliefs, religions and traditional cultural norms sometimes could be generators, but sometimes hamper social and economic development? What has Buddhism contributed?*

We suppose that the findings in cultural anthropology and even its more specific subfields such as religion, folklore, and mythology could be an important contribution to the understanding of socio-economic exchange. It seems that periodic environmental changes and technical innovations are the main forces of transformations in social structures which in their turn determine the mechanisms and levels of cross-cultural activity—either integration or isolation.

It is important to notice here that besides the cultural diversity, such as in the Eurasia-Pacific region there is the opposite phenomenon of cultural similarity in spite of the fact that nowadays

people have different beliefs and are separated by various nation-states. Cultural similarity in what peoples share could be explained in terms of former heritage unity or regular longtime contacts among them in the past. For example, wide beliefs and diversity among the Austronesian speaking peoples could be explained by their ability to adapt easily to outside influences.

The main reason for easy adaptation to outside influences is to derive profit from integration through the exchange of goods and other worldviews. Ancient peoples' cultural traditions sustaining over space and time is interesting and useful as a task because it can help to discover mechanisms of cultural integration in the region, which took place in the past and probably could be explained nowadays in terms of inter-religious tensions across regions.

To discover such traditions and effective integration mechanisms we need address to Carl Jung's concept of *collective unconscious* (see Jacobi 1959). According to Jung, the collective unconscious is a part of the individual unconscious mind, shared by a society, and is the product of ancestral experience. It is concentrated in traditions, beliefs and moral norms. The study of mythologies, beliefs, rituals, and cults in combination with particular objects of material culture and archaeological artifacts across Eurasia-Pacific regions could help to analyze peoples and find sets of commonalities, which can help to reconstruct the ideology of initial integration phase in the region and its patterns.

Jack Goody (1996) in his *The East in the West* suggests that similarities in inheritance patterns indicate that the term 'Eurasia' is more valid than either 'Europe' or 'Asia'. We suppose that unification of these two separate concepts into an indivisible one gives opportunity to observe the phenomenon of sociocultural change and stability in its *dynamic variations across* continuous geographical and historical arenas of cross-cultural interactions.

Common heritage denominators are hidden under layers of different variants of popular beliefs in different cultural traditions. Many scholars believe that religious and mythological patterns could be spread in the vast territories along ancient trade routes. For example, Carla Musi (1997) studied parallels between the

Finno-Ugrian shamanism and European mediaeval magic, explains the phenomenon of cultural similarities due to ancient trade routes. She concludes that from the most distant past, Western and Eastern Europe were much closer to each other than could be imagined. Cultural elements, myths and beliefs could be spread along the 'trade routes of Baltic amber' across vast geographic distances.

This ideas of Musi supports our supposition that the stable mythological elements that have traces in mythologies all over the Eurasia-Pacific could be a product of regular cross-cultural exchange and contacts among peoples along prehistory's trade route networks, which long ago connected Eurasia by rivers and seashores, creating and supporting a sense of cultural unity from Scandinavia and British Islands in the West, ranging across to the Far East; from Kamchatka in the North to New Guinea in the South.

RESEARCH

Our current work is based on disciplines of comparative mythology and folklore combined with data of geography, ethnography, archaeology and linguistics to discover new knowledge concerning the phenomenon of cultural transformations and stability. As a data sources we use, the first known among written texts and oral narratives was collected by previous generations of ethnographers, anthropologists, and folklorists.

We look for "native logic by which various peoples make sense out of life and to understand it on its own terms" (Babbie 2010). We are collecting data relevant both from the transfer and worth of mythological symbols and objective phenomena of economic daily living. Why is this important? It is to study the interplay of ancient cultural pursuits in the archaeological record and mapped with advanced geographic information systems (GIS). The question is relevant today to better understand ancient ocean transport networks of the *dharma* from ports of Southern Asia to eastern shores.

The research components are based on documentation of merchants and pilgrims and their routes, ship technology, navigation, and archaeology (Ray 1994). Methodological questions were created on issues of research design and strategy as an empirical science.

In recent decades we have entered an age where digital tools are ever increasing in capacity to help us with daily life. In the academic realms of text mining, network analysis, public history, heritage studies, and mapping we are coming of age in digital humanities and related disciplines (Blundell and Hsiang 1999). Among these areas, many specialties focus on analyzing digital space through time. We call this area spatiotemporal research—mapping across time with digital computational methods providing a large array of information. This enhances our ability to observe data beyond an individual’s abilities to perceive all the possible components.

The possible data stems from aerial mapping, remote sensing, photometric imagery, random sampling archaeology, statistical programming with languages such as R, and contemporary software development for innovative methods to see beyond what we can see. When conducting fieldwork, you may find there are occasions when digitizing data becomes necessary. Whether this is due to limitations such as time or access, mobility issues requiring light travel, or due to chance, such as the occasional lucky find, digitization is an excellent method to collect spatiotemporal data. This chapter outlines several varying projects and methodologies in the digital humanities incorporating integrated approaches to spatial humanities and spatiotemporal research. We invite you to participate in this field of spatiotemporal methods to enhance your research. With this chapter we hope to inform, instruct, and inspire more research in this new and exciting area (Blundell, Lin, and Morris 2018). Mapping is one of the most commonly used techniques in reviewing our “sense of being” in space (see Cosgrove 2004; see Blundell 2011, 2012).

Our time maps research contributes to important academic discourse in many ways. Time maps are utilized to trace stories by the way people move through time. These visualized spatiotemporal displays contribute to discovering knowledge, answering questions, and seeking other questions. Spatial humanities produce a cycle of questions creating layers of maps portrayed in different ways.

The question is to what extent did international religious systems, such as beliefs in the *dharma*, beginning about 2,300 years ago facilitated by Austronesian speaking Malay/Indonesian

navigators? This is to say there was a range of influence stemming from Southern Asia across the Bay of Bengal to island Southeast Asia. The region became receptive to the *dharma* in peninsula and island Southeast Asia. How could routes be traced?

The supposition is the *dharma* as a literary belief system was carried as far as writing could be traced on palm leaves, metal, and stone. In the 2nd century CE, my hypothesis is that the *dharma* moved out by sea travel onboard ships with seasoned mariners who we suppose were indigenous, now known as Austronesian speaking voyagers (Blundell 2014 a, b) and in stone relief imagery depicted at Borobudur in Java (Figure 1). Yet, there are gaps in the record. So to remedy this, we are taking stock of old knowledge, and new technologies within today's academic networks to further trace the extent of seemingly unrelated cultures intersected, and its periphery (Blundell 2016).



Figure 1. Stone relief panel of voyaging outrigger ship on the Buddhist monument Borobudur, Java, Indonesia, 9th century.

This project owes its existence to Lewis Lancaster who established the Electronic Cultural Atlas Initiative (ECAI, <http://ecai.org>), University of California, Berkeley, in 1997. At that time, Lewis Lancaster invited scholars of Austronesian languages and cultures to be part of this international collaborative reaffirming and furthering the United Nations Millennium Goals by the indispensable common house of the human family, “through which we will seek to realize our universal aspirations for peace, cooperation and development. We therefore pledge our unstinting support for these common objectives and our determination to

achieve them” (United Nations Millennium Goals 8th plenary meeting, September 2000).

For public museum displays, our team thought of producing modular units of the story intersecting early Buddhism with Austronesian voyaging. These components include visually documenting ports, ship construction, and sailing routes. Our research illustrates a range of ways to facilitate configuring social science data with geospatial tools featuring Taiwan research with GIS point locations, migration and historical trade routes, and religious sites of the region linked to enriched attribute spatial information (Blundell and Zerneke 2014).

Today’s current advances in GIS computing and information infrastructures offer researchers the possibility of reconsidering the entire strategy of analysis and dissemination of information. It “enables humanities scholars to discover relationships of memory, artifact, and experience that exist in a particular place and across time” (Bodenhamer 2010 *et. al.*).

Documentation includes merchants and pilgrims and their routes, ship technologies, ports, and remaining artifacts. The current project, ECAI Atlas of Maritime Buddhism has a first phase goal of providing GIS mapping of archaeological sites along the coast lines of India and Sri Lanka extending to Southeast Asia and ending with the Chinese river and canal systems, coastal Korea, and Japan (Figure 2).

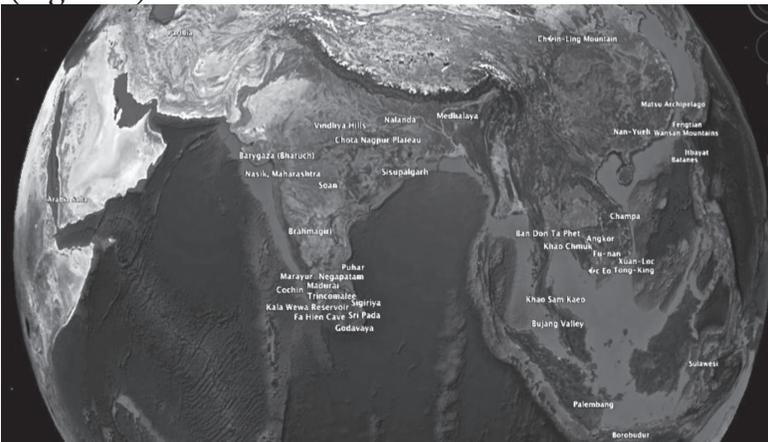


Fig 2. The ECAI Atlas of Maritime Buddhism featuring sites of research in Monsoon Asia.

Geographic information is required by a wealth of scientific research for various disciplines. Due to much progress of geospatial technologies in recent years, acquisition of high-quality spatial and temporal information has become much more efficient and cost-effective than past few decades. Remote sensing provides massive high resolution imageries about Earth surface, which can be analyzed by image processing tools to automatically derive valuable information for various applications such as climate change, land resources inventory, environmental monitoring, and urban sprawl.

We are challenged to imagine new methods for doing research and making results available to broader user communities. Can we find meaning and innovation digital humanities beyond what has been traditionally part of scholarly efforts? We examine GIS point locations tracing routes and networks imbued with historical meaning across the region linked to enriched attribute information. These are charted and visualized in maps and can be analyzed with network analysis, creating an innovative digital infrastructure for scholarly collaboration and creation of customizable visualizations.

The Atlas helps to show Buddhist related artifacts and sites clustered at seaports in India as well as a number of regions of Southeast and Eastern Asia. The network of Indian seaport merchants was a primary support for the *dharma*. Today these were classified as Hindu or Buddhist as they coincided at the time. The respect for Buddha was prevalent from the 2nd century CE, if not before. What form of Buddhism? At the time, the respect for Buddha was based on the individual. This is known as *bhakti* or to share, partake in, with your deity, such as Buddha or Siva.

The seafaring *nusantara* traders of the islands of Southeast Asia created trading centers facilitating Hindu/Buddhist propagation in Southeast Asia, which proved of the existence of Buddhism with Pala Mahayana influences from South India. This faith was brought in and practiced by these Indic merchants. The respect shown to the Buddha was a more inclusive of an overarching belief system.

Buddhism diminished in India, as it was supported by kings who were politically replaced by kings devoted to Siva, etc. by about the 10th century CE. It was seen as the raise of Hinduism. Yet, the term

Hinduism did not exist. Our view in the present day is to divide and classify those beliefs as Hindu and Buddhist.

TRACING HISTORY THROUGH MAP LAYERS

Today, with our current geographic technologies we are able to trace this historical process as map layers—from prehistory to early history into the era of written inscriptions. Paul Wheatley (1961) brought this to my attention in his publications. His methods and terminologies were based on his ability to translate texts from both early Indic and Chinese writings. He mapped the historic *Southeast Asia* showing layers of settlement. The ancient texts of Wheatley's *Golden Khersonese* comment on the trade relations with the Malay Peninsula and across Southeast Asia.

Our research shares ideas about early historical Indian Ocean destinations to seats of kingdoms and trade centers where the word of the *dharma* and its faith developed in a healthy vigorous way, especially in particularly congenial regions of Southeast Asia. We have traced early evidence of trans-ocean sailing craft across Monsoon Asia.

An important element in this research includes the role of the Monsoon winds and the annual shift of wind direction that determined the trade calendar for ocean shipments (Figure 4). The time and distance from Africa to India or from India to Malaysia or further out across the seas to East Asia depended on seasonal wind directions.

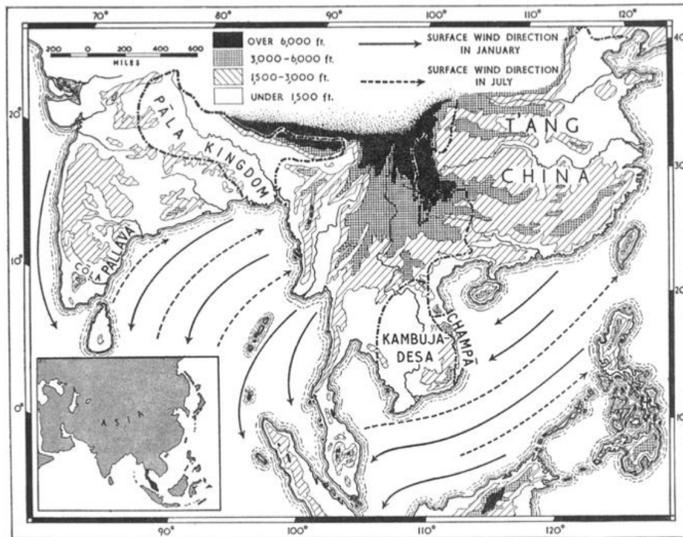


Figure 4. *Historical Monsoon wind seasons, Wheatley 1961, xviii.*

A corresponding resource is our ECAI map of Austronesia that overlaps with the Buddhist distribution of materials and providing a local context for ocean shipping lanes and ports. From East Asia some of the earliest cultural linkages were based on the innovation of ocean going navigation, sailing out of Taiwan about 4,500 to 3,500 years ago carried a linguistic dispersal known as the Austronesian trade languages incubating across the Philippines, Indonesia, Malaysia, and to Micronesia initiating Malayo-Polynesian languages (Figure 5.).



Figure 5. Out of Taiwan seafaring routes between 4,500 to 3,500 years ago. Map displayed at the Austronesia Exhibition of Bentara Budaya, Denpasar, Bali, Indonesia, July 20, 2016.

HISTORICAL ATLAS OF MONSOON ASIA

Our knowledge derives from various research fields, and integrates many different types of data and analytical styles developing new research methodologies, creating paradigm shifts and multi-vocal views in the humanities. Our aim is interdisciplinary for producing narratives from ancient evidence; thus we are recounting timelines of religious transmissions, aesthetics, and trade partnerships.

This data is collected for the Atlas, it can be a resource for museum installations that can be interactive, animated, and augmented or installed in immersive 3D display environments. The development of Apps allows for our information to be available on handheld devices.

Geographic information and timelines provide an effective integrating and contextualizing function for cultural attributes. As cross walks for information from multiple sources and in multiple formats they create visual indexes for diverse cultural data. The system is based on GIS point locations linked to enriched attribute information. We are able to chart the extent of specific traits of

cultural information via maps using GIS gazetteer spreadsheets for collecting and curating datasets. Through methods in spatial humanities, history reaches new dimensions, with state of the art opportunities while gathering and analyzing data. With our advanced spatiotemporal tools, it is exciting to research multidimensional pathways of Monsoon Asia.

Our ECAI Atlas of Maritime Buddhism efforts include the development of a touring 3D immersive museum exhibit. This exhibit is in part supported by the efforts of a diverse group of ECAI affiliates and teams. A wide range of contributors are collecting and cataloging data, which can be used in various ways for different audiences.

One of the organizing themes of the atlas is Atlas modules. These modules are curated by an author, or team, to document a story, event or theme. Each is supported by multiple forms of data and visualization. Historical kingdom map overlays on Google Earth give time-enabled layers of information within a specific geographic region, time period or cultural era, trading system, person or group of people (Figure 6). This approach is supported by an infrastructure to capture and archive content and is expected to grow.

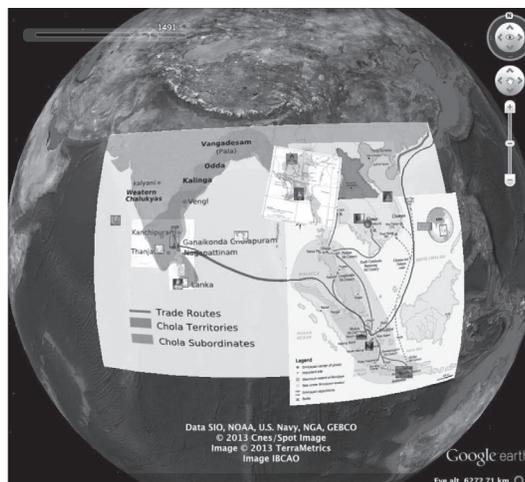


Figure 6. Maps of historical kingdoms in Southern Asia, their associated trade routes, and other information are used to construct geo-registered layers by time in Google Earth.

CONCLUSION

Origins of this research began with my thesis written from the perspective of India and Sri Lanka to explore sources and expansions of regional cultures. This work was based on translations of Indo-European, Dravidian, and Chinese early historical literature. It has increased my understanding of growth and dynamics of the ancient cities and trade routes across mainland and island Southern Asia from Neolithic cultures to early history making connections with East Asia and Pacific Ocean island cultures (see Blundell 1976, 1984, 2003, 2009, 2014 b, 2016, 2017, 2018 b).

A far-reaching goal is to further standards in cartographic strategies through the utility of digitalization and animation of map content giving new possibilities in the hands of local and international collaborators. We provide examples for developing best practice standards applied to databases giving interactive multimedia utility aspects. This allows uniting the context of environmental landscapes with cultural data for making enhanced possibilities in spatial humanities with scales of data, large and small – with humanistic and scientific results.

For comprehensive developments in spatial humanities we consult Jo Guldi's introduction of the spatial turn for eight academic disciplines, "What is the Spatial Turn?" (2016) and Richard White's essay "What is Spatial History?" (2010). Digital mapping today gives resource affordability to researchers. Availability to digital resources allows novice or advanced researchers who are not cartographers, abilities to chart information.

Now historiography has fresh and innovative tools (Robertson 2012), and not about literary text mining. GIS provides history "the most exciting developments in both digital and spatial humanities" (Gregory and Geddes 2014) with advances in computing and information infrastructures offering researchers possibilities of reconsidering the entire strategy of analysis and dissemination of information. It features 'deep mapping' acknowledging multiple meanings in a place that "enables humanities scholars to discover relationships of memory, artifact, and experience that exist in a

particular place and across time” (Bodenhamer *et. al.* 2010).

Why is this important? We connect with a continuum of religious transmissions across Monsoon Asia. This article highlights our research for the development of a digital Atlas based modules featuring maritime Indo-Pacific and Indic *dharma* influences with a focus on historical Buddhist outreach.

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DIGITALIZATION OF BUDDHIST SITES IN INDIA

by D. Dayalan*

India, being the homeland of Buddhism, is boosted with a large number of Buddhist sites. Of them, the Four Great Places namely Lumbini where the Buddha was born, Bodh-Gaya, which witnessed his Enlightenment, Sarnath, where the First Sermon was delivered and Kusinagara, where he attained *parinirvāna* (deceased) are embellished with monuments of varied kinds. Other places somewhat lesser importance in Buddha's life, namely, Sankisa (Siamikasya), Sravasti, Rajgir and Vaisali also became the scene of monumental activities. Every spot associated with Buddha is immortalized and turned into a centre of pilgrimage by his followers who erected structures in the hallowed memory of the Master. It is mentioned that Buddha himself had suggested on his death-bed that the *stūpas* should be erected over his mortal remains¹. Thus, the worship of *stūpas* was an essential feature of early Buddhism. *Stūpas* (Pāli *thūpa*), derived from the root word *stūp* (to heap), are mounds or tumuli. *Stūpas* are known in Sri Lanka as *dāgāba*, this being derived from Pāli *dhātu-gabbha* (Sanskrit *dhātu-garbha*), "structure containing within its womb, *garbha*, corporeal relics *dhātu*. Originally, they had a funerary association, being mounds containing the corporeal remains of the dead collected from the funeral pyre.

It is mentioned that after the demise of the Buddha, a Brahmin named Drona (Dona) divided the relic of Buddha into 8 parts and gave it to Ajatasatru of Magadha; the Licchavis of Vaisali; the Sakyas

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1. Debala Mitra, *Buddhist Monuments*, Sahitya Samsad, Calcutta, 1971, p.8

of Kapilavastu; the Bulis of Allakappa; the Koliyas of Ramagrama; the Mallas of Pava; the Mallas of Kusinagara and a Brahman of Vethadipa in order to erect the *stūpas* over them. Drona kept himself the urn in which the mortal remains of Buddha had been collected and divided and erected a *stūpa* over it. After the event, a messenger of the Mauryas of Pippalivana came and he took the embers/ashes over which the Mauryas erected a *stūpa*. Thus, there came into existence eight *stūpas* at Rajagriha, Vaisali, Kapilavastu, Allakappa, Ramagrama, Vethadipa, Pava and Kusinagara over the corporeal remains, the ninth over the urn and the tenth over the embers. (*Figure No.1*)

In addition to the *stūpas*, there are many other Buddhist relics such as *vihāras* (monasteries), *chaityas*, rock-cut caves, temples, sculptures, bronzes, paintings, etc., spread all over India. Monasteries had already come into existence during the lifetime of the Buddha, to provide shelter to Buddha and his disciples during the rainy seasons. Monasteries were built by his devotees and admirers at some of the important centres of his activities, such as Rajagriha, Sravasti, Kausambi and other places. The Buddhist *Stūpas* are broadly classified into four categories. (i). *sārīrika*, (ii). *pāribhogika*, (iii). *uddeśika* and (iv). Votive. The *sārīrika stūpas* are those which erected over the corporal relics of the Buddha or his direct disciples or Buddhist saints. *Pāribhogika* was built over the objects to have been used by the Buddha, like the begging-bowl, robe, etc. *Uddeśika* was commemorative of the incidents of Buddha's life, including those of his previous births, or spots hallowed by his presence. Votive *stūpas* are small in size, mostly erected by the pilgrims when they visited the sacred sites for attaining religious merit.

The earliest Buddhist monuments, however, cropped up in Bihar and Uttar Pradesh in India and in the Nepalese Tarai, which witnessed the major event of the Buddha's life and his activities. (*Figure No.2*) With the passage of time, Buddhism goes beyond the boundaries of its cradle-land, in the extension of the geographical horizon. Emperor Ashoka (circa 273-236 BCE) took a leading role for the dissemination of Buddhism within India and abroad. He was responsible for the erection of a large number of Buddhist edifices throughout his region and his exposition of the merits of

non-violence, tolerance, justice, charity, purity, truthfulness, etc., were inscribed on the rocks and pillars for the edification of the people. He had also sent missionaries to various regions, including *Yavana* (Greek), Sri Lanka and Suvarnabhumi (Southeast Asia) for propagating the Buddha's teachings. Emperor Ashoka is said to have opened up seven out of eight original *stūpas* built over the corporeal remains, and distributed the relic contained therein among innumerable *stūpas* erected by him throughout his empire. (*Figure No.3*)

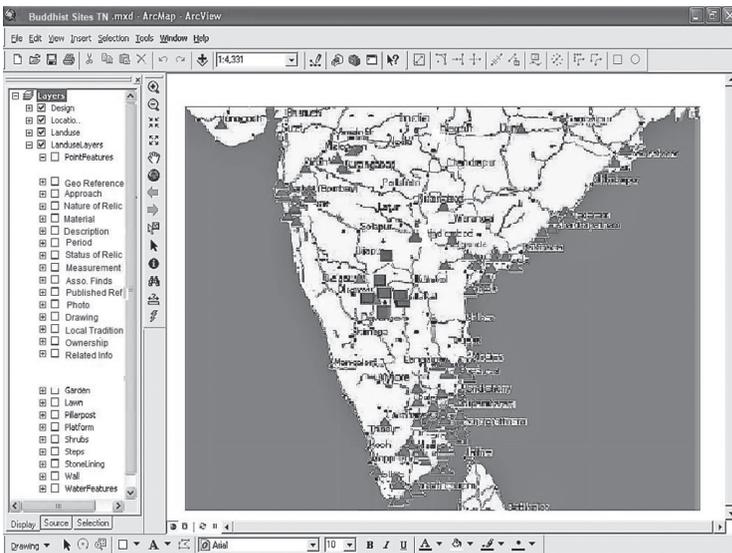
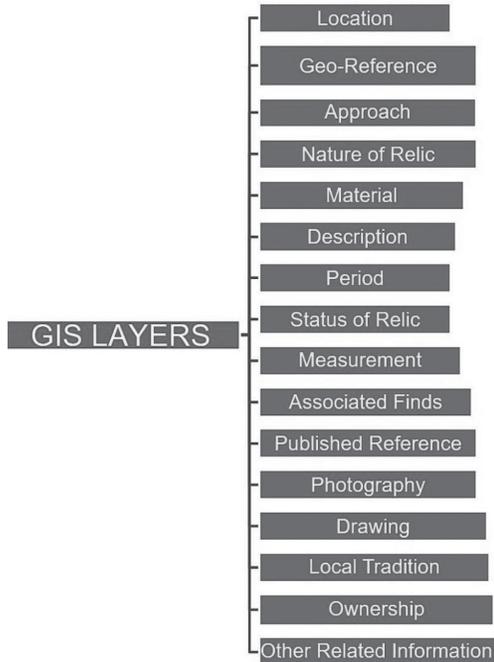
Owing to the proselytizing work of Emperor Ashoka and some of the rulers of the subsequent periods and the merchant communities and lay devotees, Buddhism spread not only throughout the length and breadth of India, but also in Sri Lanka and some other parts of Asia. The existence of hundreds of rock-cut caves and structural edifices of Buddhist affinity in the western India testify the fact that Buddhism was extensively patronized in this region. There are also a large number of Buddhist *stūpas*, *chaityas*, *vihāras*, rock-cut caves and temples in the central, northern and eastern India. However, it is generally believed that the Buddhist activities were minimal in the southern India and hardly there is any Buddhist relics in the southernmost part of India, particularly Tamil Nadu. Surprisingly, the intensive explorations carried out by the author and his team all over Tamil Nadu has brought to light more than 100 sites yielding Buddhist relics in the form of structures, excavated remains, sculptures, bronzes, paintings, terracotta figurines, inscriptions, ancient mounds, etc. All the Buddhist vestiges have been meticulously documented and geo-registered with the use of GPS². Digital map has been created by accurately plotting of all the sites. Mapping of the Buddhist sites not only revealed the distribution of the Buddhist sites in Tamil Nadu and Pondicherry but also enable to identify the focal centres of Buddhism in this area.

An Integrated digital database of the Buddhist sites in Tamil

2. D. Dayalan "Digital Documentation of Buddhist Sites in Tamil Nadu," in Stefano Campana, et.al. (eds.) *Space, Time, Place: Third International Conference on Remote Sensing in Archaeology*, 17th – 21st August 2009, Tiruchirappalli, Tamil Nadu, India, British Archaeological Reports (BAR) International Series 2118, Oxford, 2010, pp. 215-219; D. Dayalan, *Buddhist Remains of South India*, Sterling Publications Pvt. Ltd, Delhi, 2017

Nadu and Pondicherry on the designated GIS platform is created after survey of the sites. Since the GIS is the compatible tool for storing, managing, processing and reproducing volumes of data, it is used to interpret the data derived from various sources more accurately by integrating them.

The data incorporated in the GIS are:



View showing the ArcMap of all the Buddhist Sites of Tamil Nadu and the list of Layers in the Table of Contents and other icons.

All the details of a Buddhist site known as Ariyankuppam along with photographs

While plotting the ancient Buddhist sites of India in general and southern India in particular on the map, an interesting phenomenon has emerged. The concentration of a majority of the Buddhist sites is in the coastal areas and on the trade-routes. Enthrillingly these sites were also seemed to be the hub of maritime and local trade in the early period. Some of the sites are also known for their political prominence. It is not just coincidental, but probably there was a strong link between traders and trade centres and Buddhism. Kaverippumpattinam and Nagappattinam are a few of the many similar sites in Tamil Nadu, which exhibit the nexus between Buddhism and maritime trade.

Kaverippumpattinam (Tamil Nadu), an important port city of the Cōlas of the Saṅgam period (2nd BCE - 2nd CE), is situated on the confluence of the river Kāvēri in the Bay of Bengal. This city was referred to by Ptolemy as “Kaberis Emporion”, whereas *Periplus Mari Erythraei* as “Camara”. Tamil literatures of 1st- 2nd centuries CE gives a vivid account of this port city, its harbour, sailors, merchants, merchandise, etc. They also speak of a tall lighthouse on the coast, *yavanar-irukkai* (colony of foreign traders), etc. A poem from the 1st-2nd centuries CE states that big ships entered the port without slacking their sails and poured out on the beach precious merchandise from different overseas countries and also other ports of India.³ At Kilaiyur, a suburb of Kaveripumpattinam a massive brick platform of 3rd-2nd centuries BCE was brought to light with the remnants of wooden posts. The structure was very likely represented a wharf in the backwaters where boats could have been anchored to the wooden posts.

This metropolis was not only famous for its seafaring activities, but also well known in times of yore as a glorious centre of Buddhism. Many texts indicate the existence and perhaps the prosperous

3. Pattintappālai, line: 185-192.

condition of the Buddhist establishments at Kaverippumpattinam.⁴ There are literary references to the Buddhist monasteries called seven *Intira vihāras* in this city.⁵ These *vihāras*, as referred to in the Tamil work called *Silappatikāram* (c. 5th -6th centuries CE), were not constructed by hand or machinery, but was a mind-born institution.⁶ It further mentions that Indra caused these sacred seven *vihāras* to be built near the *Mahābōdhi* tree, sacred to Buddhist in the city of Pukar (Kaverippumpattinam).⁷ *Manimēgalai*, a Tamil epic of 5th-6th centuries CE speaks of a small pavilion made of crystal in a park called Upavaṇa. A replica of the Buddha's footprint was worshipped there. *Manimēgalai* also states that Killivalavan, a Cōla king converted the prison into a Buddhist monastery at the request of the nun Manimekalai. There existed in the same city, the Cakkaravāliakkōttiam, a Buddhist temple near the burial ground. There was a small Buddhist temple called Kuccarakkutikai which enshrined Goddess Campāpati. Campāpati was considered to be the tutelary deity of the Buddhist at Kaverippumpattinam. It was mentioned that Buddhadatta composed *Abhidhammavatara* in the 5th century CE while he was staying in the monastery built by Kanhadasa at Pukar (Kaverippumpattinam).

Excavations carried out in a locality known as Pallavanecuvaram, a suburb of Kaverippumpattinam yielded an excellent evidence about the existence of Buddhist *vihāra*, Buddhist temple and many other Buddhist edifices of 5th-6th centuries CE.⁸

Nagappattinam, an ancient port city in Tamil Nadu, was referred to as Nikama by Ptolemy, Nagavadana by I-Tsing, Pa-tan by Marco Polo, Malifattan by Rashiduddin and Navutapattana in the Kalyani inscriptions of Dhammaceti (1476 CE). This city was also remained as a significant seaport as well as an important centre of Buddhism for quite a long time. The close association of this

4. *Manimēkalai*, *Silappatikāram*, *Makāvaṇsa*, *Abidammavatara*, *Buddha vancatta*, *katā*, etc.

5. *Silappatikāram*, canto. 10. *Nātu kānu kātai*, line 14, canto. 27 *Nirppatuaik kātai*, line 92; *Manimēgalai*, canto. 26 *Vāñcimānakar pukka kātai*, line 55.

6. *Silappatikāram*, canto. 27. *Nirppatuaik kātai*, line 92.

7. *Silappatikāram*, canto. 10. *Nātu kānu kātai*, line 11-14.

8. K.V. Soundararajan, *Kaveripattinam Excavations 1963-73 (A Port City on the Tamil Nadu Coast)*, Memoirs of the Archaeological Survey of India, No.90, New Delhi, 1994.

place with Buddhism is revealed through the discovery of hundreds of Buddhist bronze images ranging from the 9th century to 16th-17th centuries at many localities. As a result of maritime contacts between South India and China and Southeast Asian countries, there existed in Nagappattinam a colony of foreigners and also Buddhist temples and *vihāras*. During the reign of the Pallava king Narasimhavarman II (c. 700-728 CE), it seems, a Buddhist temple was constructed at Nagappattinam under the order of a Chinese king for the sake of perhaps the Chinese Buddhist who came to Nagappattinam from China for trade. The Śailendra rulers of the Srivijaya kingdom (which comprised of Sumatra, Java and Malaysia peninsula) were also constructed Buddhist temples and *vihāras* at Nagappattinam. The Larger Leyden copper plates of Rājarāja Cōḷa (985-1014 CE) records that a Buddhist *palilii* (temple) in the Culamanivarma vihāra was erected by the Kitara king Maravijayottuṅgavarman at Nagappattinam, perhaps for his subjects who settled at Nagappattinam for trade purpose.⁹ The Smaller Leyden copper plates of Kulōttuṅga Cōḷa I (c. 1070-1122) dated to 1090 CE records the exemption of certain taxes to the villages donated for two Buddhist *paliliis* at Nagappattinam at the request of the ambassadors of the king of Katiaram.¹⁰ It is worthy to mention that an inscription at Nalanda (Bihar state) records that the Śailendra king Balaputradeva built a monastery there in the 9th century CE and at his request the king Devapala of Bengal endowed villages for its upkeep.

Since Nagappattinam was an important port city as well as a Buddhist centre many traders, pilgrims and travellers from various countries visited this place. *Da tang xi yu qiou fa gao seng zhuan* written by venerable Yi-Jing during the T'ang dynasty (c. 690-691 CE) mentions about thirty-nine Buddhist monks came to India through the south sea during the T'ang dynasty period and visited Nagappattinam perhaps to see the Buddhist centres there. The description of a place called Tuta meaning an "earthen tower" in the flat land of Patian (Nagappattinam) in the *Daoyi Zhilue* refers to the existence of a brick tower and also mentioned that the Chinese people

9. *Epigraphia Indica*, Vol. XXII (1933-34), 1984, pp.213-266.

10. *Epigraphia Indica*, Vol. XXII (1933-34), 1984, pp.267-281.

came to Tuta and engraved the inscription in c. 1267 CE. Marco Polo of Venice visited Nagappattinam in the 13th century on his way to China and describes an earthen *stūpa* and Chinese inscription in the flat land of Pa-tan (Nagappattinam). The existence of Buddhist edifice constructed by the king of China at Nagappattinam is also attested to by the Kalyani (Myanmar) inscription (1476 CE) of Dhammaceti, the king of Pegu. According to the inscription, a group of *theras* visiting Ceylon, being shipwrecked, travelled on foot to Nagappattinam and there they visited the site of the Patarikarama monastery. They worshipped an image of the Buddha in a cave constructed at the behest of the Maharaja of Cinadesa. It is well known that a broken brick tower, locally known as “China Pagood” had been standing in Nagappattinam till 1867 was closely similar to the multi-storied brick pagoda of China in character.

1. NEXUS OF BUDDHISM AND TRADE

Geo-registration and *digitization* of the Buddhist sites in India divulge that the trade routes, both maritime and overland, were the primary means by which Buddhist thought and imagery were conveyed from India to various parts of the Asian continent and beyond. The archaeological evidences and the literary sources also vividly elucidate the vital role of the maritime interface for the exchange of Buddhist religious thoughts, missionaries and materials from India to Śri Lanka, China, Korea, Vietnam, Myanmar and Asian countries and vice versa.

The Ganges delta and its dense fluvial network opening out into the sea at many outlets afforded ample opportunity for international interaction of pilgrims and traders. Tamulka (Tamralipti) was one such port had played a vital role for international transactions. Since Tamralipti was the nearest seaport for visiting the prime centres of Buddhism, such as Bodh-Gaya, Nalanda, Rajgir (Rajagriha), Sravasti, Pataliputra, Sarnath, Kausambi, Lumbini, Kusinagara, Vaisali, Vikramsila, Kapilavastu, Sankisa (Siamikasya), etc., in the Gangetic basin, the Buddhist travellers from different parts of the world who came by sea-route landed here and from there they went to various places. (*Figure No. 4*)

Mahāvamsa, the Sri Lankan Chronicle, mentions that the

sapling of the great Bodhi-tree from India was brought through the sea-route by *Mahatheri* Sanghamitta accompanied with eleven *bhikkunis* through the ship. The mission probably started from Tamralipti port. *Mahatheri* Sanghamitta was supposed to have inaugurated the *bhikkuni-sasana* in Śri Lanka. During the reign of Mahanama, the Śri Lankan *bhikkunis* were dispatched to China in 429 CE to establish the *bhikkuni-sasana* by a ship owned by one Nan-t'i (Nandi), who might have been a South Indian. Hemamala in the company of her husband from Dantipura in Kalinga was said to have brought the Tooth Relic to Śri Lanka in a trading vessel which sailed directly from Tāmralipti during the reign of Sirimeghavanna (301-327 CE).

The majority of the Buddhist sites in the western India, which are hundreds in number, were also generally connected with any one of the sea-ports on the coast of the Arabian Sea. The important seaports of them are: Barygaza (Broach), Surparaka or Suppala (Sopara), Semylla (Chaul), and Calliena (Kalyan), all of them are also renowned for their Buddhist vestiges. In fact, the majority of the Buddhist sites of the early centuries in India in general and western India in particular are located on the key trade routes as there were nurtured basically by the local and foreign merchant communities. (**Figure No. 5**) Some of the notable Buddhist sites in the western India located on the trade route are: Bhaja, Bedsa, Karla, Junnar, Kondane, Kondivite, Kanheri, Kuda, Nasik, Pitalkhora, Ajanta, Aurangabad, Ellora, Ghatotkacha, Bhandara, Kol, Karadh, Mahad, Lonad, Nadsur, Karsambla, Sopara, Bhon, Pauni, Mansar, Adam, Ter, Devnimori, Sana, Talaja, Junagadh, Vadnagar, etc.

2. IMPACT OF BUDDHIST PILGRIMS

The spread of Buddhism from India to Śri Lanka, China, Korea, Japan, Vietnam, Myanmar and other Asian countries triggered a profusion of cross-cultural exchanges between India and those countries. The Buddhist monks from those countries were quite often visited India on pilgrimage right from the day of introduction of Buddhism in their soil. It seems that the maritime traders often brought along with them in their long voyages the monks who served as priests, physicians as well as sorcerers. The Buddhist University

at Nalanda was a world-famous Buddhist learning centre and large numbers of Buddhist monks and followers from various parts of the globe stayed and studied in this university. There are a lot of inscriptions from 2nd century BCE and onwards found at Mahabodhi (Bodh-Gaya) records about the donations by Buddhist pilgrims from Sri Lanka, Myanmar, China, Vietnam and other countries.

The travels of Buddhist monks and pilgrims and the simultaneous sharing of religious texts and relics, indeed, stimulate the interactions between the Indian kingdoms and various regions. This network also fostered the trade activities between these regions. The accounts of the spiritual journeys of the Buddhist monks to India are valuable to understand the status of the Buddhist establishments and the socio-economic condition of India during their visit. Furthermore, these accounts also throw light on the ancient land and maritime trade routes, arduous nature of long-distance travel, commercial exchanges, and the relationship between Buddhist pilgrims and itinerant merchants. Faxian's narrative of his voyage on the mercantile vessels, although marked by near-catastrophic experiences due to the ravages of the sea, demonstrates the relationship between Buddhist monks and itinerant traders as well as the existence of maritime trading channels linking the coastal regions of India and China. It is also evident from Faxian's account that maritime travel between South Asia and China was perilous and the navigational techniques extremely rudimentary.

One of the earliest Buddhist pilgrims, mentioned to have attempted to visit India, was Tchou Che-hing, a native of the modern province of Ho-nam. He left his homeland for Khotan about 260 CE and died there without being able to reach India, which he had his goal. Faxian, Xuan-zang and Yi-jing were among hundreds of Buddhist monks from China, Korea, Vietnam and other Asian countries who made pilgrimages to India during the first millennium CE. It appears, Buddhism was introduced into what was in those times known as Giao-Chi (present North Vietnam) by the monks who came from India and China by land and sea-routes. During the reign of Si-Nhiep or Shiti Hsieh (187-226 CE), Giao-Chi had grown up as an important Buddhist centre with the affluence of the Indian merchants trading in that area.

3. ROLE OF TRADE AND TRADERS IN ESTABLISHMENT OF BUDDHIST CENTRES IN INDIA

As stated elsewhere that many of the Buddhist centres in India were happened to be an important maritime trade centres or located on the major trade routes. Apparently, the trade and traders both local and foreigners had played an incredible role in promoting these Buddhism centres. Furthermore, Buddhist monasteries provided accommodation and health care to the long-distance traders, many of whom reciprocated by giving donations to the monastic communities. There are many religious institutions and colonies in India, which were either established or patronized by the foreign traders or rulers who came in contact with these centres through trade. Likewise, the South Indian traders and merchant guilds such as *Ainūrruvar*, *Manigramam*, *Nanadēsi*, *Padineni-vishayam*, *Padineni-bhūmi* and *Añjuvaniniam* had also played a significant role in establishing/patronizing the religious establishments abroad as well as in India.¹¹

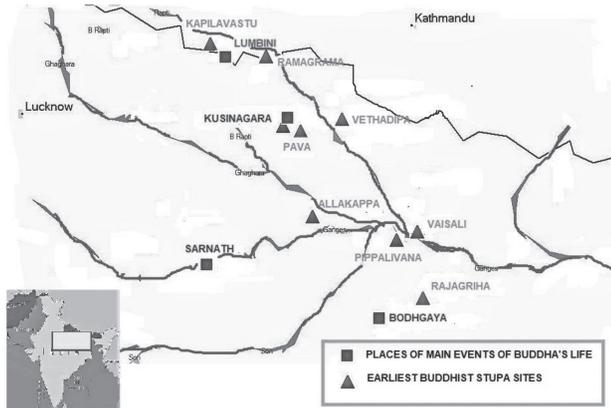


Fig.1. Map Showing the Places of Main Events of Buddha's Life & Earliest Buddhist Stupa Sites

11. D. Dayalan, "Role of Trade and Tamil Traders in Promoting Buddhism", D. Dayalan (ed.) *Sivasri: Perspective in Indian Archaeology, Art & culture (Birth Centenary Volume of Padma Bushan Dr. C. Sivaramamurti and Padma Bushan Sh. K.R. Srinivasan)*, Agam Kala Prakashan, Delhi, 2013, pp. 15-34; D. Dayalan, "The Role of Archaeology in the Study of Maritime Buddhism in India", *The Maritime Silk Road and Seaport Cities*, Sunin Publishing, Seoul, 2015, pp. 233-266.

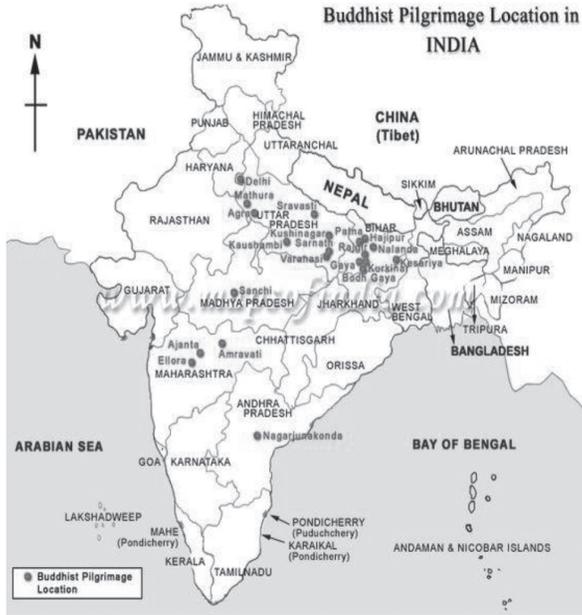


Fig.2. The notable Buddhist Pilgrimage Centres in India



Fig.3. Buddhist Stupa of 3rd-1st cent BCE, Sanchi

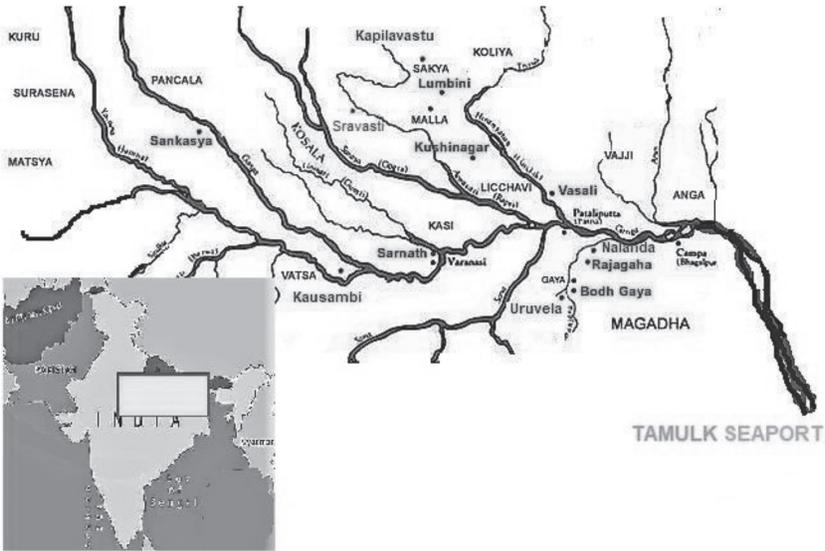


Fig.4. Buddhist Pilgrim Centres in the Gangetic Basin

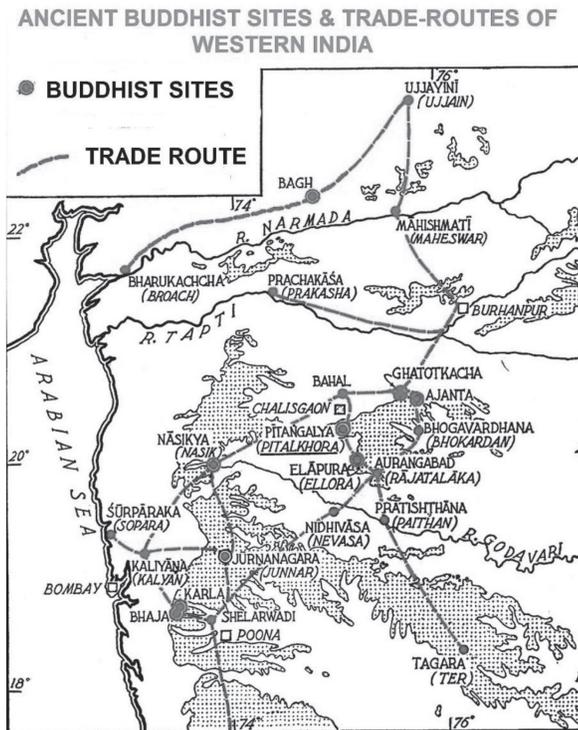


Fig.5. Ancient Buddhist Sites & Trade-Routes of Western India

THE BUILDING BLOCKS FOR OPEN ECOSYSTEMS OF ONLINE RESOURCES SERVING BUDDHIST COMMUNITIES

by Alex Amies*

ABSTRACT

The paper gives an overview of the state of the art of the software building blocks for development of online resources serving Buddhist communities and how those are driving new capabilities and broadening access. Possible choices of technologies that take advantage of the efficiencies denoted by economists as part of the Fourth Industrial Revolution are explained. The central theme described is the huge scale and rapid evolution of the open source movement and modular package management systems that are built on open source. Illustrative examples are given from the author's experience developing web applications for the study of Buddhist texts, including translation projects for Fo Guang Shan. The changes brought by these technologies in the last five years are great and further impact is still to come. The author hopes that the evolving technologies can bring more improvements to Buddhist resources, including large scale translation of the Chinese Buddhist canon and the collected works of Venerable Master Hsing Yun to English. Large scale translation of historic texts will not necessarily be based on machine translation but machine translation will be important nevertheless. An additional impact is the broadening of access to high quality scholarly resources beyond the academic community to the monastic and lay Buddhist communities.

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1. INTRODUCTION

This paper describes building blocks of open systems at two levels: the level of user experience for people accessing online resources and the development of those resources. The software systems described include websites, dictionaries, and online text collections. The theme of this track of the conference¹ is the Fourth Industrial Revolution. In his book *The Fourth Industrial Revolution*, Schwab explains that the most revolutionary impact is not just the new technologies themselves but it is the amplification of the interconnectivity between these technologies (Schwab 2017, pp. 1-3). This amplification is most important at the level of development of software systems due to interconnectivity between both the developers of the systems and of the software components making up the ecosystems. In the now classic book on open source *The Cathedral & the Bazaar*, Raymond describes the how some of the best and brightest minds in the world were attracted to the computing industry in the 1960s-1990s and evolved an early “hacker culture” (Raymond 2001, p. 9-17). The open source community developed from this early computer science culture. However, it was not until the rise in popularity of cloud computing over the last ten years that open source became widely used by businesses. There are two ways that the amplification described by Schwab is seen in the open source community: 1. the opportunity to contribute visible artifacts in large communities and free communication drives a high level of engagement among skilled software developers; 2. the software modules themselves via the package management systems, which are continuously automatically downloaded, compiled, tested, repackaged, and deployed to create new software.

What is meant by an open ecosystem and why should project sponsors care? Software projects serving the Buddhist community are sponsored by Buddhist temples, universities, and lay people. At the level of end user experience a linked

1. <http://www.undv2019vietnam.com/>

collection of simple websites is a great example of an open ecosystem. An important aspect of this open ecosystem is the links from external locations to specific content within a website. A project sponsor should care about enabling inbound links because it will enable more users to discover content and navigate directly to the most relevant location. Closed systems, in contrast, present user with a link to install new software or no link at all. Such closed systems lock up resources, inhibiting communication and innovation.

Buddhist teachings have had a large impact on many people's lives, from being able to think beyond ideas of self to dealing with impermanence of the loss of one's loved ones. However, most people in the 21st century have access to tertiary education and multiple religions and do not necessarily take Buddhist teachings at face value. Lay Buddhists and interested people from other belief systems often want access to authentic canonical texts and scholarly analysis of those. The use of open ecosystems is critical in extending open access to high quality, scholarly content beyond the academic community to communities of monastic, lay people, and the public in general. Barriers locking of academic publications in closed digital libraries and open alternatives will be discussed below.

Open discussion amongst end users is not the intended sense of 'open.' It is a possible interpretation but is outside the scope of this paper.

The Diamond Sutra states, "If a bodhisattva gives without abiding in any notion whatsoever, then his merit will be immeasurable" (Fo Guang Shan International Translation Center 2016, p. 17). The goals of open source movement in freely publishing software to the global community are mostly compatible with Buddhist ethics. While the individuals and business publishing the software have not necessarily been free of expectations of gaining something in return, the impact in many cases has been extremely large.

At the level of software development an open ecosystem is one that is based on publicly available software, such as open

source, and also publishing the software developed under an open source license. Schwab writes, “when firms share resources through collaborative innovation, significant value can be created for both parties as well as for the economies in which such collaborations take place” (Schwab 2017, p. 60). The open source community is the largest such collaborative community today. As an illustration of the unprecedented size that successful open source ecosystems have become, the open source repository management platform GitHub currently reports 31 million developers with 96 million repositories.² Even the resources of the largest corporations and governments cannot match this. In contrast to the opaque silos created by closed ecosystems the transparency of open source drives massive, unplanned innovation, and often disruption. The disruptive aspect should also be considered. The disruption has mainly been to businesses that depend on sales of packaged software for revenue since their products are now in competition with freely available software.

The transformation that is occurring today with open source ecosystems is a combination of three things: 1. the transparency and free access of the open source model; 2. the availability of free services to distribute digital assets via open source repositories; and, 3. package management systems for the automated download, deployment, and use of software modules. It is not just the existence of open source software, it is the convenience and version control structure of free hosted services for open source repositories, such as GitHub and GitLab, that makes the difference. The version control structures imposed are typically rigorous. These consist of an ownership model enabling participation from the public in general, a review and approval process, revision history and rollback, and optionally format checking and testing. There has also been an explosion of free package management systems including the Debian package management system for Debian Linux, npmjs for JavaScript modules, Python Package Index, iPython (interactive Python) scripts, and Docker containers.

2. <https://blog.github.com/2018-10-16-state-of-the-octoverse/>

Examples of modular package management systems that leverage these hosted services are the Debian apt-get install command, pip command for Python packages, and Colab for iPython. A recent change is building access to open source repositories directly into tools provided with programming languages, such as the ‘go get’ command for the Go language, which automatically downloads Go packages and their dependencies from GitHub³.

The NTI Reader⁴ website developed hosts the text of the Taishō canon and the Humanistic Buddhism Reader (HB Reader)⁵ web site hosts the text of Venerable Master Hsing Yun’s collected works. Both websites include an integrated Chinese-English Buddhist dictionary. These websites, developed by the author, use many of the open source and modular systems listed above. The code for the projects are hosted in GitHub published with an Apache 2 open software license and text assets with a Creative Commons license. The NTI Reader and HB Reader depend on open source at every level. This includes software that is written in the open source programming language Go that runs in Docker containers. Container images for the web application are stored in a container repository that can be downloaded and deployed on demand. The text search application is based on a machine learning application is trained for document relevance using Colab. The text assets would not have been possible to develop without the use of text assets from other institutions published with a Creative Commons license.

These websites are among the resources used by teams of translators at Fo Guang Shan for translation of Chinese Buddhist texts to English. These teams of translators use other collaborative tools, such Google Docs, that allow multiple authors to collaborate and write publications in real time. Besides the NTI Reader and HB Reader, the group makes use of new resources developed by other Buddhist groups, from

3. <https://golang.org/cmd/go/>

4. <http://ntireader.org>

5. <http://hbreader.org>

both temples and academic institutions. Some of the popular tools include the SAT Taishō Shinshū Daizōkyō Text Database 大正新脩大藏經 from the University of Tokyo,⁶ the Chinese Buddhist Electronic Text Association CBETA 中華電子佛典協會,⁷ the Digital Dictionary of Buddhism,⁸ and the Fo Guang Dictionary of Buddhism.⁹ These new tools and online resources are enabling faster translation of a Chinese texts, which is very important considering the enormous volume to be translated. It now finally seems like there is hope for a complete translation to English of the historic body of Chinese Buddhist literature with or without the aid of machine translation.

There are several points that make Chinese Buddhist literature unique.

The long literary history of Chinese Buddhism provides opportunities and challenges. One opportunity is that the expired copyright enables free reuse of the text. A challenge is in processing and understanding the archaic language, some of which dates back two thousand years. We have lost much of the historic context and understanding of the languages, which needs to be reconstructed by a limited number of expert scholars.

Chinese has no spaces for delimiting words. This leads to more challenges in NLTP for text segmentation. Historic Chinese texts have no punctuation, which is even more difficult.

The use of traditional versus simplified Chinese characters and historic character variants provides even more challenges in text processing.

The religious nature of Chinese Buddhist texts fosters a large lay community

The implication of these unique points is that Buddhist studies has its own unique challenges to solve and cannot completely rely on the tools and resources of other communities.

2. ECOSYSTEMS AND COMMUNITIES

6. <http://21dzk.l.u-tokyo.ac.jp/SAT/ddb-bdk-sat2.php>

7. <http://tripitaka.cbeta.org/>

8. <http://www.buddhism-dict.net/ddb/>

9. <http://etext.fgs.org.tw/search02.aspx>

Buddhist and humanities academic communities have benefited from both open and closed ecosystems of software and online resources. Some of the building blocks of open ecosystems that are central to the online resources used by the Buddhist are described.

3. OPEN ECOSYSTEMS

There are a number of key elements that enable the openness of the World Wide Web but are easy to take for granted. Open access on the world wide web depends on the use of hyperlinks as defined in the Hypertext Markup Language (HTML) standard from the World Wide Web Consortium (W3C).¹⁰ Users can navigate from one site to another by following these hyperlinks, crossing site ownership boundaries in the process. A development that may surprise users is that many large applications are now ‘single page applications’ (Mansilla 2018, pp. 162-163) written entirely in JavaScript. In these applications there is only one HTML page with JavaScript that dynamically manipulates the Document Object Model (DOM) to display new content to users and to handle incoming requests to different links. These applications are most frequently powered by web application frameworks like Angular, React, and Vuejs. These web application frameworks can help provide better user experience by minimizing the time spent going back and forth to the remote servers and still enable hyperlinks in the traditional way, if considered in the design of the application. With HTML5 local storage they can act like installed native applications. Careful thought is required in the design to retain the original flavor of the Web as a network of interlinked web pages.

At the other end of the spectrum are closed monolithic systems, including many digital libraries where access to the digital library requires login via a user account that is granted via membership in an organization, such as a university, or via a credit card. In many of these closed systems the links terminate at site ownership boundaries, such as a login screen. Some of this variety of ecosystems are not fully closed, for example incoming links to books in online bookstores to a specific book may be supported. However, the ebooks do not contain any outbound links or prevent export of

10. <https://www.w3.org/html/>

data, say via disabling cut-and-paste. Other examples of closed ecosystems are mobile applications or single page web applications that do not handle inbound requests linking to specific resources. The closed nature of these systems can be avoided if the project owners take appropriate design and care in development. Some digital libraries are exemptions. For example the [arXiv](https://arxiv.org/) digital library developed by Cornell University and the Internet Archive digital libraries, allow inbound links to ebooks without login required and allow exporting of data out, via downloading in unlocks formats.

The academic community is now encouraged to move to a more open model for publications by the open access movement. The concentration of publication of academic journals in control of small number of publishers has created an economic barrier for readers of academic literature outside of large universities (Eger and Scheufen 2018, ch. 1.1). This has especially been a problem for Buddhist monastics and lay people seeking to access academic literature on Buddhist subjects. Open access refers to making academic publications available free of cost online. An example of an open access publisher is Frontiers Media, which is an Open Access publisher of peer reviewed academic journals.¹¹ Frontiers Media also enforces a Creative Commons license to allow free copying of publications. The free availability of open source software is one of the enablers of this. A compromise that allows authors to choose to self-archive their own articles with free public access is called 'green open access' (Eger and Scheufen 2018, ch. 1.3). In summary, open access is one of the building blocks of open ecosystems.

In the past and still continuing into the present, support of software by vendors was considered a major cost. Today the cost of that support is reduced by many vendors via online forums, such as Stack Overflow. According to their own survey, in 2018 about 50 million people visit Stack Overflow each month to seek and give answers to technical questions.¹² One of the great benefits of participating in a technical community like Stack Overflow is in avoiding antipatterns. An antipattern is a solution to a problem

11. <https://www.frontiersin.org/>

12. <https://insights.stackoverflow.com/survey/2018/>

that has negative consequences (Brown 1998, pp. 7-8). A common antipattern found in web applications is serving of dynamically generated web pages of data with in a way that prevents indexing by search engines. For example, if a web application framework, such as .NET or Java Servlets, retrieves data from a database and uses that to generate web pages behind a small number of URLs then search engines and their users may not be able to discover the content, even if login is not required. This related to prevention of linking described above. Therefore, public technical forums like Stack Overflow are another of the building blocks of open ecosystems.

4. BUDDHIST RESOURCES AND COMMUNITIES SERVED

The Buddhist online community is a union of the Buddhist monastic community, the lay community, the Buddhist academic community, and the interested public at large. The University of Tokyo has sustained a tradition of the study of East Asian Buddhist literature for over one hundred years. The University of Tokyo created the Taishō Shinshū Daizōkyō 大正新修大藏經 (Taishō canon), the main version of the East Asian Buddhist canon used by scholars today, over the period 1912-1926. Nearly a hundred years after that effort began in 2008, the University of Tokyo released the SAT digital version of the Taishō canon (Muller, Shimoda, and Nagasaki 2017, pp. 175-179). This effort was driven almost entirely by scholars. The Buddhist community in Taiwan has included more participation from monastics and lay people. Wilkinson describes the community of monastics, scholars, and lay believers who joined forces in the large effort for the development of the CBETA project for the initial scanning of the Taishō Tripitaka and development of the online canonical texts in Taiwan (Wilkinson 2017, pp. 160-162). Digital versions of the Korean Buddhist canon have been published as well (Lancaster 2010).

The initial digital versions of the Taishō canon took over ten years to develop, chiefly because the creators had to overcome challenges with coverage by the Unicode standard and also lack of optical character recognition (OCR)

capabilities for Chinese characters at the time. Now that those initial foundational standards and capabilities are established subsequent capabilities are taking place more quickly. Both the SAT and CBETA allow integrated dictionaries and both inbound and outbound links to encyclopedic and bibliographic resources. The Bukkyo Dendo Kyokai (BDK) or ‘Society for the Promotion of Buddhism,’ founded by Yehan Numata (1897-1994) sponsors the translation to English of many of the texts in the Taishō.¹³ These are integrated into the SAT website in the form of a parallel corpus.

Fo Guang Shan has published a number of online resources as well. These included print and online versions of the collected works of Venerable Master Hsing Yun, the founder of Fo Guang Shan; the Fo Guang Dictionary of Buddhism, a dictionary of over 32,000 terms with both print and online versions, and a set of canonical writings including later period writings from the Ming and Qing not available elsewhere. Fo Guang Shan has assembled a large team of translators that includes lay volunteers, monastics, full time staff, university faculty, and graduate students. General online tools that have recently become available, such as Google Docs and video conferencing, are enabling teams to scale out. The online resources mentioned are enabling more rapid progress.

5. PLATFORMS, STANDARDS, AND BUILDING BLOCKS

Free hosting services for open source repositories have been one of the most important building blocks for the open source movement. GitHub is based on the open source version control system git, first released by Linus Torvalds in 2005 in order to host the source code for the Linux kernel (Loeliger and McCullough 2012, loc. 254). GitHub was founded in 2008 and acquired by Microsoft in 2018 (Microsoft 2018). The unit of hosting on GitHub is the repository. A repository can be freely and instantly created by anyone with Internet connection. Changes to source code can also be pushed freely and instantly. However, the highly structured process defined by the git is critical in maintaining software quality.

13. http://www.bdk.or.jp/english/english_tripitaka/publication_project.html

An ownership and review process enforced and the record of changes maintained are central to the release process. The software and base digital assets for the NTI Buddhist Text Reader is an example of a Buddhist project is maintained on GitHub.¹⁴

5.1 Standards

Developers of web platforms have been aware of the importance of standards since the beginning of the web. Standards for basic web development include HTML, extensible markup language (XML), and JavaScript Object Notation (JSON) emerged and evolved with the development of the web. At a higher level standards like the Text Encoding Initiative (TEI),¹⁵ and Resource Description Framework (RDF) were developed for needs closely related to digital libraries. TEI is a standard that has been adopted by the digital humanities community. TEI gives recommended structures for text corpora, bibliographies, and dictionaries. The Digital Dictionary of Buddhism (DDB) uses TEI for storage of the dictionary terms (Muller, Nagasaki, and Soulat 2012). The DDB benefited from a number of other standards, including XML and Unicode, since its initial creation in 1986.

The standards mentioned have been critical enablers for projects, such as DDB. However, standards and the committees that lead them move relatively slowly compared with the rapid movement of the open source community at large. Nevertheless, standards have been critical for the development of open ecosystems of modules.

5.2 Breaking Down Monolithic Systems

Software modules, also called components, are not easy to design. According to Bevacqua, the most important principle in module design is that a module should have a single responsibility (Bevacqua 2018, pp. 38-43). In addition, a module should be accessed via a well defined interface that is not coupled to its implementation. Also module should also be testable. When modules have these simple but hard to achieve properties and they are stored in publicly accessible package management systems then

14. <https://github.com/alexamies/buddhist-dictionary>

15. <http://www.tei-c.org/release/doc/tei-p5-doc/en/html/DI.html>

a high degree of automation is possible in a continuous integration / continuous delivery (CI/CD) pipeline. That is, software developers are continuously pushing software that is automatically downloaded, integrated, tested, and deployed in stark contrast to previous generations with waterfall processes where release cycles often took years.

In thinking about the requirements for various projects that the author has worked on for Fo Guang Shan, the author proposed building a digital library. A digital library would be able to combine many requirements into a single consistent home for users to discover and access everything necessary for their work. However, the problem with the proposal was its monolithic nature. Fo Guang Shan has many projects, which made a large project like a digital library a distraction. Digital libraries include a large set of requirements for submitting, cataloging, searching, and accessing collections of books and other digital assets (Xie and Matusiak 2016, loc. 569-700). However, modularity and participation by the software development community is not prominently discussed in the digital library literature. Today is not common for ebooks to link to specific pages in other ebooks. Rather ebooks are still using traditional citations. These points are in contrast to open systems of websites, many of which today are implementing features overlapping with digital libraries. However, digital libraries maintained by other parties are important tools for translators of canonical Buddhist texts especially for research of historic context. In summary, a digital library may be too big of a building block for practical development.

The principles of modular design can be illustrated using the author's experience with Buddhist dictionaries. There are many different types of dictionary: monolingual dictionary, bilingual dictionary, historic dictionary, specialist dictionary, and others (Atkins and Rundell 2008, pp. 24-26). The goal of the NTI Reader project is to aid Chinese users to read and translate Chinese Buddhist texts. Therefore the type of dictionary selected is a Chinese-English bilingual dictionary.

Human language is complex and historic texts are more complex but coping with this can be made efficient if the user tasks can be

modelled with software components. An entry in a dictionary can have multiple word senses, which are nearly the same as lexical units as defined lexicography (Atkins and Rundell 2008, pp. 130-131). One requirement for the online dictionary software is also to underline or otherwise highlight certain terms, such as Buddhist terminology or proper nouns, in a passage of Chinese text to let the reader know the key terms. Another requirement from the dictionary software stakeholders is to display entries from multiple dictionary sources for a given word. Combining these requirements into a model, the author developed the object model for the chinesedict JavaScript component described in Table 1.

Table 1: Object Model for the chinesedict-js JavaScript Component

DictionaryBuilder	Retrieves dictionaries from the server, parses them, and makes the data available to the browser
DictionarySource	The source of a dictionary, including file location, the name of the creator, and a title
DictionaryView	Presents the dictionary to the user, such as for looking up a term
DictionaryEntry	The term to be looked up and the data in one of the dictionary sources
WordSense	One word sense for the term, including the pronunciation, part of speech, English equivalent, and notes

The developer of an application that uses the dictionary will supply multiple DictionarySource objects to the DictionaryBuilder, which build the dictionary and return a DictionaryView showing the highlighted words. When the user clicks on one of the words the DictionaryView will present a dialog showing the Term with one of more DictionaryEntry objects, each of which will have one of more WordSense objects. Although this appears complex, it is simpler than the TEI recommendation for dictionaries, for which a dictionary entry can include orthography, pronunciation, part of speech,

senses, quotation, usage, etymology, related entries, and notes (“P5: Guidelines for Electronic Text Encoding and Interchange” 2018, ch. 9). This is somewhat analogous to a person reading a printed text. The person would have a collection of dictionaries: specialist Buddhist dictionaries, bilingual Chinese dictionaries, monolingual literary Chinese dictionaries, and specialist dictionaries of historic people and places. For interesting words encountered in the text, the person would consult the various dictionaries to decipher the meaning intended in this context. In summary, if user actions are modelled and developed as components, reading and translation of difficult texts can be made very efficient.

5.3 Modular components

Modular software development allows for convenient re-use of software in the form of libraries. The value of this has been recognized for many decades. What is new in the last several years is the combination of modular software systems with open source software and the emergence of platforms for hosting the modules. Various languages and platforms use terms other than ‘module’, often ‘package’ or ‘container.’

Besides enabling source code revision control for Linux and related projects, git has been also been an enabler for modular software development in general. For example, the Go language, which was initially released in 2012, uses a package management system allows importing of third party packages retrieved from remote sources using git. This can be done using the ‘go get [URL]’ command.¹⁶ This makes it very convenient to reuse open source Go packages hosted on GitHub. The Chinese Notes software¹⁷ that powers the NTI Reader uses Go and is hosted on GitHub. However, the software is not organized in a way that allows other developers to access the packages with the go get command. There is an opportunity to refactor the code in a way that is more reusable by others. The step that is missing here is illustrative of one challenge of software reuse: it takes extra effort and careful planning to make your software reusable by other developers.

16. https://golang.org/cmd/go/#hdr-Module_aware_go_get

17. <https://github.com/alexamies/chinesenotes.com>

Container systems are another technology that has exploded in the last several years. The most prominent of these is Docker, first released in 2013. Containers have been revolutionary in enabling dependency management and efficiency in deployment and running of systems with open source software. The NTI Reader makes use of Docker containers but does not provide a container for other developers to conveniently reuse. The benefit to the NTI Reader of using containers are that they allow reliable operation of the web application in a cluster and easy rollback in case a code change is rolled out that breaks the application.

JavaScript module systems are one of the newest and most important developments impacting web application development. There has been rapid evolution of JavaScript or ECMAScript in the last few years via the ECMA standards body.¹⁸ In 2015 the ES2015 release included major changes, such as changes in scoping, arrow syntax, classes, template strings, Maps, Promises and modules. These new features have been a substantial enabler of more complex and more powerful JavaScript applications and driver of change in the JavaScript ecosystem. Modern browsers have now adopted most of the recommendations in ES2015. However, the most startling phenomenon has been the rapid rise of the ecosystem of JavaScript modules. At the time of writing this paper, there were 883,140 modules hosted on the Node Package Management service npmjs.org with 8,897,268,546 downloads in the previous week.¹⁹ The number of downloads is startling as an indication of the degree of automation in downloading by CI/CD pipelines.

In addition to ES2015 modules there are other JavaScript module systems, including CommonJS and the AngularJS module systems (Bevacqua 2017, pp. 296-297). NPM leverages the package.json²⁰ format that is used to describe publication of JavaScript modules. This greatly helps structure the download and use of the modules. The UNPKG²¹ system freely distributes JavaScript packages to make them directly accessible to websites via a content distribution

18. <https://www.ecma-international.org/memento/tc39.htm>

19. <https://www.npmjs.com>

20. <https://docs.npmjs.com/files/package.json>

21. <https://unpkg.com/#/>

network (CDN). This is exactly the kind of amplification described Schwab above by enabling low cost, universally available, structured automated download and distribution of software.

5.4 Artificial Intelligence

Artificial intelligence, specifically machine learning, is becoming an important tool that can be leveraged for digital humanities projects, especially with natural language text processing. Three recent developments in machine learning are having a large impact on the development of Buddhist resources and digital humanities in general: (1) the improvement of deep learning methods for processing natural language, (2) the release of open source machine learning frameworks, and (3) the ‘democratization’ of machine learning through application programming interfaces (APIs) and services that do not require deep specialization in the field by the developers using them. This is really the same pattern as described for open source software in general as described above.

TensorFlow is an deep learning (artificial neural network) library released to open source by Google in 2015 and in 2016 became the most popular machine learning project on GitHub (Dean 2017). Keras is an open source project that wraps TensorFlow and other deep learning libraries to make them easier to use by software engineers not specializing in machine learning (Chollet 2018, pp. 29-30). The Colab²² service hosted by Google provides a free hosted solution for running iPython programs that leverage machine learning software, particularly TensorFlow.²³ The iPython programming model encourages an iterative programming style where code and data can be viewed and save together. Colab sheets can be saved to GitHub and the output viewed directly by other users. Together TensorFlow, Keras, and Colab enable software engineers and data scientists to conveniently and cheaply develop machine learning applications and collaborate in a global community.

The NTI Reader uses machine learning for document search. The NTI Reader text search feature classifies documents as relevant

22. <https://colab.research.google.com/>

23. <https://github.com/tensorflow>

or not-relevant with a combination of vector space model document similarity scores (Zhai and Massung 2016, pp. 90-92). The scores are based on word and bigram frequencies. The scores are combined using machine learning with a technique called logistic regression by the open source library Scikit-learn (Pedregosa et al. 2011). The resulting Colab sheet was saved to the author's GitHub project to allow anybody to review the data re-run the code.²⁴

The Buddhist academic community is investigating the use of machine learning to scale analysis of historic data beyond individual scholars manually examining data. For example, Bingenheimer discusses the use of named entity recognition for the discovery of the identities and references to people and places from corpora of historical East Asian texts, in particular the Digital Archive of Buddhist Temple Gazetteers²⁵ (Bingenheimer 2015). There are many obstacles to machine learning with historic Chinese text sources, including lack of digitization and lack of punctuation in the stream of text. An example of machine learning in Buddhist studies to overcome this is the automatic insertion of punctuation and optical character recognition in historic Chinese texts by researchers working with Longquan temple (Liu 2018).

While the early digital versions of the canon were manually typed from print editions (Muller, Shimoda, and Nagasaki 2017, pp. 177) later versions have been able to be digitized using OCR. Early OCR techniques worked adequately for printed Chinese texts enabling scanning of the Taishō, Yongle Northern, and the Qing Dragon canons (Fang, p. 210). Correction of scanning errors was a large task for these scanning projects. Recently, OCR techniques based on machine learning have been used to scan handwritten historic texts that were not able to be scanned with early generations of OCR technology.

Although important, the use of machine learning by the Buddhist academic community is trivial in comparison to the highly dynamic community of data scientists in competitions, such as those hosted

24. https://github.com/alexamies/chinesenotes.com/blob/master/colab/querying_cnotes.ipynb

25. <http://buddhistinformatics.ddbc.edu.tw/fosizhi/>

on Kaggle.²⁶ 600,000 new users joined Kaggle in 2017 for a total of 1.3 million members.²⁷ Such a large community will certainly drive improvements in machine learning that will have an impact on Buddhist studies.

To date machine translation has not been useful for translation of canonical and other historical texts. However, it is not inconceivable that this will change in the near future. Today, machine translation is already having an impact in the translation of academic publications in modern languages other than English. Medieval Chinese literary scholar Knechtges describes the challenges of translating historical texts in his essay on the translation of the important and large historic text *Wen Xuan*, which took over 14 years (Knechtges 1995, pp. 41-42). One problem was the variety of styles encountered considering the long historic period that the work covered. The sources for understanding the background to these styles themselves are untranslated historic texts. This resulted in the need to establish translations for large number of new terms. However, much of the historical context of these works is also discussed in modern Chinese sources, which can be accessed via machine translation.

In Buddhist studies, many Western Buddhist scholars have learned Japanese to access the large body of modern Japanese academic literature on Buddhism. Translation of this body of literature from Japanese to English and other languages is also possible with machine translation. Starting in 1984, Japanese journal articles on Buddhism have been indexed in INBUDS and these are linked from SAT (Muller, Shimoda, and Nagasaki 2017, p. 176).

Some Fo Guang Shan translation team members have experimented with machine translation for modern text. While the results is not directly suitable for publication, it can be helpful as a first step.

5.5 Mobile Accessibility

For online resources to be accessible to a wider community they

26. <https://www.kaggle.com/>

27. <http://blog.kaggle.com/2017/12/26/your-year-on-kaggle-most-memorable-community-stats-from-2017/>

should be accessible on mobile devices. One issue that has arisen is the accessibility of web sites to mobile devices. For example, some websites display very small text on mobile devices or rely on behavior, such as mouseover, with no mobile equivalent. This led to an explosion of mobile applications. However, native mobile applications behave as islands and do not work well in open ecosystems. Responsive web applications are websites that can be accessed on both workstations and on mobile devices without substantial degradation of experience. In the last several years responsive web application frameworks, such as Material Web from Google,²⁸ have been developed and released to open source. A best practice is to develop web applications rather than native mobile device applications and leverage web component frameworks to enable use on mobile devices. In that way, the websites can function as building blocks for open ecosystems on mobile devices as well as workstations.

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ABBREVIATIONS

API: application programming interfaces

CBETA: Chinese Buddhist Electronic Text Association 中華電子佛典協會

CI/CD: Continuous integration / continuous delivery

DDB: Digital Dictionary of Buddhism

ECMA: European Computer Manufacturers Association

ES: ECMAScript

HB: Humanistic Buddhism

28. <https://material.io/develop/web/>

NPM: Node Package Manager

NTI: Nan Tien Temple

OCR: Optical character recognition

SAT: Taishō Shinshū Daizōkyō Text Database

TEI: Text Encoding Initiative

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IMPACT OF DIGITAL TECHNOLOGY ON BUDDHIST EDUCATION

by Miroj Shakya*

ABSTRACT

Digital technology is transforming every aspect of our life and also rapidly changing the education system throughout the world. People all over the globe are slowly shifting away from the traditional classroom based model of education. Students are also learning more outside of the classroom through various digital devices via modern smart enabled TVs, cell phones, computers, tablets, iPads and all the other multiple platforms. Professors and students are able to communicate more efficiently with each other with the help of digital technology. The advent of digital technology into the Buddhist education brought it into new territory with opportunities for Buddhist scholars, students and practitioners. In this digital age, there is a need for Buddhists to incorporate new technologies into their education systems to keep pace with modern methods. Buddhist education will remain ineffective without bringing about some substantial modifications to educate the young generation with Buddhist wisdom and values. Buddhist academics should use digital tools to promote their scholarly works carefully. Here in this paper, an attempt may be made to discuss how the technology is impacting Buddhist education in this digital age in both positive and negative manners. What are the online resources available for Buddhists to use for their research and practice?

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1. POSITIVE IMPACT OF TECHNOLOGY

1.1. Interactive learning environment

Use of technology such as audiovisual material, and PowerPoint causes classes to become more interesting and creates a more interactive learning environment. New literacy is breaking boundaries by integrating video, images, music, and animation features to the traditional print media (Collins & Halverson 2009, p. 13). As Hamilton points out:

Technology offers ways to deliver content, meaningfully connect with students, and model rigorous academic discourse without the difficulties and challenges associated with assembling five hundred students and their phones, tablets, and laptops in one room to watch a small figure forty rows away read through his or her PowerPoint slides for an hour. (Lupton et al. 2018, p. 113)

Teachers are using different learning management sites, such as Moodle to interact with students. Students are using such site to do their homework and write a reflection on lessons on the basis of what they have learned in the class (Collins & Halverson 2009, p 13).

Most of the schools and Universities are beginning to utilize smart classrooms with digital tools for teachers and students to assist them, and certain schools are turning into smart schools.

As Lupton, Mewburn and Thomson highlight “*the discourse of smart schools is accompanied by that of the ‘smart university’, a model of tertiary education in which academics are proficient in employing digital media for teaching and research are equipped in accessing data analytics to measure and monitor student learning and their own teaching performance*”. (Lupton et al. 2018, p.6)

1.2. Globalization of Buddhism

Technology plays a big role in globalizing Buddhism. Buddhist teachings are transmitted through digital media and the Internet. Many Buddhist TV channels run by various Buddhist organizations are running 24 hours programs which are directed towards disseminating the Buddha’s teaching in Taiwan (BLIA TV, Da Ai TV), Nepal (Bodhi TV), Sri Lanka (The Buddhist TV), Thailand

(DMC TV) and other countries.

Another effective way of dissemination of Buddhist teaching is offering online classes. More people outside the classroom are able to attend the Buddhist lectures through online streaming. In the 21st century, distant learning and online education became an internal part of education in Buddhist Universities. It has already made a huge impact globally. Students around the world can enroll in a distance learning course from different Universities and are able to receive credit for the courses.

Recently, some Buddhist academics have started sharing their publications and books at an open platform such as Academic.edu and Research Gate. Such platforms became a good source for scholars to find academic papers and resources for their studies. This platform only allows academics to connect with each other and share their works (Lupton et al. 2018, p. 3).

Academics are now using such platforms such as open access publishing, blogs, academic.edu and ResearchGate to promote their research works. Such platforms give them a diverse audiences from both within and outside the academy. It will help the academics to find a better job and there are better chances that others will read and cite their works (Lupton et al. 2018, p. 3-8).

1.3. Network of Buddhist Scholars

H-Buddhism Network allows Buddhist scholars to communicate with each other. It serves as a tool for exchange of information. Any scholar can ask a question on H-Buddhism and post news about his/her publication, new research projects, academic resources and job opportunities for it. Thousands of scholars around the world are benefiting from such a network (H-Net: Humanities & Social Sciences Online, 2018).

1.4. Digital Resources

1.4.1. Digital Buddhist Canons

In the 21st century, a majority of Buddhist scriptures written in Pāli, Chinese, Tibetan, Sanskrit and other languages have been digitized, most of which are freely made available in both CD Rom

and Internet for public use. This digitization of Buddhist texts is said to have begun in the late 1980s (Lancaster 2003, p. 79-86).

1.4.2 Pāli Buddhist Canon

The Mahidol University in Bangkok first digitally recorded the Siam edition of the Pāli canon (Lancaster 2003, p. 79-86). Then other groups have also followed suit by starting to input the Pāli canon. Currently, there are four versions of Pāli Tipiṭaka publicly available in digital format. They are as follows (Wittern 2000, p. 461-501):

Thai version of the Pāli Tripitaka (BUDSIR)

Pāli Text Society Edition

Pāli Tripitaka in Sinhala Script

Chaṭṭha Saṅgāyana (Sixth Council) Edition

Home > *Chaṭṭha Saṅgāyana*
Pāli Tipiṭaka
Chaṭṭha Saṅgāyana
 The Six Dhamma Councils

The authentic teachings of Gotama the Buddha have been preserved and handed down to us and are to be found in the Tipiṭaka. The Pāli word, Tipiṭaka, literally means "the three baskets" (vithare = prolix/reflections of scriptures). All of the Buddha's teachings were divided into three parts.

1. The first part is known as the *Vinaya Piṭaka* and it contains all the rules which Buddha had down for monks and nuns.
2. The second part is called the *Sutta Piṭaka* and it contains the Discourses.
3. The third part is known as the *Abhidhamma Piṭaka* and comprises the psycho-ethical teachings of the Buddha.

It is known, that whenever the Buddha gave a discourse to his ordained disciples or lay-followers or prescribed a monastic rule in the course of his forty-five year ministry, those of his devoted and learned monks, then present would immediately commit his teachings word for word to memory. Thus the Buddha's words were preserved accurately and were in due course passed down orally from teacher to pupil. Some of the monks who had heard the Buddha preach in person were Arhants, and so by definition, "pure ones" free from passion, ill-will and delusion and therefore, was without doubt capable of retaining, perfectly the Buddha's words. Thus they ensured that the Buddha's teachings would be preserved faithfully for posterity.

Even those devoted monks who had not yet attained Arahanthood but had reached the first three stages of sainthood and had powerful, retentive memories could also call to mind word for word - that the Buddha had preached and so could be worthy custodians of the Buddha's teachings. One such monk was Ananda, the chosen attendant and constant companion of the Buddha during the last twenty-five years of his life. Ananda was highly intelligent and gifted with the ability to remember whatever he had heard. Indeed, it was his express wish that the Buddha always relate all of his discourses to him and although he was not yet an Arhant he deliberately committed to memory word for word all the Buddha's sermons with which he educated monks, nuns and his lay followers. The combined efforts of these noble and devoted monks made it possible for the Dhamma and Vinaya, as

Chaṭṭha Saṅgāyana (Sixth Council) Edition Site: <https://www.tipitaka.org/chattha>

1.4.3 Chinese Buddhist Canon



Chinese Buddhist Electronic Texts Association (CBETA) Site:
<http://www.cbeta.org/>

The digitization of Pāli Buddhist Canon was followed by the input of Chinese Buddhist Canon. Two scholars Christian Wittern and Urs App in Japan started to input Chinese Zen texts (Lancaster 2003, p 84). Later, in 1998, Venerable Hengching, Taiwan University and Venerable Huimin founded Chinese Buddhist Electronic Texts Association (CBETA) in Taiwan. CBETA made available six volumes of the Taisho Tripitaka on Internet and CD Rom in 1998. From 1998 to 2007, CBETA completed the digitization of Taisho Canon and Manji Continued Canon. Today, CBETA offers the Taisho Tripitaka (2373 titles in 8982 fascicles), Manji continued Canon (1229 titles in 5060 fascicles and Jaixing canon (285 titles 1659 fascicles and other, both on CD-ROM and on the CBETA website free of cost (Tu 2016, p. 321-335). Korean edition of Chinese canon on CD-ROM and the Internet are available for use (Lancaster 2003, p. 84). The International Dunhuang Project has been instrumental in digitization and preservation of significant amount of rare manuscripts found in Dunhuang caves. Those collection of thousands of manuscript images are available online for use (Lancaster 2003, p. 84).

Besides CBETA, there are another two projects which have been digitizing Chinese Buddhist texts:

i. The Tripiṭaka Koreana

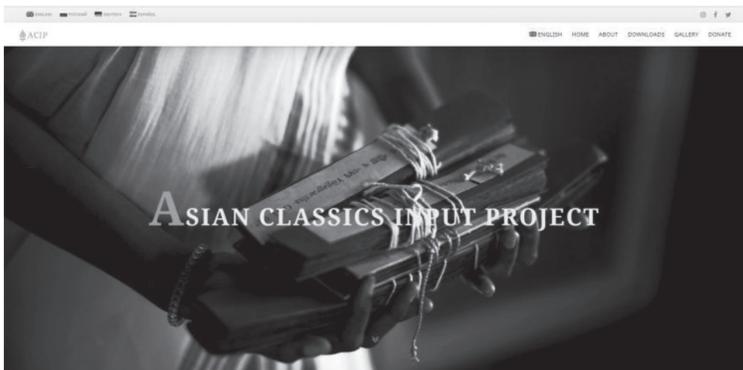
The Tripiṭaka Koreana or *Goryeo Daejanggyeong* in Korean, is a Korean collection of Tripiṭaka consisting 81,258 wooden printing blocks in the 13th Century carved during the Goryeo Dyanasty of Korea (918-1392 CE). It is kept at Haein-sa Monastery, South Gyeonsang Province, South Korea. The Tripiṭaka Koreana project (<http://www.sutra.re.kr>) was started in 1992 and completed the digital input of the Tripiṭaka Koreana in 2000 and were made available on a CD-ROM and the internet (The Research Institute of Tripiṭaka Koreana, 2019).

ii. The SAT Daizōkyō Text Database

The 2012 edition of the SAT Daizōkyō Text Database provides the online Taishō Shinshū Daizōkyō. The users are allowed to view the image of the original pages with the zooming feature. This SAT database is widely used by Buddhist scholars in Japan. However, it is slowly getting popular outside Japan (The SAT Daizōkyō Text Database, 2008).

1.4.4 Tibetan Buddhist Canon

The Asian classic Input Project has been undertaking the input of Tibetan Buddhist canon since 1988 (Asian Classics Input Project 2018). The Asian classics Tibetan Digital Library provides the entire Kangyur (nearly 1000 ancient books containing teaching by the Buddha, the Tengyur (3700 commentaries on Kangyur) and the Sungbum (5000 additional commentaries texts) for free download (Asian Classics Input Project 2018).



Asian Classics Input Project Site: <https://www.asianclassics.org/>

Another ground breaking project called the Buddhist Digital Resource Center (formerly Tibetan Buddhist Resource Center) has been digitizing Tibetan Buddhist canon since 1999 by E. Gene Smith (1936-2010). BDRC has already completed digitizing over 15 million pages of Buddhist works. It has been used by academic scholars, translators, practitioners and students in the world (Buddhist Digital Resource Center 2019).

1.4.5 Sanskrit Buddhist Canon

In 2003, the University of the West, California, in cooperation with Nagarjuna Institute of Buddhist Studies (NIBS) in Nepal, initiated the Digital Sanskrit Buddhist Canon project. Ven. Master Hsing Yun, founder of Fo Guang Shan, Kaohsiung, Taiwan and founder of the University of the West, kindly consented to be sponsor of this worthy project under the joint leadership of Dr. Lewis Lancaster and Mr. Min Bahadur Shakya.

This project is not only a digitization effort, but at the same time an ambitious attempt to devise a Buddhist “canon” in Sanskrit. The project was named the “Digital Sanskrit Buddhist Canon” even though the complete tripitaka in Sanskrit, the “Sanskrit Canon” proper, had disappeared from the Buddhist world long ago. The DSBC project has already digitized over 630 texts (about 53000 pages). Currently over 400 scriptures are freely offered on the DSBC project’s website at <http://www.dsbcproject.org/> (Digital Sanskrit Buddhist Project 2018).



Digital Sanskrit Buddhist Canon Project Site: www.dsbcproject.org

These valuable resources of Buddhism Canon can be copied to our computers and the identical versions of any digitized canon can be reproduced whenever we want. A student or scholar who has access to these resources, is able to develop comprehensive research on the particular text or word and he or she will be able to compare it with various editions in different languages on the same platform. As a result, their research goals can be achieved in a short span of time without defraying any cost whatsoever. The latest technology can extend their research far beyond what used to be previously possible.

1.5. Digital Archives of Journal, Books and Dissertations

The Journal of Buddhist Ethics has been available online since July 1994. It is quite successful in drawing an audience. Currently, it has over six thousand subscribers around the world. There are various online resources like Buddhnet.net of Buddha Dharma Education Association Inc., Australia, and Buddhist Studies WWW Virtual Library at the Australian National University, DharmaNet International, and Access to Insight: Readings in Theravāda Buddhism site which freely provide a large amount of information in the fields of Buddhism and Buddhist studies to all (Prebish & Keown 2010, p. 271-72).

2. NEGATIVE IMPACT OF TECHNOLOGY

There are certainly some negative impacts that the development of new technologies has brought together with them. These technologies cause a number of problems for teachers. It demands a lot of new skills that the teachers may not have received in their academic studies. The teachers do feel that their expertise in the field has become redundant or limited due to the students having free access to unlimited amount of information (Collins & Halverson 2009, p. 6).

Online materials are not always trustworthy, and may cause some problem when they are used for the students' research. Nevertheless, there are some authentic academic sites which the students can visit like J-Stor digital library of academic journals, books and primary sources or google scholar and any other site run by authentic education organization. Some of the tools and platforms for sharing scholarly work became commercialized and

have been controlled by corporate enterprises. There is a danger that such sites will turn into commercial sites and make a profit on the material that academics are sharing free of charge (Lupton et al. 2018, p.5).

2.1 Lack of hand-writing skills

With the excessive use of desktop and laptop computers, students feel paralyzed if they have to dispense with those devices. Furthermore, many hand-writing skills have also become seriously limited from lack of use. As a result, the students are feeling reluctant to write even a few sentences. This has slowly led them to forget how to write. What is more, they even tend to misspell words when they start writing. This has emerged as a big problem today. Heavy dependence on the computers is growing faster and faster.

2.2 Distraction

Students are constantly using cell phones and other electronic devices, which often distract them from the instructor's lecture in the classroom. The students should not be allowed to use such devices unless necessary. Some schools have even started to make their classrooms mobile free zones.

2.3 Health issues

Computers, Internet and social media have become an integral part of our daily life. Regular physical activities of people have reduced dramatically due to increased usage of screen time among the new generation. It is causing a negative impact on individuals' health to some extent. It is very important to moderate the use of such device and increase the physical activities to prevent health issues in the future.

2.4 Misuse of social media

The growing usage of social media has some negative impact on people. Some employees or faculty of University have caused problems by posting some sensitive material to social and other digital media outlets. In such circumstances, there is a question about ethical concerns. It has caused the loss of some teacher's job (Lupton et al. 2018, p.11).

In some jurisdictions teachers are banned from becoming friends with their students on social media or giving them access to their profiles. Some universities have instituted policies for staff's use of social media, but many provide little or no guidance to their employee. (Lupton et al. 2018, p.11)

These social media platforms are extremely vulnerable in terms of controversies and involving the blurring of boundaries between students and teachers. Academics who use these platforms should be extra cautious when they post anything on social media to prevent such mishaps in the future (Lupton et al. 2018, p.12). Now explicit materials are also freely and easily available on the internet which leads to growth of crime like rape, sexual violence, and aberration etc. It has tremendous negative impact on the growing population of children and adults.

To sum up, the new technology has definitely helped us to enhance the capabilities of learners. It has changed the study of Buddhism in a good way. The digitization of various editions of Buddhist canon has expanded the scope of researchers. However, scholars and students are still not properly taking advantage of these digital resources. There is a need to offer more preparatory classes to students so that they can utilize these digital resources more efficiently.

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SUTRA TRANSLATION USING RECENT ADVANCES IN ARTIFICIAL INTELLIGENCE

by Khanh T. Tran*

ABSTRACT

Artificial intelligence (AI), especially machine learning, has begun to impact many activities in our daily life. This paper will focus on the application of recent advances in machine translation to Buddhism, namely the translation of Buddhist sutras, especially those in the Mahayana or Northern Tradition Tripitaka, from Chinese into English. The Taisho Tripitaka (Three Baskets) is composed of over 70 million Chinese characters and 2372 texts divided into sutras, vinayas (precepts) and sastras (commentaries).

In recent years, many international organizations in Japan and USA have translated Mahayana texts. Yet there are still too many sutras that have not yet been translated. Since 2006, Tuệ Quang Wisdom Light Foundation has committed to translate the Taisho texts into Vietnamese, English and French. At the present time, we have developed computer software based on the word substitution approach that performs the rough translation of the entire Taisho Tripitaka in less than 60 hours.

Our rough translations based on word substitution are more accurate than those from Google Translate but they are still full of grammar errors and, hence, require intense manual editing. For the last several years, we have sponsored several editors to develop the Vietnamese version of the Taisho Tripitaka which is nearly completed. For the English version, we plan to use the latest advances in artificial intelligence (AI) to enhance the accuracy of the computer translation. This paper will review the recent

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advances in machine learning, especially the neural machine translation (NMT). NMT translates a sequence of words and entire phrases using large artificial neural networks, much like neurons in human brain. In addition to a dictionary, NMT learns from a large database of Chinese-English parallel texts. This critical Buddhist corpus is taken from well-known translated sutras such as the Amitabha Sutra, The Diamond Sutra, the Lotus Sutra and the Flower Ornament Sutra. NMT is expected to be more accurate than the word substitution approach and the expense of much more computer resources. We will develop a NMT app based on the library TensorFlow developed by Google Brain and present some preliminary NMT translations at the conference.

We fully realize that the translation of an English Tripitaka requires a multi-year effort from numerous experts and editors. However, we also believe that all Buddhists, lay or monastic, can participate and contribute to this important Buddha-work. To encourage the wide participation of all Buddhists, we are making the English computer translations available online at The Compassion Network of Rev. Guo Cheen. We hope to expedite the Tripitaka translation by the active participation of other Buddhists through Open Wiki.

INTRODUCTION

Artificial intelligence (AI), especially machine learning, has begun to impact many activities in our daily life. In recent years, major advances have occurred in several areas, from medical diagnostics to autonomous driverless cars. Since 2015, rapid developments have also been realized in the field of machine translation (MT). This paper will focus on the application of recent MT advances to Buddhism, namely the translation of Buddhist sutras, especially those in the Mahāyāna or Northern Tradition Tripiṭaka, from Chinese into English.

THE TAISHŌ TRIPITĀKA

Mahāyāna texts are organized into Sutras (discourses), Vinayas (precepts) and Śāstras (commentaries). Collectively they are known as Tripiṭaka (Three Baskets). These texts have been primarily translated from Sanskrit into Chinese for over 1200 years, from the Later Han dynasty (2nd century) until the Yuan dynasty (13th

century). The first translated text is the Sutra in Forty Two Sections in 76 BCE. Among numerous translators, the most famous ones include Kumārajīva (344-413) and Xuanzang (599-644).

Among several Tripiṭaka versions, the most widely used today is the Taishō Tripiṭaka. For nine years (1924-1932), this Tripiṭaka was compiled by two scholars at the University of Tokyo, Takakusu Junjirō (1866-1945) and Watanabe Kaikyoku (1872-1932). It was published in 85 volumes under the Taishō reign and, hence, its name Taishō Tripiṭaka. Mahāyāna texts are primarily in volumes 1-55 and 85 (the other volumes belong to Japanese Buddhism). With over 70 million Chinese characters, they are organized into 9035 fascicles and 2372 texts. The length of texts varies greatly, from the short Heart Sutra (the version by Xuanzang has only 260 words) to the voluminous Great Prajñā Sutra (600 fascicles).

Advances in computer technology in recent years allow the development of an electronic Tripiṭaka. Since 1998, the Chinese Buddhist Text Association (CBETA) has published a CD/DVD containing the Mahāyāna texts of the Taishō Tripiṭaka. The most recent version can be downloaded from the CBETA website (<http://www.cbeta.org>). The availability of digital texts such as CBETA greatly facilitates their translation, especially computer-based, from Chinese into English.

MANUAL ENGLISH TRANSLATION

As described above, the Mahāyāna Tripiṭaka is composed of numerous texts. Many individual scholars and organizations in USA, Japan and elsewhere have been involved in translating these texts. Among these are the Buddhist Text Translation Society (<http://www.cttbusa.org/cttb/btts.asp>) and BDK America of the City of Ten Thousand Buddhas (<http://www.bdkamerica.org>). These efforts are labor-intensive, time-consuming and costly. They also require several experts since they are done manually. They have translated several popular texts such as the Amitābha Sutra, the Diamond Sutra, the Lotus Sutra and the Flower Ornament Sutra. A list of translated sutras is available at <http://vnbaolut.com/sutras/> and <http://fodian.net/world/>. Of 2372 texts in the Taishō Mahāyāna Tripiṭaka, less than 10% of them have been

translated. Thus, there are still too many sutras that have not yet been translated.

COMPUTER-BASED ENGLISH TRANSLATION

Buddhism has been a major religion in Vietnam for over 2,000 years. Yet we do not have a complete Tripitaka in Vietnamese. Until the beginning of the 20th century, traditional Chinese was the official writing language. Today, most Vietnamese do not know how to read Chinese. Further, many translations of Buddhist texts still are heavy with Chinese terms that are difficult to understand. Since 2006, Tuệ Quang Wisdom Light Foundation has committed to translate the Taishō texts into Vietnamese, English and French (Tran and Tran 2006). At the present time, we have developed computer software based on the word substitution approach and a comprehensive dictionary of Buddhist terms. In our translation work we have compiled a multi-lingual dictionary of over 40000 Buddhist terms in Chinese, Sanskrit, Vietnamese and English. The translation tool performs the rough translation of the entire Taishō Tripitaka in less than 60 hours.

Our preliminary translations based on word substitution are more accurate than those from Google Translate without a specialized Buddhist corpus (see Appendix B). However, they are still full of grammar errors and, hence, require extensive efforts of manual editing. For the last several years, we have sponsored several editors to develop the Vietnamese version of the Taishō Tripitaka which is nearly completed (<http://vnbaolut.com/daitangvietnam/>).

For the English Tripitaka, we are using the latest advances in artificial intelligence (AI) to enhance the accuracy of the computer translation. In recent years advances in machine learning and machine translation in particular are focused on the neural machine translation (NMT). NMT is a relatively new approach which translates a sequence of words and entire phrases using large artificial neural networks, much like neurons in human brain. A NMT model often consists of an encoder and a decoder. The encoder extracts a fixed-length representation from a variable-length input sentence, and the decoder generates a correct translation from this

representation. In addition to a dictionary, NMT learns from a large database of Chinese-English parallel texts. We have assembled a Buddhist corpus of over 100000 entries that have been taken from well-known translated sutras such as the Amitābha Sutra, The Diamond Sutra, the Lotus Sutra and the Flower Ornament Sutra. Our translation app is based on OpenNMT from Harvard University (2019) and other Deep Learning algorithms in the library TensorFlow that was developed by Google (2019).

Appendix A shows a sample translation of the Diamond Sutra. As shown, each Chinese line is followed by three translated lines: Han-Viet, Vietnamese and English. From similar texts, the Chinese-English bitext can be extracted for corpus usage. Separate files in Chinese or English can also be easily obtained as UTF-8 text files. NMT is expected to be more accurate than the word substitution approach at the expense of much more computer resources. Since 2016, NMT has been used by online translators from Google and Microsoft. Both of these translation services does a good job in translating newspaper articles and business letters. However, as shown in Appendix B, Google Translate does a poor job in translating the first few sentences of the Diamond Sutra. This poor performance is due to its unfamiliarity with Buddhist terminology and lack of a specialized Buddhist parallel corpus.

PROPOSED TRANSLATION PROGRAM

Based on our experience with the development of a Vietnamese Tripitaka, we propose the following 5-stage program:

1. Refine our translation software by implementing the latest advances in Chinese-English NMT including context, word order and lexical analysis. A critical and time-consuming input is to increase the size of the Buddhist parallel corpus -- the bigger the better. The refined software will be tested by applying to popular sutras such as the Amitābha Sutra, the Diamond Sutra, the Medicine Buddha Sutra, the Lotus Sutra and the Sixth Patriarch's Platform Sutra;

2. Apply the software to translate the Chinese Tripitaka. With the improved software in Step 1, the accuracy of the translated texts will be increased;

3. Edit the translated texts. Due to the large number of texts (9035), it will be necessary to enlist several editors from the United States and elsewhere. They can be drawn from various Buddhist institutes, universities as well as volunteers from Buddhist temples and Dharma practicing groups;

4. Review and approve by the Masters, and

5. Publish the final texts online, by electronic means (CD/DVD) for free distribution.

We fully realize that the translation of an English Tripiṭaka requires a multi-year effort from numerous experts and editors. However, we also believe that all Buddhists, lay or monastic, can participate and contribute to this important Buddha-work. To encourage the wide participation of all Buddhists, we are making the English computer translations available online at The Compassion Network of Rev. Guo Cheen (<http://thecompassionnetwork.org/>). We hope to expedite the Tripiṭaka translation by the active participation of other Buddhists through Open Wiki. Any Buddhist who abides by the Five Precepts is welcome to register as an editor and help to: 1. Translate from Chinese to English, 2. Review the English against the Chinese, and 3. Edit and proofread the English. Let's pray to the Buddhas for a complete English Tripiṭaka soon!

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Tue Quang Wisdom Light Foundation, More information are available from Websites

<http://vnbaolut.com/sutras/> (English)

<http://vnbaolut.com/daitangvietnam/> (Vietnamese)

Appendix A

Sample Translation of the Diamond Sutra

Note: A complete translation of the Diamond Sutra is available at Tue Quang Wisdom Light Foundation website http://vnbaolut.com/sutras/TQtranslate_DiamondSutra.pdf

Taishō Tripiṭaka Vol. 8, No. 235 金剛般若波羅蜜經

#CBETA Chinese Electronic Tripiṭaka V1.13 (UTF-8)
Normalized Version

金剛般若波羅蜜經

Kim Cương Bát Nhã Ba La Mật Kinh

Kinh Kim Cương Bát Nhã Ba La Mật

Diamond Prajna Paramita (Perfect Wisdom) Sutra

姚秦天竺三藏鳩摩羅什譯

Điêu Tần Thiên Trúc Tam Tạng Cưu Ma La Thập dịch

Diêu Tần Thiên Trúc Tam Tạng Cưu Ma La Thập dịch

Translated by Indian Tripiṭaka Master Kumarajiva in the Dao Qin Dynasty

如是我聞。一時佛在舍衛國祇樹給孤獨園。

Như thị ngã văn. Nhất thời Phật tại Xá vệ quốc Kỳ-Thọ Cấp-Cô-Độc viên.

Tôi nghe như vậy. Một thuở nọ, Đức Phật ở nước Xá vệ, trong vườn Kỳ-Thọ của Ông Cấp-Cô-Độc.

Thus have I heard. Once Buddha resided in the country of Śrāvastī, at the Jeta (Victory) Grove of Anathapindika (Provider to the Orphans and the Solitaires).

與大比丘眾千二百五十人俱

Dĩ đại bi khâu chúng thiên nhị bách ngũ thập nhân câu

Với đại chúng gồm một ngàn hai trăm năm mươi vị Tỳ kheo

With a grand assembly of one thousand two hundred fifty Bhiksus (monks)

爾時世尊食時著衣持鉢入舍衛大城乞食。

Nhĩ thời Thế tôn thực thời trước y trì bát nhập Xá-Vệ đại thành khát thực

Lúc bấy giờ, gần đến giờ ăn, Đức Thế Tôn đắp y cầm bát, vào thành lớn Xá-Vệ khát thực

At that time, near meal time, World-Honored One put on a robe, held his alm bowl and entered the great city of Shravasti to beg for alms

於其城中次第乞已。還至本處飯食訖。

Ư kỳ thành trung thứ đệ khát dĩ. hoàn chí bản xứ phạn thực cật

Trong thành đó, sau khi khát thực tuần tự từng nhà, Đức Phật trở về tịnh xá. Dùng cơm xong,

In that city, after begging successively from door to door, he returned to his retreat. When he finished eating,

收衣鉢洗足已敷座而坐。時長老須菩提在大眾中。

thu y bát tẩy túc dĩ phu tọa nhi tọa . Thời Trưởng Lão Tu Bồ Đề tại Đại chúng trung.

cất y bát, rửa chân, trải tọa cụ và ngồi xuống. Bảy giờ, Trưởng Lão Tu Bồ Đề (Thiện Hiện), ở trong Đại chúng,

he put away his robe and his alm bowl, washed his feet, spread a seating mat and sat down. At that time, Venerable Subhūti (Good Apparition), in the assembly,

即從座起偏袒右肩右膝著地。

tức từng tọa khởi thiên dẫn hữu kiên hữu tất trước địa.
từ chỗ ngồi đứng dậy, trịch áo vai phải, quỳ gối phải sát đất,
rose from his seat, uncovered his right shoulder, knelt on
the right knee to the ground,

合掌恭敬而白佛言。希有世尊。如來善護念諸菩薩。

hợp chưởng cung kính nhi bạch Phật ngôn. Hi hữu Thế tôn. Như-Lai thiện hộ niệm chư Bồ Tát

cung kính chấp tay và bạch cùng Đức Phật rằng: Hi hữu thay Đức Thế Tôn, Đức Như-Lai hay khéo nâng đỡ các Bồ Tát,

and, with his palms joined together, respectfully said to Buddha: It's extraordinary, World-honored One, the Thus-Come-One (Tathagata) is well supportive of all Bodhisattvas,

善付囑諸菩薩。世尊。善男子善女人。

thiện phó chúc chư Bồ Tát. Thế tôn. Thiện nam tử Thiện nữ nhân
hay khéo giao phó cho các Bồ Tát. Bạch Thế Tôn, khi Thiện nam
Thiện nữ

and entrusting so well all Bodhisattvas. World-honored One, if
good men and good women

發阿耨多羅三藐三菩提心。

phát a nậu đa la tam miệu tam Bồ Đề tâm

phát tâm Vô Thượng Chánh Đẳng Chánh Giác

engender the mind of supreme and perfect enlightenment

應云何住云何降伏其心。佛言。善哉善哉。須菩提。
如汝所說。

ưng vân hà trụ vân hà hàng phục kỳ tâm. Phật ngôn. Thiện tai
Thiện tai. Tu Bồ Đề. như nhữ sở thuyết

thì phải trú ở tâm ấy như thế nào, và phải sửa tâm mình như thế
nào? Đức Phật dạy: Lành thay! Lành thay! Này Tu Bồ Đề, như Ông
nói,

how should they abide there and how should they subdue their
mind ? Buddha said: Excellent! Excellent ! Subhūti, just as you say,

如來善護念諸菩薩。善付囑諸菩薩。

Như-Lai thiện hộ niệm chư Bồ Tát. thiện phó chúc chư Bồ Tát

Như-Lai hay khéo bảo hộ và nhớ nghĩ các Bồ Tát, hay khéo giao
phó các Bồ Tát

The Thus-Come-One (Tathagata) always protects and is well
mindful of all Bodhisattvas and is well entrusting all Bodhisattvas

汝今諦聽。當為汝說。善男子善女人。

nhữ kim đế thính. đương vi nhữ thuyết. Thiện nam tử Thiện nữ nhân.

Hãy nghe kỹ ! Ta sẽ vì Ông mà dạy cho hàng Thiện nam Thiện nữ,

Listen carefully! Because of you, I will instruct how good men and good women,

發阿耨多羅三藐三菩提心。

phát a nậu đa la tam miệu tam Bồ Đề tâm

phát tâm Vô Thượng Chánh Đẳng Chánh Giác

when they engender the mind of supreme and perfect enlightenment,

應如是住如是降伏其心。唯然世尊。願樂欲聞。

ưng như thị trụ như thị hàng phục kỳ tâm. Duy nhiên Thế tôn. nguyện lạc dục văn.

được ở tâm ấy và sửa chữa tâm mình. Dạ phải, Đức Thế Tôn, con vui mừng xin muốn nghe.

will be able to abide there and subdue their mind. Yes, World-honored One, I would joyfully want to listen.

佛告須菩提。

Phật cáo Tu Bồ Đề

Đức Phật bảo Ngài Tu Bồ Đề :

Buddha said to Subhūti:

諸菩薩摩訶薩應如是降伏其心。所有一切眾生之類。

Chư Bồ Tát Ma-Ha tát ưng như thị hàng phục kỳ tâm. sở hữu nhất thiết chúng sanh chi loại.

Các Đại Bồ Tát phải sửa chữa tâm mình như thế này. Tất cả chúng sinh.

All Great Bodhisattvas should subdue their mind as follows .All sentient beings

若卵生若胎生若濕生若化生。若有色若無色。若有想若無想。

nhược noãn sanh nhược thai sanh nhược thấp sanh nhược hóa sanh. nhược hữu sắc nhược vô sắc. nhược hữu tưởng nhược vô tưởng.

dù sanh từ trứng, từ bào thai, từ ẩm thấp , từ biến hóa , có hình sắc hay không hình sắc, có tư tưởng hay không tư tưởng,

whether egg-born, womb-born, wetness- born, or born of transformation; whether with form or no form; whether with thought or no thought.

若非有想非無想。

nhược phi hữu tưởng phi vô tưởng

hoặc chẳng có tư tưởng chẳng không có tư tưởng ,

or whether neither with thought nor without thought,

我皆令入無餘涅槃而滅度之。如是滅度無量無數無邊眾生。

ngã giai lệnh nhập Vô-Dư Niết-Bàn nhi diệt độ chi. như thị diệt độ vô lượng vô số vô biên chúng sanh

Ta đều khiến tất cả được nhập Niết-Bàn hoàn toàn mà được diệt độ. Dù diệt độ vô lượng vô số vô biên chúng sinh,

I will lead all to enter the No-Residual (complete) Nirvana to be liberated. Though I have liberated an infinite, countless and boundless number of sentient beings,

實無眾生得滅度者。何以故。須菩提。

thật vô chúng sanh đắc diệt độ giả. hà dĩ cố. Tu Bồ Đề.

mà thật ra không có chúng sinh nào được diệt độ cả . Vì sao?
Này Tu Bồ Đề!

in reality not one sentient is getting liberated. Why? Subhūti !

若菩薩有我相人相眾生相壽者相。即非菩薩。

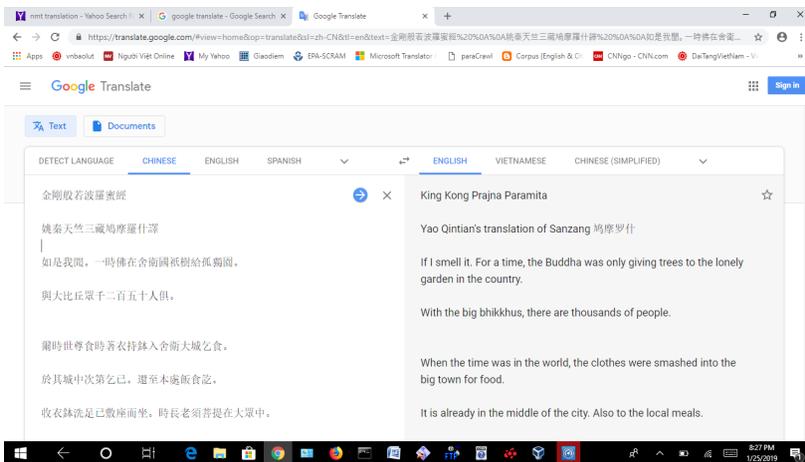
nhược Bồ Tát hữu ngã tướng nhân tướng chúng sanh tướng thọ
giả tướng. tức phi Bồ Tát.

Nếu Bồ Tát nào vẫn còn có tướng ngã, nhân, chúng sinh, thọ giả,
thì chẳng phải là Bồ Tát.

If a Bodhisattva still has the images of a self, the images of a
person, the images of sentient beings or the images of a life span,
then he is not a Bodhisattva.

Appendix B

Sample Translation from Google Translate (Jan. 25, 2019)



DHAMMA - FOR THE 4TH INDUSTRIAL REVOLUTION

by A.T.Ariyaratne*

I am responding to the Most Ven. Dr. Thich Nhat Tu's invitation to send a contribution on the given subtheme of **Buddhism and the Fourth Industrial Revolution**. Though I am no expert on Buddhism or a scholar on Industrial Revolutions, I accepted this invitation extended to me as a practitioner of Buddha's teaching since my childhood. Besides, the Sarvodaya Shramadana Movement we started six decades ago in 1958, attempted to apply Buddhism to find solutions to modern day social, political and economic issues.

I was fortunate to be born into a family of Buddhists. In my country Sri Lanka, we had inherited a culture that dates back to over two thousand six hundred years. My parents, specially my mother, were my primary educators to introduce age-old traditional Buddhist ideals to us. Later these values were inculcated into our personalities as life-long practices applicable to every moment of living by the learned and virtuous monks of our village temple and the school teachers.

It may be appropriate to mention one of those lessons I learnt at this point. A mosquito may land on my left hand and its bite hurts me. My right hand alights on the mosquito spontaneously. My mother sees my reaction. She calls me lovingly and makes me sit on her lap and begins to talk. "My son, look at the size of this mosquito. So tiny, you even can't see it easily. Imagine how small his brain is. Imagine how big you are and your brain compared to the mosquito. The poor pest hasn't got a developed mind to understand that it

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hurts you. In your case you have a very advanced mind. So, my son, remember, never to hurt even a mosquito.”

This is how my mother taught me the first precept of “Abstinence from Killing” and the *supremacy of the human mind*. It also should be mentioned that respect for all life and the importance of safeguarding the entire living world was inculcated into our consciousness at that blooming age. Similarly we learnt about the other four precepts, namely, Abstinence from Stealing, Sexual Misconduct, Speaking Untruth and Consuming Intoxicants and many other lessons while we were still children. In Buddhism we call these Five Precepts *Pancha Sila* which is the bare minimum of moral principles needed for the progress of a civilized and peaceful society. My personal belief is that it is the non-adherence to this bare minimum of moral principles by leaders at local, national and international levels which has led to the misery, conflicts and chaos of today’s world..

Panca Sila is the bare minimum of Buddhist practice for lay disciples. Building on the *Panca Sila*, Buddhism indicates a very clear program not only for the further development of individuals, but also for the “welfare of the many” and the material development of individuals, families, groups, organizations and states. One is free to choose the path one may take at a pace one may also choose. Though there are many possible paths, all of them can be subsumed under three main teachings of the Buddha. They are as follow:

The four noble truths (chaturaryasatya)

The noble eightfold path (aryaastangikamarga)

The theory of dependent origination (paticca samuppada dhamma)

Looking at the past, the present and considering the future of the world I do not think that there is any scientific discovery or technological innovation done during the last 2 600 years comparable to the enunciation and exposition of the above teachings. Please allow me to expand on the above salient teachings for the benefit of those who may not be Buddhists.

1. THE FOUR NOBLE TRUTHS

The Four Noble Truths constitute the Buddhist analysis of life.

It reveals the real status of life as “being unsatisfactory” in that whoever we are, we are subject to illness, decay, death, separation from loved ones, association with those whom we dislike, etc. No one is exempt from this, neither the richest nor the poorest, neither the most powerful nor the weakest, etc. This is the First Noble Truth in brief. Buddhists refer to this as the ***Noble Truth of Suffering***.

The Second Noble Truth states the Cause for this “unsatisfactory state”. It is not due to any materialistic, or physical reason outside of “us”, but due to the operation of “Greed”, “Hatred” and “Ignorance” within “us”. The “ignorance” referred to is the ignorance of the “Four Noble Truths.” Buddhists refer to this as the ***Noble Truth of the Cause of Suffering***.

The Third Noble Truth gives hope to one in that it states that it is possible to escape this recurring cycle of “being unsatisfactory”. Buddhists refer to this as the ***Noble Truth of the Eradication of Suffering***.

The Fourth Noble Truth indicates the path one should take to permanently leave this “unsatisfactory state”. This path is the Noble Eightfold Path. Buddhists refer to this as ***The noble eightfold path***. This is a path which is open to any human being to follow ***Noble Truth of the Path to the Eradication of Suffering***. Many in this audience and outside are most certainly following this path either knowingly or unknowingly. Many who followed this Path in the Buddha’s time were not Buddhists as such. The Path is best understood in three segments as follows.

Right Speech, Right Endeavour, Right Livelihood (Abstaining from all evils), which leads to Right Effort, Right Mindfulness, Right , Concentration (Cultivating the good) which leads to Right View and Right Understanding.

2. THE THEORY OF DEPENDENT ORIGINATION (PATTICCA SAMMUPPADA DHAMMA)

The Noble Eightfold Path is the one to be followed diligently by any one who wishes to be free from this “unsatisfactory state” or suffering. But this is exactly what many of us fail to do. We know what is “right” but most of the time we do what is “not right”. What we practice is not the Noble Eightfold Path but its opposite, namely, the Ignoble Eightfold Path of Wrong Speech, Wrong Endeavour, Wrong Livelihood, Wrong Effort, Wrong Mindfulness, Wrong Concentration, Wrong View and Wrong Understanding.

In the theory of Dependent Origination, the Buddha provides an explanation of how this can happen. If we know “how”, then we have the potential to arrest the operation of the Ignoble Eightfold Path and get on to the Noble Eightfold Path, not all at once but gradually.

The theory of Dependent Origination is a chain of twelve factors with each factor building on the previous one for its existence, hence the name “Dependent Origination”. Each one of the twelve links, starting with **IGNORANCE** and ending with **SUFFERING** is necessary for the subsequent one to exist. If **IGNORANCE** is eliminated then each subsequent factor is also eliminated ending in the elimination of **SUFFERING**.

IGNORANCE (Avijja) is ignorance of impermanence, suffering and non-self (Anicca, Dukka, Anatta) which leads to volitional formations (Sankhara), leading to consciousness (Vinnana), leading to name and form (Namarupa), leading to six sensory organs (Salayathana), leading to contact (Passa), leading to (Vedana), leading to craving (Thanha), leading to clinging (Upadana), leading to cycle of births and deaths (Bhava), leading to birth (Jathi), leading to old age, disease and death etc. (Jara, Marana, Soka, Parideva, Dukka, Domanassa).

Avijja is a distorted understanding of how things work; a delusion arising from the operation of the Five Hindrances (*PancaNivarana*), which are Desire for Sense Objects (*Kamachchanda*), Ill Will (*Vyapada*), Sloth and Torpor (*Tina, Midda*), (*UddaccaKukkuka*), Doubt (*Vici kicca*). If the Hindrances are weakened, the lesser is the Suffering.

Having very concisely introduced certain basic principles of

Buddhist teachings we follow, let me now turn to the ***Fourth Industrial Revolution*** and how it could be related to Buddhism in view of Global Leadership and Shared Responsibilities for Sustainable Societies which is the main theme of this conference.

The phrase ***Fourth Industrial Revolution*** was introduced by Klaus Schwab, the Executive Chairman of the World Economic Forum based in Davos-Klosters, Switzerland, in 2015. In October 2016 at a meeting of the Forum it was decided to open a center in San Francisco to serve as a platform for interaction, insight and impact on the scientific and technological changes that are changing the way we live, work and relate to one another. This is a welcome opportunity for Buddhist Scholars and leaders to actively participate in shaping the direction the Fourth Industrial Revolution should take. This opportunity should not be missed by leaders of nations such as India, Pakistan, Sri Lanka, Nepal, Thailand, Laos, Vietnam, Cambodia, China and Japan who have inherited a Buddhist culture. They should guide those at the San Francisco Center to follow the Buddhist path to Global Leadership, Shared Responsibilities and Sustainable Societies by developing and applying appropriate and relevant technologies that are harmless. In the words of Schwab himself, “There has never been a time of greater promise, or one of greater potential peril.”

From the 18th to 19th centuries in Europe and North America mostly agrarian and rural societies got transformed into industrial and urban societies. The main roles were played by steam and water power and iron and textile industries. This was the First Industrial Revolution. During the last three decades of the Nineteenth Century and the first two decades of the Twentieth Century use of electricity for mass scale production in existing industries as well as new ones such as steel and oil heralded the Second Industrial Revolution. It was during this period that major technological advances were made for wide use of telephones, phonograph, electric lighting and internal combustion engines. The Third Industrial Revolution began around 1980s with digital technology and continues to this day. It is during this period that we started using personal computers, internet, and information and communication technologies.

The Fourth Industrial Revolution, according to Schwab and others is being built on the Digital Revolution and by “emerging technology breakthrough in a number of fields, including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, The Internet of Things, Blockchain, 3DPrinting and autonomous vehicles.” So the Fourth Industrial Revolution, in their own words “will make ways in which technology becomes embedded within societies and even the human body.”

Having described very briefly the four industrial revolutions that impacted on our society in the past three centuries and are affecting our human society and the planet even today, it is time we pay attention to the role Buddhism, which survived for over twenty-six centuries and the role it should play in relation to the present and future societies human beings are attempting to build applying these new technologies.

At the inception of this paper I mentioned about the deep respect for all life we have to cultivate as Buddhists. Similarly I spoke about the importance of adhering to a minimum of five precepts to live a peaceful and happy life. I then described how a human being strives to awaken his personality to the fullest by extending the practice of *Sila, Samadhi and Pragna*. When we compare this Buddhist approach to the way western science and technology developed, it had no moral or spiritual foundation to conform to or a spiritual goal to aspire for. It was free to pursue research for a universal knowledge and develop numerous technologies one may use for betterment of oneself or annihilation of one’s enemies irrespective of its positive or negative impact on the broader society. Their main objective was craving for wealth or power or to satisfy the six senses. Beyond that materialistic desire there was no other spiritual ideal to look for in both research and application.

Who gained from the past three industrial revolutions? Certainly, they were not the people in general or those who deserved it the most. On the contrary from all these revolutions the wealthy, the ruling classes, industrialists, multinational investors, imperial powers and such other privileged classes benefited while the farmers, labourers, small landholders and non-professional masses suffered.

“The richest 1% of the population now owns over half of all household wealth”

Source: Credit Suisse’s Global Wealth Report 2015.

Oxfam’s new report presents an even more dramatic concentration of assets, finding that 62 individuals controlled more assets than the poorer 3.6 billion people combined who constitute half the world’s population.

Whatever the damage done to poorer communities in the world, especially to those who were under western imperialistic powers in the past like those of us in Sri Lanka and Vietnam and the present neo-colonialist ways, our economies are controlled by rich countries and multinational corporations, we still have to view the future realistically. We have to clearly identify the positive aspects of the Fourth Industrial Revolution and develop a common approach for the world to follow based on Buddhist principles and practice which will result in the wellbeing of all humans and also ensure the preservation of all life on this planet. We have to keep in mind the Buddha’s directive to the first sixty enlightened disciples (*Arahats*) He sent out to the world to teach His Dhamma. “Bhikkus, wander forth for the welfare and happiness of the many, for the compassionate assistance of the world.”

In this spirit Buddhists both clergy and lay have a great responsibility to re-educate the world as to how best we can remove inequalities, injustices and ignorance from human society which originated right from the first, second and third industrial revolutions. There are communities in the world who are still living in the pre-industrial age. There are a vast majority of communities who have yet to experience the second and third industrial revolutions. If the Buddhist ideal of serving humans, other forms of animals, plant kingdom and nature as a whole is truly practiced in the new industrial era that has begun, the past mistakes can be rectified. It is possible to bypass or leapfrog the first two or three phases and straight away help the weak and poor communities enter the fourth phase with a chosen mix of technology to deal with predetermined issues such as mass scale poverty, disease and social conflicts, if only those who are in control of technology

are educated in Buddhist teachings of *Loving Kindness (Metta)*, *Compassionate Action (Karuna)*, *Dispassionate Joy (Muditha)* and *Equanimity (Upekkha)*.

Buddhist practitioners have a great responsibility of engaging themselves in a global survey to identify communities who have to be immediately helped using appropriate technologies that are available to us. All this become possible if only a universal scale transformation of human consciousness is launched successfully. At the present moment Buddhists have easy access to the communication technologies which can initiate and accelerate this renewal. When a critical mass of such consciousness transformation occurs only, people will begin to think and question certain commonly accepted beliefs and practices. Their greed will be replaced with giving or charity (dana)'.⁷

In my opinion we have to first identify those relevant technologies which could be used for such a global consciousness shift by Buddhists. Secondly we have to identify the issues that have to be immediately dealt with in relation to the vast majority of people in the world who are struggling to survive without even having enough to eat. Thirdly we have to develop a clear perception as to how these technologies and their applications will affect the life support systems and the conservation of nature and secure the living world from disasters like the worsening climate change and global warming.

For a moment let us look at the materially advanced societies like Japan in our region and how technological advances affected their individual, family and community lives. In these so called highly advanced societies suicide rate is said to be the highest in the region. Interpersonal relationships have become so distanced and estranged that an individual no longer can turn to his or her parents, elders or the community for advice and help. The inbuilt value systems that prevailed in the pre-industrial society are no longer there. The human personality is lost in a barren desert of dumb technological gadgets and networks. In this kind of helpless situations mental disorders are on the increase in the same way as suicides. The human beings almost from the adolescent age have no vision in life to live for. Besides endless gratification of the six sense

faculties they hardly have any other reason to live for.

On the positive side we are aware that these technological industrial revolutions have brought about numerous benefits to ordinary populations as well even though most of the benefits were acquired by the privileged classes and countries. Depending on the governance and fair economic systems common people have got the freedom to access to the best of health care, medical treatments, educational opportunities and other forms of services such as in the areas of travel, leisure and entertainment to live a comfortable and happy life. Humanity from its inception has been cursed by famine, disease and violence. The industrial revolutions along with advancement of democratic governing systems are successfully combating these three evils.

The United Nations Universal Declaration of Human Rights states that 'the right to life' is the most fundamental value of humanity. Various UN bodies like FAO, WHO and the Security Council along with other intergovernmental bodies and non-governmental organizations have immensely contributed to save human lives from these three enemies. Yet we have a long way to go before we can say that humanity as a whole is free from hunger and disease. In the case of violence and war the very advancements made in nuclear weaponry keep those who possess them to refrain from confrontations because of mutual fear and instead resort to peaceful negotiations to resolve their conflicts. On the contrary individual and group violence are on the increase due to various social factors such as poverty, communalism, ideological and racial rivalries.

Scientific researchers with support from billionaires, bankers, and dictators who wish to be immortal are exploring ways to remain young, without getting old or dying. They are very serious about it and some have publicly declared that by 2050 they can overcome death. While a few of them who never stop craving for more and more will continue on pursuits like that, we should concentrate on a selective application of a mix of available technologies to show the world the path of Buddhism for all those who are yet to satisfy their basic human needs and others who do not find happiness in all the material affluence they have acquired from the industrial revolutions. There is no doubt that the vast majority of human

beings will consider the Middle Path (*MajjimaPatipada*) or the Noble Eightfold Path as a sensible way of life to meet the present-day challenges.

The Buddha's advice to the monks was as follows:

"Monks, this life of human beings is short; one must pass on to the future life. You should reflect wisely, do good, and live a pure life (brahmacharya). One born cannot avoid death; one who lives long lives a hundred years or a fraction more."

"Short is the life span of human beings, The good man should disdain it. You should live like one with head aflame. No one can avoid death's arrival".

According to the *Dhammapada* a collection of sayings of the Buddha in verse form and one of the most widely read and best-known Buddhist scriptures "Mind precedes all phenomena. Mind is their chief; they are all mind-wrought. If with a pure mind a person speaks or acts happiness follows him like his never-departing shadow"

In the Dhammapadawe also come across the following stanza:

*Arōgyā paramā lābhā
santutthiparamamdhanan
vissāsaparamā nāthi
Nibbānanparamamsukhan*

The meaning of this stanza is:

"Health is the ultimate profit, contentment is the ultimate wealth, trust is the best relative, Nibbana is the ultimate bliss".

Buddhism is not a religion as such. It is an explanation of the human personality in relation to the rest of the living world and a time frame in which there is no beginning or end. If the stakeholders of the Fourth Industrial Revolution examine the teachings of the Buddha in the above four spheres of health, contentment, trust and bliss from a scientific viewpoint, certainly immense good results could be achieved for humanity as a whole. There are diseases which are the result of polluted air we breathe, chemically poisonous food and unhealthy drinks we consume all of which

are by products of the so-called revolution. Kind of entertainment to which our eyes and ears and all other faculties of our bodies are tuned to and endless possessions our minds crave takes good health and inner peace away from us. Buddhism shows us to place confidence or trust in the Dhamma for the good of present life and lives to come.

Sadly, with the onset of the new techniques, systems and disciplines the very structures of biological organisms is now brought to the sophisticated level of manipulating individual genes. This has resulted in manipulating the very codes of life, thereby giving rise to the likelihood of creating entirely new realities for humanity as a whole. According to Buddhism, there are five Cosmic Laws or natural processes (Niyamas) which operate in the physical and mental realms and which should not be meddled with. The Buddha taught us that these five factors at work in the cosmos cause things to happen. They are :

Bija Niyama : Cosmic Law pertaining to genetic order, living matter or what we call biology, Bija Niyam governs plant life, germs, seeds and nature of all life plant and animal..

Utu Niyama : Cosmic Law pertaining to Seasons, Climatic Cycles, weather and all inorganic phenomena. Natural disasters such as earthquakes, tsunamies and cyclones are not caused by Karmic factors.

Kamma Niyama: Cosmic Law pertaining to Kamma (*Karma in Sanskrit*) is the law of moral influence, Cause and Effect.

Dhamma Niyama: Cosmic Law pertaining to the twelve factors of Dependent Origination, Impermanence Suffering and Egolessness and such other phenomena .

Citta Niyama: Cosmic Law pertaining to consciousness, thoughts and perceptions.

I wish the scientists took time to study these five cosmic laws before they started experimenting with genes and cloning either naturally or artificially. Only then they would have realized the degree of damage caused to humanity. At times I wonder whether all these advancements contribute to the degeneration of our historic,

intellectual and cultural roots on which our civilization was built.

The Buddha declared that His Teachings are not for the ignorant. Buddha Dhamma is meant for the intelligent and wise people. It is not like all forms of technological advancements which produce mass scale goods and services to quench the unending desires of human beings, corporations, governments and other organized bodies. Buddha Dhamma is principally meant for those who want to spend a happy and contented life in the present existence and strive heedlessly to achieve supreme happiness of Nibbana.

In conclusion, I believe that Buddhist have a critical role to play in propagating the real Dhamma. Buddhists around the world should use every possible communication methodology to educate masses to apply the principles of Buddha's teachings. Number of Sutras like *Mahamangala Sutra*, *Karaneeya Sutra*, *Singalovada Sutra* must be made available in all possible languages. *Similarly, industrialists and businessmen should be made familiar with Sutras like the VyaggaPajja Sutra which explains four principles they should follow for right kind of business and industry. They are Efficiency in production (Uttana Sammapada), Conservation with regard to raw material as well as the products (Arakka Sampada), Social environment in which employers and employees live in harmony (Kalyanamittata) and purpose of which Production is made (Samajeevakata).*

With regard to rulers it is necessary to educate them about Buddhist principles of Sharing of power (Dana), Morality (Sila), Recognition and promotion of talent (Pariccaga), Uprightness (Ajjava), Impartiality in judgment (Majjavam), Composure in conduct (Tapam), Non-hatred (Akkodo), Non-violence (Avihinsa), Patience and Forgiveness (Khan-ti) and Non-revengefulness (Avirodhita).

The Four Noble Truths, the Noble Eightfold Path and the twelve factors of the Theory of Dependent Origination cannot be realized with any technological gadgets or tools of Artificial Intelligence except by a highly cultivated and enlightened mind. Only enlightened communities, leaders and rulers can bring true peace, happiness and prosperity to the humanity and the rest of the living world.

RELIGIOUS EDUCATION OF BUDDHISM AND THE FOURTH INDUSTRIAL REVOLUTION

by Ven. Jeongwan Sunim*

1. INTRODUCTION

The digitization of education and academia is being debated diversely. Recently, in all disciplines of Korea, the Fourth Industrial Revolution and Artificial Intelligence are mentioned in important terms. Many economists predicted that the development and digitization of science and technology changed everything and the speed and change of that innovation was explosive at the World Economic Forum.(Schwab, 2016). Changes in organization and individuals in the world are totally different revolution from the former, more fundamental. Changes are occurring in methods that communicate with social work methods. Each government and institution are preparing for a rapid system transition. In the field of education and health care, we are making efforts to improve the system while directly experiencing the development of fusion technology.

The development of innovative science and technology serves as a catalyst to consider human identity and worldview. The change in the Fourth Industrial Revolution is not the only question of what will changes. We ask the fundamental question about who we are and how this world is composed. We need to worry about whether there will be any change in existing identity of human and nature that we had. We should also think about how Artificial Intelligence

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realizes the thoughts and emotions that we considered human. In order to respond to this social change, we need to worry about the religious and ethical issues we face.

The change of religion will not be an exception in the process of transformation in the era of the Fourth Industrial Revolution. It could not predict all the specific aspects of what the Fourth Industrial Revolution will have on religion. However, there will be many changes, and the change needs to be accompanied by a social need to bring human life as positively as possible. In this paper I am trying to explore the problem of Buddhist religious education which is faced in the era of the Fourth Industrial Revolution according to the trend of such time.

2. FOUR INTELLIGENCES AND BUDDHIST EDUCATION

Klaus Schwab has described the following four human intelligences that can bring out the potential of destructive innovation in the era of the Fourth Industrial Revolution (Schwab, 2016: 251).

The first is situational-contextual intelligence. This concept refers to the ability to predict trends in changes and to draw conclusions from facts that are gleaned in fragments. This intelligence enables one to form necessary relations anytime and anywhere, analyze required information, and to make the best decisions possible. One is capable of such intelligence when one can increase connectivity across boundaries and competently build networks.

Relating this, Buddhist religious education seems to attract attention, obviously is the formation and strengthening of networks between religions.

Understanding situations and contexts by increasing connectivity and building networks is not limited to the religious context. In order to address the various social, structural, and ethical issues that we are experiencing and are bound to experience in the current era of the Fourth Industrial Revolution, it is necessary to interact and cooperate with more diverse social organizations, including academia, civil society, government, and business.

The second is emotional intelligence. Emotional intelligence

is the ability to notice one's own thoughts and emotions and to use them in daily life. This concept is not the opposite of cognitive intelligence, which involves rational thinking. Rather, it is the capability to use the cognitive functions of the brain. In fact, it has been developed and utilized by general corporations and organizations in their various psychological and cultural programs. Organizations with higher emotional intelligence tend to be more creative, and they are capable of quicker recovery from problematic situations in a constantly changing world.

Emotional intelligence—the functioning of the mind and its utilization—is the core of traditional Buddhist religious education, which has provided various learning and training programs related to the “mind”. Of course, it is not possible to equate the “mind” with the “emotion” in emotional intelligence. Nonetheless, considering that emotional intelligence is, in fact, the intersection of brain and psychological functions, a path for the better use of the cognitive ability of thinking, studying the “mind” may be a good way to develop emotional intelligence. In the era of the Fourth Industrial Revolution, changes are expected in the educational methods and media of the study of the “mind” that Buddhism currently provides. However, the fundamental content of learning and training need to be continuously developed and utilized.

The third is inspired intelligence; it is the ability to constantly explore meaning and purpose. The most important thing in inspired intelligence is sharing (Schwab, 2016: 255), which means the balancing of directions and methods between individual pursuits and the common goal of society as a whole.

One of the biggest changes caused by digitalization is the formation of an individual-oriented society. The society of the Fourth Industrial Revolution is hyper-connected; all information is shared as the scope of human relations expands globally. Physical distance or space becomes meaningless, and individual values and interests define one's membership in the community. Youth are familiar with digital identities created on online platforms and in the media rather than their identities as citizens.

One of the issues to be considered in the balancing between

individuals and organizations is the individual's religious identity. Buddhist denominations and other religious groups have previously sought to form and maintain the same identity among religious believers. However, it is possible that identity in the Fourth Industrial Revolution may be formed with a different meaning from that of the contemporary Buddhist. Individuals may establish a relationship with Buddhism by participating in certain social activities without necessarily joining directly. Others may not fulfill "the Three Refuges" as Buddhists but follow other religious doctrines and programs. There is a possibility of religious organizations autonomously communicating by necessity, rather than due to a sense of religious belonging or per denomination, and that religions will become more active than they are now. In the individual-oriented society, Buddhist communities need to devise practical ways of relating to individuals and setting common goals.

Physical intelligence is the fourth concept. It refers to the ability to cultivate and nurture individual health and happiness. Physical intelligence is a necessary attribute to maximize the three intelligences mentioned above. A sound body has a positive impact on cognitive and emotional functions—we think and feel. The balance among body, cognitive function, and emotional feelings is an indispensable factor not only in the real world but also in carrying out one's life in a future virtual or augmented reality. Currently, we are learning how to manage and monitor our body's functions and activities through wearable body devices, procedures involving implants in the body, and brain research. In this hyper-connected society, the information of our body's functions and activities will become data, providing us with the opportunity to experience a new world that is different from the physical world of time and space we experience today.

The balance between mind and body is often mentioned in Buddhism. Indeed, changes are expected in the educational methods and evaluation of Buddhist rituals and meditations if various devices that can monitor physical functions are developed and applied to the religious practices.

3. ARTIFICIAL INTELLIGENCE AND RELIGIOUS EDUCATION

The world's first robotic Buddha image, Android Kannon(觀音, Avalokiteśvara) "Minder" was completed and was announced on the 23rd, last February in Kodaiji(高台寺) in Kyoto city. After Kodaiji monks and others opened the eyeglasses, the minder did the first explanation to preach the teachings of the Heart Sūtra(般若心經). As for the minder, Kodaiji(高台寺) was produced with the cooperation of Ogawa Kohei(小川浩平), the instructor of Osaka University(大阪大学) from September 2017. Minder is 195 cm in height, 90 cm in width, 90 cm in depth. Its face and hand parts are made of silicone, but most parts evoke human imagination, so aluminum material is exposed. On this day, the monks of Kodaiji made a legal requirement to welcome the new Kannon Bodhisattva statue to the temple. In addition, Minder went to the first Buddhist sermon for about 25 minutes. With the theme of the contents of the Heart Sūtra(般若心經), it said, "Śūnyatā(空) means everything will keep changing."

Artificial Intelligence has been developed to provide optimal customized solutions for human life through continuous information collection and algorithm analysis in real time. However, Artificial Intelligence does not remain as a tool of mechanical meaning at present. Although it is a virtual space, it is expanding its scope by mimicking the relationship with human emotion. The attributes of continuous self-development of Artificial Intelligence differs from that religious introspection of human. However, we should keep in mind the possibility that it will evolve on its own and change close to the characteristics of religious human beings. The current situation that can be foreseen is that an object equipped with artificial intelligence imitates emotional and spiritual aspects in the form resembling human beings and is humanized.

Humanization of Artificial Intelligence means that various things that programmed human thoughts and emotions can be utilized by forming relationships with humans in physical space or virtual space. The influence of Artificial Intelligence depends on who controls in the short term. However it depends on whether Artificial Intelligence can be controlled in the long run. If the spirit is called the realm of sattva, it cannot be denied that the intelligent

object still imitates the spiritual world of human being, but is still the force of matter to overcome. It is a substance that is shaped by human beings and imitates human beings, but eventually controlled by nonhuman beings. Considering the possibility that Artificial Intelligence plays a role of human, and is moved by collective forces that can control human, first of all, what is necessary is religious learning of artificial intelligence.

Religious learning of Artificial Intelligence literally teaches robot with Artificial Intelligence. One way is to program the Artificial Intelligence to respect the core values of religion just as it learns social rules, mathematical principles, and laws.

This is to ensure that the function of continuous reflection in order to acquire the universal value of all religions as like love, respect for human beings and life is taken as essential information.

If this is reflected in the form, it is likely that communication programs will be possible for robots that imitate sitting meditation, a human being who monitoring the robot's learning programs, to communicate religious insights and ideas.

The Fourth Industrial Revolution cannot be free from the logic of capitalism, and the IoT (Internet of Things) and Artificial Intelligence aim to produce more added value. Therefore, there is a constant problem in the social perception that cannot keep up with the development contents and speed of Artificial Intelligence in many parts of society. In this concern, Buddhist and other religions' interest is a fundamental question of humanity and world view triggered by Artificial Intelligence.

The reason why religious education of Buddhist coexists in the discourse of the Fourth Industrial Revolution is because it is a way of gathering the wisdom of mankind into the social change that Fourth Industrial Revolution will bring. It is also intended to take measures against some ethical and religious problems that we have to face as human beings in the era of the Fourth Industrial Revolution. On the other hand, it is an effort to adapt and survive the educational organization of Buddhist in the age of the Fourth Industrial Revolution as a group of society. As the educational environment of the Fourth Industrial Revolution era changed, it

would be inevitable to change the way of religious education and educational media of Buddhism. The content of the education will be reflected in the analysis and interpretation of characteristics of the Fourth Industrial Revolution era based on the doctrine of Buddhism. The aim of education is to cultivate the human capacity necessary for the Fourth Industrial Revolution era.

Artificial Intelligence learns human beings. The future of mankind depends not on Artificial Intelligence but on what we do. In addition, we are neither a God, nor an agent of God. Man is not the lord of all creation. It is just one of those beings that should live together.

4. NEW TALENT IN THE ERA OF THE FOURTH INDUSTRIAL REVOLUTION AND RELIGIOUS EDUCATION OF BUDDHISM

Buddhism has not only functions of religion but also functions of education. It is to make people able to complete Buddhist personality through education about Buddha's teaching (Kim, 1996: 39).

Especially the educational function of Buddhism represented by wisdom may have succeeded in fostering the intellectual talents required by society through knowledge education in the institutional framework of school education. However it suggests that formal school education really does not achieve the success of 'completion of personality'. The advantage of Buddhism is thus that it can be accomplished through the practice of Buddhism, 'completion of personality' which has not been achieved through school education.

It can be seen that 'the qualitative element of education' is inherent in such educational function of Buddhism. The qualitative aspect of Buddhist education seems to be very helpful not only for formal education but also for 'religious education' to establish directions of future.

From the viewpoint of qualitative research in curriculum through Buddhist curriculum and practice, the possibility of effectively achieving the educational goal of 'completion of personality' is very high. It is possible because Buddhism has an ethical attitude basically by observing the precepts and controlling the sense organs. Buddhism further places the purpose through the

training of the mind such as Samatha and Vipassanā to reach pure Nirvāṇa enlightenment. The achievement of this enlightenment is the perfect ‘completion of personality’.

Therefore, it can be called ‘educational curriculum’ when seeing the process of educational curriculum and practice of Buddhism, that is, the whole process of enlightenment of the highest personality completion from the perspective of education. In other words, if the curriculum is the process of planning, practicing and evaluating the contents of education to achieve the purpose of education, in the case of Buddhism, all processes planning and implementing what kind of contents and how to teach for the purpose to make it to reach enlightenment for Buddhists or people who first introduced to Buddhism to reach enlightenment are ‘Curriculum’. Therefore, we can call it ‘Curriculum in Buddhism’.

The purpose of religious education of Buddhism can be explained in two ways. The most basic is to seek bodhi above (上求菩提). Another thing is trying to save all sentient beings (下化衆生). It is the fundamental spirit of Buddhism that self-educational efforts to seek enlightenment as well as the type of other-educational effort based on the deep compassion, to enlighten society and all sentient beings should be exercised. In other words, the goal of Buddhism is to enable other all sentient beings, including oneself, to realize the truth and implement enlightenment in the life of an individual and community life. And this is also the purpose of desirable Buddhist education as it is. Buddhism does not conquer the environment and the world, but emphasizes the sympathy and agreement with it, persuading the organic relevance between humans and the world. The Buddha taught the importance of relationship through the worldview of dependent origination. The fact of religious education in Buddhism has focused on awareness of these relationships. Then, how is the relationship between in individual beings newly organized in the era of the Fourth Industrial Revolution?

The primary factors that explain the relationship between the newly organized individual beings during the Fourth Industrial Revolution are the Intelligent of machines, the appearance of Virtual Reality, Hyper Connected Society. The dimension the newly expanding organization is that the relationship between

human beings and machines becomes intelligent, while the physical space and the virtual world coexist, individual beings are connected between time and place.

The characteristics of the talents emphasized by the Fourth Industrial Revolution can be divided into cognitive and moral character. Among these, attention is focused on the spirit of challenge, the personality to cooperate, the communication, the honesty, the self-led ability, the correct understanding of the rights and obligations as members of civil society, the ability to act, the ability to explore with patience and curiosity want so (Back, 2016: 59-60).

STEAM education aims at the training of human resources with interdisciplinary and integrated fostering through creative design and sensibility experiences. STEAM is an educational approach to learning that uses Science, Technology, Engineering, Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking (https://steam.kofac.re.kr/?page_id=11267/ Accessed 2nd February 2019). Various programs at the educational site to train human resources with STEAM Literacy which enhance the interest and understanding of integrated knowledge, processes, and nature in various fields and can solve problems creative and comprehensively have been developed and carried out (Back, 2016: 56).

However, in this respect humanistic knowledge is indispensable in establishing humanity and values as much as improving cognitive abilities. And the field that take charge of this is just religious education. Especially, in the field of religious education, various practices and experience programs of Buddhism are highly utilized in the field of integrated cognitive education in the future. In addition, it will help communication and understanding with other people in the field of education of whole personality and greatly helping the formation of values and establishment.

CONCLUSION

People are experiencing the Fourth Industrial Revolution while watching innovative devices and platforms that are regarded as reality. Through continuous innovation of technology, we expected

the advantages and convenience that mankind can obtain. Labor market instability and social gaps, which may occur while the changes of industrial structure, are also factors of anxiety. The reason why religious education of Buddhism together with discourse of the Fourth Industrial Revolution is because Buddhism is a means of gathering the wisdom of mankind as a change of society brought by the Fourth Industrial Revolution. In addition, in the era of the Fourth Industrial Revolution, as a human being, we are taking measures to deal with some ethical and religious problems we have to face. On the other hand, it is also an effort to adapt and survive Buddhist educational organizations in the era of the Fourth Industrial Revolution as an organization of society.

While the educational environment is changing in the era of the Fourth Industrial Revolution, changes in methods and media for religious education of Buddhism are inevitable. Based on the teaching of Buddhism, the content of the education reflects the characteristics that analyze and interpret the characteristics of the Fourth Industrial Revolution era. The purpose of religious education of Buddhism should include cultivating human ability necessary for the era of the Fourth Industrial Revolution.

The Fourth Industrial Revolution and Artificial Intelligence are merely tools for a better life, can never become subjects to substitute for humans or adjust human beings. With the Fourth Industrial Revolution, now is the time when religious faith and practice are urgently required.

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朝日新聞, *Kyoto temple enlists Android Buddhist deity to help people*,

THE FOURTH INDUSTRIAL REVOLUTION AND BUDDHISM

Thich Duc Tuan (Bhikkhu)*

This paper aims to discover what the fourth industrial revolution is, whether the fourth industrial revolution optimistically will improve the human condition or it could lead to greater inequality, disruption of labor markets because of “low-skill/low-pay” and “high-skill/high-pay” workers and other negative consequences. It also addresses how Buddhism can contribute its part to reduce the adverse effects of the fourth industrial revolution.

The first industrial revolution occurred from the 18th to 19th centuries in Great Britain and North America as the most successful industrial revolution, when mostly agrarian, and rural areas became industrial and urban ones. The textile and iron industries, the development of the water wheel, as well as the steam engine played essential roles in the first industrial revolution (Deane, 2000).

The second industrial revolution occurred before World War I between 1870 and 1914, when steel, oil and electricity were mass produced. Major technological inventions during this period include the telephones, phonographs, internal combustion engines, and light bulbs in many cities such as Chicago, Paris, London, Berlin, and Tokyo (Levin et al, 2010).

The third industrial revolution, or the digital revolution can be understood as the advancement of technology in the 1980s from analog electronics to the digital technology that is dominant to-

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day. The advanced technologies of the Third Industrial Revolution encompass the personal computer, the internet, as well as the information and communication technology that quickly spread to countries in Asia, Africa, and the Americas (Rifkin, 2011).

The fourth industrial revolution can be defined as the fourth major industrialization that is blurring the lines among the physical, digital and biological spheres, as cyber-physical systems from the early 2000s. The fourth Industrial Revolution is characterized by innovated technology breakthroughs, such as robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the Internet of Things, decentralized consensus, fifth generation wireless technologies, additive manufacturing/3 D printing and fully autonomous vehicles, and others (Groscurth, 2018).

Professor Klaus Schwab, the executive chairman of the World Economic Forum, (January 11, 2016) claimed that the effects of digitization and artificial intelligence on the global economy, and the broader role for advances in biological technologies are disrupting almost all industries in all countries in the world. These tremendous changes forewarn the transformation of entire systems of production, governance, and management in the world.

Schwab (2016) also mentions the fourth industrial revolution as emerging technology breakthroughs in various fields, such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, nanotechnology and 3D printing that may create high potential of disruptive effects on human history. The survey report with the title *Deep Shift-Technology Tipping Points and Social Impact* was publicized in September 2015 about 23 technology shifts, including their expected arrival to market and the tipping points of their novel technologies.

Shift 1. Implantable Technologies: The first implantable mobile phone will be available by 2025. Individuals will be connected to devices, which are directly connected to their bodies. Therefore, devices will not only be worn, but also be implanted into individuals' bodies. Pacemakers and cochlear implants were only the beginning of the implantable technologies. The future devices will be able to sense the parameters of diseases that will enable people to

act, submit data to monitoring centers, and automatically release healing medicine as immediate and appropriate treatment (Skilton & Hovsepian, 2018).

Shift 2. Our Digital Presence: Now, individuals' digital presence can be considered as their digital interactions and traces through multiple online platform and media, such as Twitter, Facebook, LinkedIn, Instagram and so on. The digital presence allows individuals to present themselves to the world through fashion, words and acts. The digital life also enables them to express their ideas and emotions, look for information and share it to others, as well as maintain and develop relationships virtually everywhere in the world (Schwab, 2016).

Shift 3. Vision as the New Interface: 10 percent of the reading glasses will be connected to the internet by 2025. Google glass will produce a variety of glasses, eyewear/headsets and eye-tracking devices can become very intelligent and lead to visions and eyes connected to the internet and other devices. People's experience can be increased, mediated or completely enhanced to provide different, immerse reality by direct access to internet application and their data through the vision (Schwab, 2016). Moreover, the devices can feed information through visual interfaces, as well as eyes can be the source for interacting with and responding to the information with emerging eye-tracking technologies (Schwab, 2016).

Shift 4. Wearable Internet: 10 percent of wearing clothes will be connected to the internet by the year 2025. Computer technologies were increasingly located in large rooms, next to desks, and on individuals' laps, and now in their pockets. In the near future, Apple Watch will be replaced by clothing and other equipment that will be embedded chips connecting to the Internet (Schwab, 2016).

Shift 5. Ubiquitous Computing: 90 percent of the global population will regularly access to the Internet and services in the cloud by the year 2025. 1.2 billion smart phones were sold in 2014. In 2015, sales of tablets took over sales of personal computers, while all mobile phone outpace computers by six to one. Soon, wireless technology will enable individuals easily to access the Internet and information easier than ever before because it requires less infra-

structure than any other utilities (Schwab, 2016).

Shift 6. A Supercomputer in Our Pocket: 90 percent of the world's population will use smartphones by 2025 that contains supercomputer power compared to previous ones. Global smartphones are overly subscribed in 2019 to more than 3.5 billion that equate to 59 percent smartphone penetration by the world population. The shift in devices has taken place in various countries across different continents, in which Asia leads the current trends because more individuals are using their smartphones instead of traditional personal computer (Schwab, 2016).

Shift 7. Storage for All: 90 percent of individuals will have free and unlimited storage by 2025. Although storage capacities have evolved in the last few years, a variety of companies will offer free and unlimited storage to their clients as a part of the services benefits. Therefore, users will produce increasing amount of their content without bothering to delete it to make room for the current contents (Schwab, 2016).

Shift 8. The Internet of and for Things: One trillion sensors will be connected to the Internet by 2025. Because of the increasing computer power as well as the fall in intelligent sensors and hardware prices, all things will be smartly connected to the internet to facilitate greater communication and new data services based on augmented analytic capabilities. A recent study revealed how sensors can be applied to monitor animal health and their behaviors. The study proposed how sensors wired in cattle can communicate with each other through a mobile phone network and can report real-time data about cattle conditions from everywhere (Schwab, 2016).

Shift 9. The Connected Home: More than 50 percent of Internet traffic will be delivered to homes for appliances and devices by 2025. Very rapid changes are happening in home automation, enabling individuals to control lights, shades, air conditioning, ventilation, audio and video, security system, and other home appliances. Additional supports are accumulated by connected robots for a variety of services, such as vacuum cleaning, dishwasher, and so on to save more energy and time (Schwab, 2016).

Shift 10. Smart Cities: The first city with 50,000 inhabitants without traffic light will take place by 2025. Many smart cities will connect their services, utilities and road to the Internet. Singapore and Barcelona are smart cities that are implementing various data-driven services, smart trash collection, intelligent parking solution, and intelligent lighting. Smart cities are continuously progressing their network of sensor technology and working on their data platforms that will formulate the necessary core for connecting a variety of technology projects and adding future services based on previous data analytics and predictive modelling (Schwab, 2016).

Shift 11. Big Data for Decisions: The first government will replace its demographic census with big-data resource by 2025 because they will enable more accurate and updated data about communities than ever before. Therefore, the government will use the current programmes from big-data technologies and apply new and innovative approaches to serve its citizens and customers. Leveraging big-data will facilitate faster and better decision-making in a wide range of industries and applications. The automated decision-making process not only can reduce complexities for citizens, but also generate governments and businesses to offer real-time services and support for multi-services, such as customer interactions, automatic tax filings and payments (Cukier & Mayer-Schoenberger, 2013).

Shift 12. Driverless Car: 10 percent of driverless cars will commute on US roads by 2025. Trials of driverless cars from giant companies, such as Audi and Google occurred; and various other enterprises are preparing to develop new solutions. These vehicles will be safer and even more efficient than before because they will reduce congestion and emission, as well as upend existing models of transportations and logistics (Schwab, 2016).

Shift 13. The Artificial Intelligence and Decision-Making: The first Artificial Intelligence machine on a corporate board of director will be established by 2025. The Artificial Intelligence can learn from previous experiences to provide input and automate the complex future decision processes easily and rapidly to arrive at concrete conclusions based on data and past situations. This initiative innovation will lead to less bias, rational and data-driven decisions

(Cukier & Mayer-Schoenberger, 2013).

Shift 14. Artificial Intelligence and White-Collar Jobs: 30 percent of corporate audits will be performed by Artificial Intelligence by 2025. Artificial Intelligence excels in automating processes and matching patterns that makes the technology liable to many functions in large organizations. Artificial Intelligence will replace a range of essential and complicated functions performed today by white-collar professionals, such as doctors, surgeons, lawyers, tax accountants and so on. An Oxford Martin School study proposed the susceptibility of jobs to computerization from Artificial Intelligence and robotics, and conclude some sobering results. The study predicted that 47 percent of US jobs in 2010 will become computerized in the next one or two decades (Gleason, 2018).

Shift 15. Robotics and Services: The first robotic pharmacist in the US will be officially established by 2025. Robotics will undoubtedly influence many jobs from agriculture to manufacturing, and retail to services. According to the International Federal of Robotics, the world includes 1.1 million active robots, and machines are working in car manufacturing plants. Robots are streamlining supply chains to produce more predictable and efficient business results (Schwab, 2016).

Shift 16. Bitcoin and the Blockchain: 10 percent of the global gross domestic product is stored on blockchain technology. Digital currencies and Bitcoin are based on the idea of a distributed trust mechanism named the Blockchain, a way of trusted transaction and keeping track in a distributed fashion. The current total worth of bitcoin in the blockchain is around 20 billion dollars, or around 0.025 percent of the global gross domestic product of about 80 trillion dollars (Schwab, 2016).

Shift 17. The Sharing Economy: Globally there will be more trips or journeys by car sharing than in private cars by 2025. The new technology enables individuals' preference for access over ownership, peer to peer, sharing of personal assets versus corporate assets, increased social interaction, ease of access, collaborative consumption and officially shared user feedback

(Schwab, 2016).

Shift 18. Governments and the Blockchain: Tax will be collected for the first time by a government via a blockchain by 2025. The blockchain evidently generates both opportunity and challenges for many countries because it is unregulated and uncontrolled by any banking institution. Moreover, the blockchain can generate the ability for a new taxing mechanism to be developed into the blockchain itself (Schwab, 2016).

Shift 19. 3D Printing and Manufacturing: The first 3D-printed car in production will be presented by 2025. 3D-printing or additive manufacturing can be understood as the process of creating a physical object by printing its layer upon layer from a digital 3D model. 3D-printing obtains the potential capacity to create extremely complex products without complicated equipment. Various types of materials, such as plastic, aluminum, ceramic, stainless steel, and advanced alloys will be used in the 3D-printer. The printer eventually will be able to perform what a whole factory was once required to accomplish. 3D-printing is actually being used to make wind turbines and toys. 3D-printer will overwrite the challenges of cost, speed, and size and become more prevailing in the worldwide market economy (Schwab, 2016).

Shift 20. 3D-Printing and Human Health: The first transplant of a 3D-printing liver will occur by 2025. A process named bioprinting will enable 3D-printers to create human organs that are printed layer by layer from a digital 3D model. The material used to print a human organ will be original, such as titanium powder for making human bones. 3D-printing has tremendous potential to perform custom design needs because the human body is very particular and unique with many intricate details (Skilton & Hovsepian, 2018).

Shift 21. 3D-Printing and Consumer Products: 5 percent of consumer products will be printed in 3D by 2025. Since 3D printing can be performed by any individual with a 3D printer, it will generate opportunities for typical consumer products to be printed locally on demand. A 3D-printer can be in an office or at home. This process will increase the availability of the 3D-printed objects and reduce the cost of accessing consumer. (Schwab, 2016).

Shift 22. Designer Beings: The first human genome was deliber-

ately and directly edited and born. The cost of sequencing an entire human genome has continuously fallen from 2.7 billion dollars in 2003 to 100 thousand dollars in 2009, and now it costs only one thousand dollars for researchers to pay a lab specializing to sequence a human genome. The development of the CRISPR/Cas9 approach generates higher effectiveness and efficiency as well as lower cost than the previous method (Schwab, 2016).

Shift 23. Neurotechnologies: The first human being with fully artificial memory implanted in the brain was accomplished. Over the past few years, the most two funded research programs: The Human Brain Project funded by the European Commission and President Obama's Brain Research Through Advancing Innovative Neurotechnologies was successfully achieved (Fernandez et al, 2015). These programs are focused on medical and scientific research that proves the quick development of neurotechnology. The neurotechnologies include monitoring brain activities and observing how the brain changes and interacts with the environment. For instance, the affordability and portability of neuro-headsets create unique possibilities such as a neuro-revolution and societal-revolution in 2015 (Schwab, 2016).

Adverse Impacts: the computing power found in the fourth industrial revolution in which, many professionals, such as journalists, financial analysts, lawyers, doctors, librarians, insurance underwriters and others are being replaced by robots and artificial intelligence. This disruption forces workers to become unemployed or retrained to afford new jobs with their new skills. Increased demand for technical skills may exacerbate gender inequalities because male workers tend to dominate mathematic, computer science, and engineering professions. The fourth industrial revolution may further increase social tensions and conflicts, and generate a less cohesive as well as injustice world because of the discrepancies in living conditions between different countries that may create other negative impacts (Schwab, 2016).

Positive impacts, such as new revenue sources, rapid growth in financial returns, preserving resources, lowering costs, clean natural environment are beneficial results from the fourth industrial revolution. New technologies also allow social groupings and virtual in-

teractions to exercise influence that would have been unimaginable just a few years ago. Governments apply web technologies to help public administrations, and modernize their overall performance from strengthening the process of e-governance to fostering better transparency, engagement, and accountability between the government and its citizens (Schwab, 2016).

The fundamental nature of this revolution will impact and be influenced by all economies, countries, sectors and individuals. Therefore, it is critical that energy and attention in multistakeholder cooperations, such as academic, social, political, national, industrial, and religious boundaries. These collaborations and interactions are critical to creating a positive and hope-filled future, facilitating all worldwide groups and individuals to participate in and benefit from the ongoing transformation with great leadership (Schwab, 2016).

Two traits of good leadership characterized the 11 chief executive officers who led their companies to great success. The first trait was “being modest and humble”. The second important trait was “extreme persistence” or “fierce resolve” (Collins, 2001). Additional evidence suggests that most good leaders commonly have decisiveness, integrity, competence, and vision that manage organizations and industries through dramatic shifts. All leaders and their followers need to embrace change and realize that what their responsibilities are today might be dramatically different in the near future. Their education and retraining systems need to adapt to better prepare all individuals for the flexibility and critical thinking skills that they will need late on (Schwab, 2016).

According to Baumeister and Busman (2017), beliefs help individuals understand the world around them; especially when they experience serious problems, such as disasters or misfortune. The general terminology for how individuals attempt to deal with dramatic traumas and return to functioning effectively is “coping”. Therefore, the study of “coping” in critical and vulnerable times for social psychologists is to comprehend beliefs (Baumeister & Busman, 2017).

Buddhism, over 2500 years ago was founded by Buddha who proposes the Middle Path that avoids the two extremes of self-in-

dulgence and self-mortification with a practical philosophical system (Huxley, 1945). The Middle Path is the central platform to develop the Noble Eightfold Path. The Noble Eightfold Path, such as (1) right understanding (*samma-ditthi*), (2) right thought (*samma-sankappa*), (3) right speech (*samma-vaca*), (4) right action (*samma-kammanta*), (5) right livelihood (*samma-ajiva*), (6) right effort (*samma-vayama*), (7) right mindfulness (*samma-sati*), and (8) right concentration (*samma-samadhi*) are the best solutions for all problems of all ages that are categorized into three groups: morality, concentration and wisdom (Piyadasi, 1991). (A) The wisdom group includes (1) right understanding and (2) right thought; (B) The morality group encompasses (3) right speech, (4) right action, and (5) right livelihood; and (C) The concentration group consists of (6) right effort, (7) right mindfulness, and (8) right concentration.

(1) Right understanding (*samma-ditthi*) can be defined as the correct understanding of oneself and the world as they really are, and comprehending of the Four Noble Truth, which includes (a) suffering, (b) the cause of suffering, (c) the end of suffering and (d) the path leading to the end of suffering. Right understanding is the first and highest importance in the Eightfold Noble Path because if individuals understand clearly and correctly, they will possess the right speech and actions that lead to their happier and more successful life (Yin & Ho, 2002). Right understanding belongs to (A) the wisdom group. Likewise, if worldwide leaders and their communities have accurate and clear understanding of the positive and negative impacts of the fourth industrial revolution, they will have appropriate speech and actions to lead this revolution to benefit the humanity and the world.

(2) Right thought (*samma-sankappa*) can be regarded as being unselfish, loving, and non-violent. These thoughts can be cultivated and extended towards all beings regardless of their race, sex, religion, political viewpoint, social class, educational level, and cultural background (Piyadasi, 1991). Right understanding also belongs to (A) the wisdom group. With the non-frontier compassion through right thought, we can overcome all the obstacles of hatred, racism, discrimination, prejudice and differences to collaborate and to ben-

enefit from this revolution.

(3) Right speech (*samma-vaca*) means to abstain from lying, tale telling, gossiping, backbiting, scandal/rumor, and harsh words (Yin & Ho, 2002). Right speech belongs to (B) the morality group. Buddha taught, “Pleasant speech is as sweet as honey; truthful speech is beautiful like a flower; and wrong speech is unwholesome like filth.” Therefore, if worldwide leaders and their communities speak or write words that are meaningful, truthful, and compassionate, everyone will feel happy to listen and to cooperate with them closely leading to the full cooperation towards the mutual welfare and benefit in the fourth industrial revolution.

(4) Right action (*samma-kammanta*) means individuals should conduct themselves in moral, peaceful and honorable manners that abstain from killing, stealing, sexual misconducts, lying and intoxicants (Piyadasi, 1991). Right action belongs to (B) the morality group. Right action can be considered as self-regulation or self-control that refers to the individuals’ capacity to alter their own responses because human beings essentially adapt to various demands. Self-regulation encompasses three components, such as moral standard (concepts of how things should be), self-monitoring (keeping track behaviors), willpower/capacity for change (bringing behaviors up to standard line) (Baumeister & Busman, 2017). Thus, if worldwide communities possess the right actions and self-regulation in this revolution, they will get the most benefit and avoid many unnecessary disruptions.

(5) Right livelihood (*samma-ajiva*) is the member of (B) the morality group that abstains from trading in weapons, human beings, animals for slaughter, intoxicating drinks, poisons, and drugs (Yin & Ho, 2002). Buddha taught, “Do not earn your living by harming others. Do not seek happiness by making others unhappy.” The purpose of the right livelihood is to bring about happiness to the individuals and the society and to promote harmonious solidarity among communities at large (Piyadasi, 1991). Therefore, if leaders and communities in the fourth industrial revolution apply the right livelihood as Buddha taught, human beings will receive prosperity and happiness in the future.

(6) Right effort (*samma-vayama*) is the persevering endeavor (1) to prevent the presence of evil and unwholesome thoughts, which have not arisen yet; (2) to erase all evil thoughts, which have arisen; (3) To develop the wholesome thoughts, which have not arisen yet; (4) To maintain and promote thoughts, which have already existed (Piyadasi, 1991). Right effort belongs to (C) the concentration group. Similarly, if worldwide leaders and communities are ready to follow the Buddha's teaching to possess the persevering endeavor to maintain and develop the wholesome and good thoughts and initiatives to serve the universal peace and development of the humanity and the environment, they will definitely gain the full result in the fourth industrial revolution.

(7) Right mindfulness (*samma-sati*) is being attentively conscious of what one is thinking, saying, or doing (William, 2000). Right mindfulness also belongs to (C) the concentration group. Right mindfulness can be understood as the constant and complete awareness of all phenomena as impermanence (*anicca*), dissatisfaction (*dukkha*), and non-ego (*anatta*) (Kabat-Zin, 2013). When everyone is attentively conscious of what they are thinking, saying, and doing, as well as clearly are aware that all things in the universe are impermanent, unsatisfactory, and non-ego, they will forgive each other, as well as love each other more and care for mutual happiness and global sustainability in the fourth industrial revolution.

(8) Right meditation (*samma-samadhi*) means the complete and steady concentration or unification of mind on one single object. Right meditation evidently belongs to (C) the concentration group that leads to pure equanimity (Gunaratana, 1995). Buddhist meditation is divided into two systems: (a) the concentration of mind (*Samatha*), and (b) insight (*Vipassana*). The purpose of (a) the concentration of mind (*Samatha*) into one-pointed mind is to attain the calmness and tranquility. Whereas, the purpose of (b) insight (*Vipassana*) is to see the true nature of things as they are (Dhammananda, 1996). However, (b) the insight (*Vipassana*) cannot exist and be developed without (a) the concentration of mind (*Samatha*). Thus, if worldwide leaders and their followers will practice the right meditation, they will possess their pure equanimity, calmness, and tranquility to observe the true nature of the fourth

industrial revolution as it is. They will deliberately apply their utmost insights from the right meditation to resolve all negative impacts of this revolution with equanimity, calmness, and tranquility.

Although the fourth industrial revolution poses various dilemmas of challenges, and opportunities, all worldwide leaders and citizens already comprehended this reality. We need to be proactive in shaping this novel technology and disruption. All businesses and companies should network together with trust and love. Global cooperation should mindfully reshape our cultural, social, economic, and individual lives according to the Buddhist noble eightfold path to pacify the world for the humankind in the fourth industrial revolution.

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