Transformative Technologies and Social Change: An Introduction

Sangeeta Karmokar

Auckland University of Technology

Sangeeta.karmokar@aut.ac.nz

Abstract: Rapid transformation in the technology is accelerating has create exponential growth in many areas. New innovation in product and services are seen in all sectors such as agriculture, medical diagnosis and treatment, societal changes, manufacturing and business. It has captured the imagination and provided diverse sectors of business and society with new opportunities for strategic and social changes. These changes are coming fast and we need to be creative and collaborative to navigate positively to these changes. Transformative technologies have the potential to contribute to both personal and societal transformation. Transformative technologies can enrich our life and bring social awareness and changes in the society. In this conceptual paper, we explore transformative technology and its capability to drive social change. We present some examples where transformative technologies have played a significant role in social awareness and change.

1. Introduction

In recent years the escalating numbers of development in technology and its innovative application have experienced a huge growth. In this digital era, software, gadgets, hardware and other technologies have proven to work and ready to go viral across diverse sectors. So, what are transformative technologies? Transformative technologies are science-based hardware and software than can produce reliable outcomes and bring positive changes in human social experience, support mental health, emotional well- being

and human flourishing. In transformative technologies, technology is a spine, but the nexus connects to all different sectors as food, disability innovation, social impact, data for good and nature inspired engineering. Transformative technologies are the application of digital knowledge in a disruptive way by challenging the previous successful historic paradigms that exist and provide new opportunities and tools to solve specific problems. In simple words, transformative Technologies means technology that changes and enhances people's lives (L.Jarvenpaa & Ives, 1996). There are a number of researchers and practitioners working in this area that want to make a significant improvement to understanding it, and to apply this to improve the world we live in.

Technology-driven changes are not confined to one sector or a few industries, nor are their impacts felt exclusively in one group or social class. These changes are far reaching and intersectional. Transformative technologies go beyond the personal and societal changes into technological advances such as automobiles, smart phones, medical facilities, entertainment industries and communications. Indeed, 20th century technologies have completely changed the way people meet, interact, learn, work, travel and do business (L.Jarvenpaa & Ives, 1996).

Transformative technologies have a huge impact on how we live now and in the future. It leverages smart phones, Internet of Things, sensors and wearables, big data, neural networks and computing power, machine learning, AI and AR/VR to support our emotional wellbeing and social change. Focusing and aligning with multidisciplinary expertise such as artificial intelligence, quantum, systems, virtual reality and visual communications with real world problems from various sectors, a novel technology innovation can be delivered that will benefit society and transform the world we live in (Stetter, 2018).

This paper starts with discusses the positive use of transformative technologies and explores transformative technology and its capability to drive social change. Some examples are presented where transformative technologies have played significant role in emotional well-being and social awareness.

2. Emerging Technologies and their Transformative Capacity

In recent years increasing attention has been paid to phenomena of emerging technologies. There are growing number of news articles and papers published with the topic emerging technologies. A designer may consider emerging technology because of its novelty and its capability of socio-economic impact, while others may see the same technology as a natural extension of an existing technologies (Rotolo, Hicks, & Martin, 2015). Also, emerging technologies are often grouped under general labels such as nanotechnology, virtual reality and wearable technology. However, there is lack of consensus over the definitions and a wide variety of methodological approaches have been developed, especially by the scientometric community, for the detection and analysis of emergence in science and technology domains (e.g. Boyack, Klavans, Small, & Ungar, 2014; Glänzel and Thijs, 2012). According to Daniele and others framework, there are five prominent attributes that defines emerging technologies. These are:

(1) *Radical novelty*

Emerging technologies are radically novel in fulfilling the function by using different principle as compared to what was used before to achieve a similar purpose.

(2) *Relatively fast growth*

Emerging technologies have exponential growth rates compared to non-emerging technologies such as immersive technologies, big data, augmented reality and 3D technologies.

(3) *Coherence*

Coherence and its persistence over time are the two components that distinguishes technologies that are in state of flux and the emerging technologies. Emerging technologies are easy to combine to achieve a desired impact.

(4) *Prominent impact*

The impact of emerging technologies exists in all domain such as health, science, medicine, social science and economic. They have broad impact on

the socio-economic system by changing the composition of actors, institutions and patterns of interactions.

(5) Uncertainty and ambiguity.

There is high level of uncertainty in their possible outcomes and uses, which may be unintended and undesirable.

Based on the above research study, emerging technologies is typically accompanied by widespread speculation in economic and social impact. The new wave promises to reconfigure work, employment and the social aspects in the workplace and beyond [9]. As the exponential growth occurs in technologies and technology enabling sciences, it would appear that nothing can escape the reach of transformation and that the human mind, social interactions, communications and emotional well-being, can all be engineered. New and emerging technologies such as virtual reality, social media, sensors and ambient assistive technology have the potential for enhancing the quality of human life, transforming the social participation and bring positive social changes (Riva,̃os, Botella, Brenda K. Wiederhold, & Gaggioli, 2012). Emerging technologies have rapidly engaged a large number of organizations and people, which can compete and collaborate forming diverse networks from all different sectors of the society (Assimakopoulos & Pandza, 2015).

New technologies have a capacity to provide innovative and disruptive positive transformative solutions to the real-world issues. Positive transformative focuses on the use of technology for improving the quality of personal and societal experiences with strategies for improving or modifying social behaviour, emotional well-being, cognitive movements and social connectedness. Emerging technologies have technologically mediated the experience that support a positive, enduring transformation of the society (Riva et al., 2016).

According to Rive and others (Riva et al., 2016), positive technologies framework, new and emerging technologies can be classified into three features based on their effects:

Hedonic: technologies used to induce positive and pleasant experiences;

Eudaimonic: technologies used to support individuals in reaching engaging and self-actualizing experiences;

Social/Interpersonal: technologies used to support and improve social integration and/or connectedness between individuals, groups, and organizations.
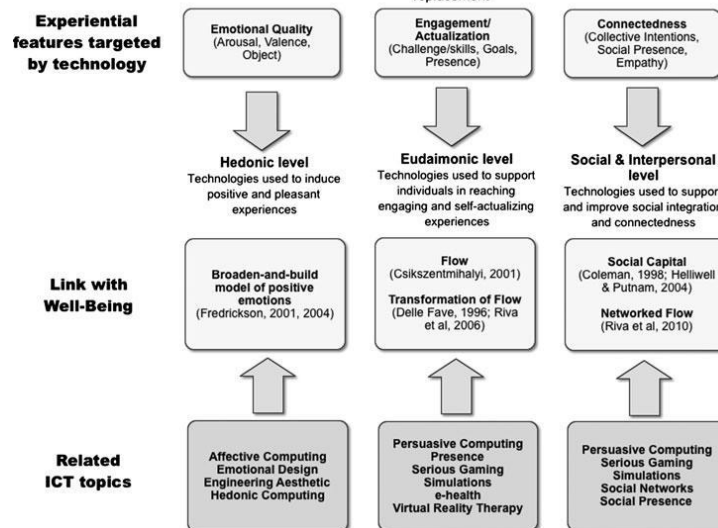

Figure. 1. Positive Technology Domain (Riva et al., 2012)

The first Hedonic level technologies are used to induce a positive and pleasant emotional state. Hedonic level concerns how to use technology to foster a positive emotional experience. Key arguments for the usefulness of positive emotions in increasing well-being have been recently provided by Fredrickson in what she called the ''broaden-and-build model'' of positive emotions.

The second Eudaimonic level is strictly connected to using technology to promote

engagement and self-empowerment. It consists of investigating how technologies can be used to support individuals in reaching engaging and self-actualizing experiences. The theory can produce positive cognitive effects in users such as an augmented focus on the process, increased creativity and enhanced learning. There has been significant work to understand user experience Web navigation, online games, immersive VR, social isolation, VR - mental health and engagement with disability challenges.

The third Social and Interpersonal level is concerning the use of technologies to support and improve the connections between individuals, groups, and organizations.

Conventional computer communicative tools, such as e-mail or text-based chat, are regarded as having a lower social presence and social context cues when compared to face-to-face communication. As a consequence, emerging technologies have been increasingly interested in addressing social issues in areas of metal health, social isolation, social awareness, healthcare (Riva et al., 2012). Researchers and practitioners have explored ways to understand how transformative technology knowledge to drive social change. A brief discussion is presented in the following section.

3. Transformative Technologies to Drive Social Change

Technology advancements over the years have had a considerable impact on society and the lifestyle of human being. It is inspiring to see how technology is used for social innovation by many social enterprises and Non-governmental organisations (NGO). We are seeing growing number of inspiring people recognising the potential of technology to support new forms of collaboration and reorganise resources across communities and create new opportunities for social participation. Transformative technologies are addressing big societal challenges. The solution stems from collaboration and networking within and across diverse communities and integrating knowledge and expertise (Assimakopoulos & Pandza, 2015). Technology is steadily changing the landscape of the society. From artificial intelligence to big data, technological developments are steadily improving and changing what we do and how we do in our day-to-day life. There are social movements in technology that are generally oriented towards bringing social change that

are having higher impact on the society. Many NGO's such as Asoka (https://www.ashoka.org/en-IN/home) and The Big Life Fix by Simon Reeves (https://www.bbc.co.uk/programmes/b09g5hwf) are focused on creating an impact at a scale that solves real social issues.

Technology has potential to dramatically shift and enhance social practices. Potential integration of emerging technologies such as gamification, bio technology, robotics, wearable technology, social media and Nano technology presents tremendous potential for social change (Berzin, Singer, & Chan, 2015). Emerging technologies has transformational strength to connect, create new opportunities to reconsider social and real world issues. New technologies have fundamentally shifted the way humans communicate with each other and their environment (Mishna, Bogo, Root, Sawyer, & Khoury-Kassabri, 2012) and created transformational opportunities ions in mental and behavioral health practice (Chan & Holosko, 2015).

The exponential growth and improvements in technology have led to an increase in knowledge and information and thus uncovering the means to create better technology. Researchers are also exploring how technological societies will be forced to adapt to the social changes that improvements in technology will continue to bring. Transformative technologies initiate sociological change as well as technological and social disruption. Disruptive technologies can change societal norms and human behaviour. Commenting on the role of technology in society, historian Melvin Kranzberg (Bukowski, 2015) said "Technology is neither good nor bad - nor is it neutral". Technology is what you make it, and there is a largely unsung bunch of heroes using digital tools to bring positive changes to societies and communities around the globe (Bukowski, 2015).

Beyond industrial and economic impacts, the transformative technologies have a significant impact on the society and it's broader well-being. For example, emerging digital technologies can promote social inclusion by creating better access to quality education, enhanced health care, offer new skills development or improved free access to information and data (Directorate for Science, 2018). Digital technologies area also be a significant

driver of improved services to vulnerable groups in society (Mickoleiti, 2014). Transformative technologies starting from 3D printed on-demand houses to cancer diagnosis by smartphone or crowd sourced website mapping disabled access to public places have continued to produce innovative solutions to major social challenges that build the future of digital social technology. There are many organisations such as The Big Life Fix by Simon Reeve and Nominet Trust 100 (NT100), highlights the power of transformative technologies, celebrating the myriad of projects created by creative people taking actions to solve social issues. Across time zones, cultures and sectors, all address big social challenges in creative ways.

For example, Harassmap (https://www.socialtech.org.uk/projects/harassmap/), which uses crowd-mapping to try to end the culture of impunity around sexual harassment and assault in Egypt, a country where a staggering 83% of women, and 98% of foreign women, have experienced sexual assault https://www.huffingtonpost.co.uk/annika-small/tech-for-social-change_b_6596030.html). Another international organisation, Libraries Without Borders, has harnessed technology from an education perspective and created Ideas Box (https://www.socialtech.org.uk/projects/ideas-box/), a fantastic project that equips refugee camps with education, information and culture through pop-up media centres.

An expert group, Foresighting the New Technology Wave identified four potential key characteristics of what makes technology transformative (Nordmann & Rapporteur, 2004). Each of these presents an opportunity to solve societal problems and to benefit individuals.

- Embeddedness: Transformative technologies will form an invisible infrastructure for human action. They are similar to an analogous to the visible infrastructure provided by buildings and cities.
- Unlimited Reach: As the convergence draws in other technologies and technology-enabling social sciences, it would appear that nothing can escape the reach of technology and that the mind, social interactions, communication, and emotional states can all be engineered.

- Engineering the Mind and the Body: Some advocate using of transformative technologies for engineering of mind and for the body. Electronic implants and physical modifications are to enhance our current human capacities.
- Specificity: Science and Technologies can be geared to address very specific tasks. The real benefits of a technology can derive not only from its creation but also from its intelligent application and social absorption, what seems to be necessary in creative adaption and diffusion.

Over the recent years transformative technologies have been a positive catalyst in areas such as global competitiveness, security, social justice, sustainable exploitation of common resources, distribution of wealth, migration, unemployment levels, diversity, and much more. For example, in developing and diffusing new therapies for cancer there is a basic requirement for carrying out trials that they may last five to ten years minimum for establishing mortality rates or/and quality of life after treatment (Assimakopoulos & Pandza, 2015). Esoko – Empowering with Information, a Ghanaian technology firm's impact on food security, as it provides small-holder African farmers and businesses with timely crop information via SMS (Grindle, 2015) and Charity Water – Raising cash for good, creates campaigns around birthdays, holidays and other life events where people can raise money to provide clean water to communities in need.
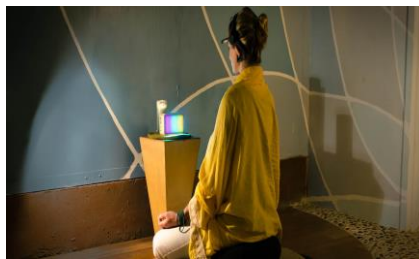

Figure 2. Muse: Wearable Tec for Social Well Being (Janicke, 2017)

Figure 3. Technology for Social Awareness (Foundation, 2012)

Figure 4. Participatory Video Story Telling (Pedroli et al., 2013)

The development of Muse (Figure 2), designed for emotional and social well-being. You just put it on like a headset, or better yet, like a fancy sweat band (like they used to wear in the 70's) on your forehead and it measures your brain waves (EEG) from your pre-frontal and parietal cortex, an area we know from neuroscience research has decreased activation (reduced activation of the Default Mode Network) after meditation.

Sustainable Livelihoods Foundation used transformative technologies for social awareness and bringing social change among south African youth and women (Figure 3). The main objective was to engage south African youth and women on the effects that tuberculosis and HIV have on the lives of people living in poverty in South Africa, using the participatory methodology of digital storytelling (Foundation, 2012).

Sonke Gender justice community explored a community driven story telling participatory video that facilitated community engagement and mobilisation process that uses filmmaking as a catalyst for awareness-raising, personal and group development, confidence-building and strengthening voice (Figure 4). The main intention is that the storytelling and filmmaking process spurs dialogue that feeds into wider social and behaviour change efforts (Plush & Shahrokn, 2012).

Based on the above examples, there are tremendous opportunities to solve complex problems but at the same the time they create barriers in understanding and resistance to new technologies (Assimakopoulos & Pandza, 2015). Our society still lacks at

understanding the effectiveness of new technologies and its social value creation. The digital transformation also raises some broader challenges in the society. For example, crypto currency like block chain or bit coin could greatly enhance the ability of individual to engage in online trading and potential for fraud. Yet they could also enhance the ability to undertake illegal financial transactions. For example, Bitcoin, while it has legal use, can also be used to avoid government oversight (e.g. in illegal arms and drug trade) (Directorate for Science, 2018). There is also alarming work around reproductive technologies and sex preselection is altering human behaviour through genetic engineering. Cloning or the creation of exact replicas from a single genetic ancestor, represents the most extreme form of genetic engineering (CliffsNotes, 2013).

This paper described the emerging transformative technologies and some of the research domain focusing on the social impact and well-being. Many innovations are driven by social challenges in the areas of sustainability, environment, health and ageing. There is a need to create engagement with a set of social actors to deal with social issues and bring positive transformation. Establishing partnerships between Universities and community groups such as citizen groups, non-governmental organizations, non-for-profit research institutes and social think tank will help us to bring positive social transformation.

4. Conclusion

Society appears to be on the verge of a new wave of technological adoption that presages significant changes in the world we live in. Transformative technologies present significant opportunities and can enrich our life and bring social awareness and changes in the society. Researchers and practitioners have shown that the emerging technologies lead to fundamental changes in personal and social lives. Along with the opportunities, it also comes with many challenges. Emerging Technologies has the capacity to bring far reaching effect, but by formulating common goals or shared visions transformative technologies can facilitate positive social transformations giving them better lives in the future. Yet, the existing knowledge and work in this area is just the tip of the iceberg. The positive use of technologies inspires research on emotional well-being and social awareness in creating a

better future. It is the responsibility of researchers and social scientists of various disciplinary backgrounds to provide greater clarity on transformative technologies and its impact towards positive social change.

It is clear that effective use transformative technologies have capacity to drive positive social change but it can't be done alone. There is a need for interdisciplinary collaboration, requiring partnerships with technologists, computer scientists, researchers, software engineers, and governmental organisations. Universities needs to build a strong partnership with various external stakeholders in the community. Cross sector partnerships will create changes that extend beyond the discipline field and the future of technology. As an researchers, it is important to build social investment and resources required to leverage the existing technology and create stronger infrastructure to support new innovations. A paradigm shift in the education and research area is necessary to see how pretensioners, researchers and social worker can work together towards a common social cause. The future work will explore various approaches to engage as an interdisciplinary researcher in enabling social change.

References

Assimakopoulos, D. G., & Pandza, I. O. a. K. (2015). Management of Emerging Technologies for Economic and Social Impact: an Introduction. 1-21.

Berzin, S. C., Singer, J., & Chan, C. (2015). Practice Innovation through Technology in the Digital Age: A Grand Challenge for Social Work. American Academy for Social Work and Social Welfare, 1-24.

Boyack, K., Klavans, R., Small, H., & Ungar, L. H. (2014). Characterizing the Emergence of two Nanotechnology topics using a Contemporaneous Global micro-model of Science. Journal of Engineering and Technology Management, 32, 147-159.

Bukowski, M. (2015). Neither Good, nor Bad, nor Neutral. Retrieved from https://my.vanderbilt.edu/vanderbiltdivinity/2015/12/neither-good-nor-bad-nor-neutral

CliffsNotes. (2013). Technology and Social Change Retrieved from https://www.cliffsnotes.com/study-guides/sociology/social-change-and-movements/technology-and-social-change

Cziksentmihalyi, M. (2015). *Flow: The Psychology of Optimal Experience*: Harler Collins. New York.

Directorate for Science, T. a. I. (2018). *Transformative Technologies and Jobs of the Future* Retrieved from Montreal, Canada:

Fedrickson, B. L. (2001). The Role of Positive Emotions in Positive Psychology: The Broaden-and-Build Theory of Positive Emotions. *National Institute of Health, 56*(3), 218-226.

Foundation, S. L. (2012). Engaging South African Youth and Women on the Theme of Tuberculosis and HIV using a Digital Storytelling Approach. Retrieved from https://www.transformativestory.org/digital-story-telling-on-tuberculosis-and-hiv-in-south-africa/

Gianzel, W., & Thijs, B. (2012). Using core Documents for Detecting and Labelling New Emerging Topics. Scientometrics, 91(2), 399-416.

Grindle, A. (2015). 6 Ways Technology Is Breaking Barriers To Social Change. Retrieved from https://www.fastcompany.com/3043761/6-ways-technology-is-breaking-barriers-to-social-change

Janicke, S. H. (2017). Transformative Technologies: How They Work, What They Are, And How Their Impact Our Well Being. Retrieved from https://www.rewirehappiness.com/single-post/2017/07/18/Transformative-Technologies-How-They-Work-What-They-Are-And-How-Their-Impact-Our-Well-Being

L.Jarvenpaa, S., & Ives, B. (1996). Introducing Transformational Information Technologies: The Case of the World Wide Web Technology. *International Journal of Electronic Commerce, 1*, 95-126.

Mishna, F., Bogo, M., Root, J. S., & Khoury-Kassabri, M. J.-L. (2012). It just crept in": The Digital Age and Implications for Social Work Practice. Clinical Social Work Journal, 40(3), 277-286.

Mickoleiti, A. (2014). *Social Media Use by Governments:A Policy Primer to Discuss Trends, Identify Policy Opportunities and Guide Decision Makers* OECD Working papers on Public Governance. Paris.

Nordmann, A., & Rapporteur. (2004). *Converging Technologies – Shaping the Future of European Societies*. Retrieved from

Pedroli, E., Cipresso, P., Serino, S., Pallsvicini, F., Albani, G., & Riva, G. (2013). *Virtual Multiple Errands Test: Reliability, Usability and Possible Applications*

Plush, T., & Shahrokn, T. (2012). Case study: Story-driven Participatory video with Mobile Technology. Retrieved from https://www.transformativestory.org/story-driven-pv/

Riva, G.,˜os, R. M. B., Botella, C., Brenda K. Wiederhold, & Gaggioli, A. (2012). Positive Technology: Using Interactive Technologies to Promote Positive Functioning. *Cyberpsychology, Behaviour and Social Networking, 15*(2), 69-76.

Riva, G., Villani, D., Cipresso, P., Repetto, C., Triberti, S., Lernia, D. D., . . . Gaggioli, A. (2016). Positive and Transformative Technologies for Active Ageing. *Medicine Meets Virtual Reality*, 308-315.

Rotolo, D., Hicks, D., & Martin, B. R. (2015). What is an Emerging Technology. Research Policy, 44, 1827-1843.

Stetter, K. (2018). Tech for Transformative Change? Looking beyond Disruption.