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**HOW TO CITE:**Marwala T. The Fourth Industrial Revolution has arrived. Comments on Moll (S Afr J Sci. 2023;119(1/2), Art. #12916). S Afr J Sci. 2023;119(1/2), Art. #15429. <https://doi.org/10.17159/sajs.2023/15429>**ARTICLE INCLUDES:**

- Peer review
- Supplementary material

**KEYWORDS:**

Fourth Industrial Revolution, digital technologies, COVID-19, higher education

**PUBLISHED:**

24 January 2023

# The Fourth Industrial Revolution has arrived.

## Comments on Moll (S Afr J Sci. 2023;119(1/2), Art. #12916)

**Significance:**

This Commentary is a response to Moll (S Afr J Sci. 2023;119(1/2), Art. #12916) who refutes the Fourth Industrial Revolution (4IR) and its impact. As this Commentary demonstrates, there is a case to be made that the 4IR constitutes a revolution and that the limitation at the level of pure technology can be refuted as a revolution is based on its wider impact. While the 4IR can be classified as an evolution of the Third Industrial Revolution, its scale, scope and complexity denote a revolution of its own.

*If there is any period one would desire to be born in, is it not the age of Revolution; when the old and the new stand side by side, and admit of being compared; when the energies of all men are searched by fear and by hope; when the historic glories of the old can be compensated by the rich possibilities of the new era?*

Ralph Waldo Emerson<sup>1</sup>**Introduction**

In 2016, as Klaus Schwab took to the podium at the World Economic Forum, and alluded to his groundbreaking article<sup>2</sup> in *Foreign Affairs* the year before, he was conjecturing about the trajectory of technology and the possibility of a Fourth Industrial Revolution (4IR). As he stated:

*We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society.<sup>2</sup>*

At the time, it was not clear what the implications of this revolution would be, if it would really unfold, and how this shift constituted a new revolution that would differ from the previous revolution. The pace of change in the last few years, however, has demonstrably been a revolution in action when we consider the breadth and scope of the shifts attributed to the 4IR – on a scale we have not seen before.

Long has there been debate over the 4IR. Are we on the brink of it? Are we firmly entrenched in it? Or is it simply a fictional concept like many of the science fiction novels that were popular in the 1980s? Theorists have teased out each of these arguments. The prolific use of artificial intelligence (AI) across sectors meant the 4IR was here, gaps and overlaps with the previous three industrial revolutions made it doubtful, or, in an echo of Aldous Huxley and many of his peers, the robots were taking over. Though I am being quite simplistic in dividing this argument into just three camps, it is a necessary precursor for our recent history. As the coronavirus outbreak unfolded in corners of Asia, it seemed to be quite similar to the SARS and MERS epidemics. Like the viruses that preceded it, there was little global panic, and it seemed likely that this virus would soon be contained, posing no real threat to the rest of the world. Singh et al.<sup>3</sup> tracked how COVID-19 became a pandemic. This was a result of a convergence of factors – the virus spread with great speed; it arose in winter when pneumonia typically increases, making it hard to distinguish; it did not behave the same way as previous SARS viruses did and people experienced varied reactions; and it emerged at a time of increased travel to and from China. These factors were the perfect storm that would soon transform the world and arguably dismiss any conjecture about the 4IR. It certainly sped up the need to adapt to this revolution.

There are two main arguments to be made in response to Moll's paper 'Why there is no technological revolution, let alone a 'Fourth Industrial Revolution'<sup>4</sup>. Firstly, there is a clear demarcation between the Third Industrial Revolution (3IR) and 4IR, cementing the argument that the 4IR does constitute a new era. Moreover, the limitation of the conception of a revolution purely at the level of technology is not consistent with the term revolution. Secondly, the impact of the pandemic and the fundamental need to switch to remote systems in order to adapt to stringent lockdowns throughout the world, hastened the adoption of digital technologies. Additionally, the very unfolding of our response to the pandemic signified the 4IR in action. As this Commentary will demonstrate, the 4IR can be understood as a scientific paradigm shift in itself and the very nature of this scientific paradigm shift implies a revolution.

**3IR versus 4IR**

Important in the argument for the existence and impact of the 4IR is the distinction between this revolution and 3IR. The 3IR is, of course, also characterised by the use of information technology and digitisation but the transition through increased specialisation aimed at complex challenges distinguishes 4IR. The 3IR is the result of the emergence of semiconductors in the 1940s and 1950s and refers to the shift from analogue electronic and mechanical devices to digital devices. The 4IR, of course, builds on these technologies – much like the trajectory of previous industrial revolutions, albeit with closer common traits. It is a confluence of technologies that blur the lines between the various spheres: biological, physical and digital. The 3IR is preoccupied with digitising infrastructure



while 4IR constitutes reconstructing our infrastructure to be intelligent. The 3IR gave us computers, revolution automated production and digital computing while the 4IR gives us interactive computational forms, intelligent automation and quantum computing.<sup>5</sup> The real distinction is that the 4IR can be likened to an intelligence revolution. We are anticipating that machine intelligence in this era will eventually exceed the intelligence of humans. This phenomenon is called the 'singularity'. Shanahan states, "Some singularity theorists predict that if the field of AI continues to develop at its current dizzying rate, the singularity could come about in the middle of the present century."<sup>6</sup> This very possibility implies that we are in the midst of a new revolution. While there is an acknowledgement that the 4IR is emerging out of the 3IR, it is considered a revolution rather than simply a continuation based on the expected scale, pace and depth of its disruption. Lee and Lee<sup>7</sup> argue that the technologies of the 4IR are not a 'radical break' from technologies of the 3IR but are evolutionary in nature. Lee and Lee further argue that, even if we limit our comparison of 3IR and 4IR technologies, it is apparent that 4IR technologies have a longer technological cycle time and are more scientifically based, based on diverse knowledge fields, implying more originality. This is a marked distinction from technologies of the 3IR.

It can be argued that the 4IR represents a scientific paradigm shift. As Kuhn defined it, "A paradigm is a universally recognizable scientific achievement that, for a time, provides model problems and solutions to a community of practitioners."<sup>8</sup> This implies that the technologies of the 4IR represent a scientific revolution in itself. As Cunningham argues, we can understand the 4IR as a scientific paradigm shift not because of the technological characteristics "but because we cannot imagine what the social arrangements, institutions and regulations and the broader infrastructure will be needed in the new paradigm."<sup>9</sup> This very phenomenon constitutes another revolution. Moll argues that, following Schwab's introduction of the 4IR into the public realm, there was opposition and scepticism from global leaders. However, the development of national and regional 4IR blueprints signifies that this is a shift that governments are taking seriously and that Schwab's claims are no longer being dismissed. While Moll states that "purely at the level of technology, there does not seem to be a case that there is such a phenomenon as a 4IR"<sup>4(p.2)</sup>, this is a limited view of our understanding of revolutions. Although the technology, in many instances, seems to be an evolution of 3IR technology, its impact is notable and important for this discussion.

## The rise of the 4IR during the pandemic

The pandemic accelerated the use of 4IR technologies and their impact on various facets of society. This impact was multi-prong. In the shift towards remote working and living, the adoption of technology was swift. This moved beyond a reliance on connectivity as was indicative of 3IR. It entailed the adoption of AI, cloud computing, big data and 5G. As proponents of 4IR have asked, what would this shift have looked like a decade or more ago? In the higher education sector, for instance, the shift towards the 4IR was tangible. As far back as 2017, my colleague Bo Xing and I theorised about the impact of the 4IR on the sector. As we stated:

*Given the 4IR, a new form of a university is emerging that does teaching, research and service in a different manner. This university is interdisciplinary, has virtual classrooms and laboratories, virtual libraries and virtual teachers. It does, however, not degrade educational experience but augments it.<sup>10</sup>*

Online degrees were piloted, which was a marked shift when you consider that space constraints are one of the biggest hurdles to greater access. Elsewhere, we used technologies to create simulations as site visits were not possible. Through platforms such as blackboard, we are able to track the progress of our students, and this can even be done via mobile devices. Digital assistants have become more common for administrative purposes. The sector's ability to adapt and the changes in our approach to education signified the very paradigm shift the 4IR

represents. Importantly, this was not confined to higher education, but was a shift that was apparent across all sectors and industries.

Moreover, as countries scrambled to find solutions to combat COVID-19, 4IR technologies were heavily relied on. There is a host of examples of these technologies being leveraged in the fight against COVID-19. For example, AI was used to identify disease clusters, monitor cases, predict outbreaks, gauge the risk of mortality, as a diagnostic tool, and for studying the disease trend, amongst other developments. In the development of vaccines, algorithms were used to sift through data on potential adverse reactions. As more people have had to seek treatment, blockchain has been used to ensure data privacy and has been a tool in widening access.<sup>11</sup> These are tangible shifts in our approach to the pandemic, which were not apparent in earlier iterations of the virus such as SARS and MERS.

## Conclusion

The argument that the 4IR does not constitute a revolution is thus unfounded. Perhaps prior to the COVID-19 pandemic, an argument could have been made that we had not yet arrived. However, the sweeping changes, tangible shifts across sectors, and even the shifts in our own lives are representative of a revolution unfolding. As Moll acknowledges, "The ideology of the 4IR, construed by its mainstream ideologues as a technological revolution, has become hegemonic in the prevailing language of academia, business, politics and education."<sup>4(p.5)</sup> This very phenomenon denotes another industrial revolution and represents the broader impact of the 4IR. To dismiss this phenomenon as by-product of these technological changes would be myopic. We are in the age of the Fourth Industrial Revolution.

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