

**THE FUTURE OF THE WESTERN CAPE AGRICULTURAL
SECTOR IN THE CONTEXT OF THE 4TH INDUSTRIAL
REVOLUTION**

Review: Drivers of the Fourth Industrial Revolution

October 2017



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1. Introduction

Setting the scene

As previously observed, humanity finds itself at the threshold of the Fourth Industrial Revolution (4IR), with many commentators of the view that the cross-over has already occurred. Technologies such as artificial intelligence and machine learning, robotics, nanotechnology, 3D printing and genetics and biotechnology are not only advancing exponentially, they are also building on, and amplifying one another.¹ The question, however, beckons: “What is causing the profound change we are experiencing”, i.e. what drives the 4IR phenomenon? From a scenario approach perspective, driving forces are often referred to as “the key factors, trends or processes which influence the situation, focal issue, or decisions, and propel the system forward...”² In the context of 4IR it is important to note that parallel to the technology revolution are also a set of broader socio-economic, geopolitical and demographic developments, each interacting in multiple directions and intensifying each another.¹

Point of reference in this review

When considering scenarios, it is common practice to start off with the familiar listing of categories, i.e. Society, Technology, Economics, Politics, and Environment, which one finds that in almost every situation, forces from each of these categories make a difference in the narrative.³ Literature abound with studies on drivers of change, although mainly contextually ring-fenced in relation to the topic under investigation, e.g. sustainability, water, agriculture, human migration, population growth, etc. However, “the fundamental and global nature of this revolution (4IR) means it will affect and be influenced by all countries, economies, sectors and people.”⁴ Subsequently, a macro perspective on the drivers is necessary, implying neglecting trends which are too domain-specific, industry-specific or detailed in nature, as it could number into the hundreds. The discussion to ensue will therefore consider the drivers of 4IR from a macro perspective, i.e., the overarching, general, key factors, trends and/or processes which are influencing, and propelling the phenomenon forward.

2. Megatrends

What is a “megatrend”?

The term “megatrend” was coined by John Naisbitt in his 1982 book of the same name, and is used to describe “large, transformative global forces that define the future by having a far-reaching impact on business, economies, industries, societies and individuals.”⁵ Another description is “profound and long-lasting social and/or economic change that has been spurred by factors such as technological breakthroughs, shifts in the balance of geopolitical power, altering demographic patterns and environmental change.”⁶ There is, however, also

the view that the term “megatrend” belongs to the lexicon of over-used business catchwords, with the “mega” prefix intended to convey the idea of a trend which is very large scale compared to other trends, and a more general definition of a megatrend is suggested as “an inevitable evolution leading to a change of society, business, economics or environment.”⁷

Trends in, and drivers of, megatrends

Michael O’Sullivan, Head of Portfolio Strategy & Thematic Research at Credit Suisse considered megatrends within three distinct, yet interrelated drivers or pillars, namely, (1) rapidly changing demographics, (2) increasing emergence of a multipolar world, and (3) rising relevance of sustainability.⁶ From these drivers, eight megatrends were identified with twenty significant areas in which the megatrends find expression through innovation and investment (Table 1).

Table 1: Drivers, megatrends and associated innovations and investments

| Megatrend | Innovations & Investments | Description |
|-------------------|---------------------------|--|
| Urbanisation | Construction | Companies exposed to infrastructure, residential and office construction and urban mobility, primarily in emerging markets but also in developed markets. |
| | Smart cities | Sectors such as navigation, smart grids, traffic management, escalators and air-conditioning are set to benefit from the emergence of sustainable and smarter cities. |
| Health and aging | Health | Industries exposed to new trends in diagnostics and treatments, particularly age-related diseases, increased access to healthcare in developing countries, personalised medicine and e-health. |
| | Lifestyle | Companies set to benefit from increased consumption of lifestyle-related goods and services, including leisure and recreation, healthy food and cosmetics. |
| Knowledge economy | Networks | Industries exposed to hyper connectivity, including data storage, person-to-person and person-to-machine communication, or wireless modules and devices. |
| | Automation | Machinery and control systems which aim at increasing precision and efficiency in manufacturing processes, including human-machine interfaces, industrial robots and self-guided vehicles. |
| Crowded world | Energy | Companies exposed to new trends in global energy consumption, including increased energy demand in emerging markets and new energy sources. |
| | Food | Technologies which provide effective solutions to increase agricultural productivity, including farm machinery, precision agriculture, crop science and fertilisers. |
| | Water | Industries active in water treatment, desalination, filtration, supply and distribution. |
| Emerging world | Emerging consumers | Companies, both local and multinational, with strong industry positioning set to benefit from the steady increase in emerging market consumption. |
| | Emerging producers | Emerging market industries which penetrate global goods and services markets through unique business models, brand value or competitive advantage. |

| Megatrend | Innovations & Investments | Description |
|---------------------|---------------------------|--|
| | Frontier markets | Companies exposed to the next wave of growth markets in Africa, Southern Asia and Eastern and Central Europe. |
| Globalisation | Transportation | Companies active in the transportation of goods, particularly those operating on fast-growing trade routes between emerging markets. Industries include maritime transport, air freight and transportation infrastructure. |
| | Tourism | Includes industries exposed to the global travel industries, including booking services, hotels and resorts and passenger airlines. |
| | Global workforce | Companies active in human resources, corporate outsourcing and educational services. |
| Adaptability | Climate change | Includes solutions to cope with the adverse effects of climate change, including climate insurance, resilient infrastructure and early warning systems. |
| | Emerging risks | Companies which provide risk management solutions for emerging technological, economic and societal risks. |
| Resource efficiency | Renewables | Producers of alternative sources of energy, including among others wind, solar, hydroelectricity and biomass. |
| | Waste and recycling | Sectors active in the collection, transport, processing and recycling of waste materials. |
| | New materials | Producers of advanced composites, nanotechnology and bio-based or biodegradable materials. |

Additional exploration into the drivers in megatrends follows to establish thematic commonalities.

In a review of the general megatrends emphasised by a selection of approximately 20 significant intelligence providers and trend observers, twelve commonly-cited megatrends across four dimensions were identified as shown in Table 2 below:⁷

It is, however, important to note that these trends are not new to our human existence. In fact, these patterns have been playing out since time immemorial.

Table 2: Twelve commonly-cited megatrends across four dimensions

| Dimension | # | Megatrend | Description | Examples |
|------------|---|------------------------------------|---|---|
| Technology | 1 | Disruptive technology developments | Major area, multiple technology megatrends cited by many different trend observers, e.g.: <ul style="list-style-type: none"> - Ubiquitous connectivity, Internet of Things - Materials (e.g. smart, nano, bio etc.) - Customisation, personalisation, localisation - Data-driven technologies - Information security and data protection - Virtual world - Artificial intelligence and Robotics - Genomics - Personalised medicine – Etc. | <ul style="list-style-type: none"> • Global smartphone penetration exploded from 5% of the global population in 2009, to 22% by end 2013. By 2017, more than a third of all people around the globe will be smartphone users • The worldwide market for 'Internet of Things' is forecasted to hit \$7.1 trillion by 2020, from \$1.9 trillion in 2013 |

| | | | | |
|-------------------------------|----|-----------------------------------|--|--|
| Energy and Environment | 2 | Changing energy mix | New energy mixes to address growing demand, dwindling non-renewables, energy security, higher costs (e.g. shale, nuclear, coal, renewables etc.) | <ul style="list-style-type: none"> China, the world's biggest energy consumer is projected to increase its energy demand by 75% between 2008 and 2035. Today it relies on coal for almost 70% of its total energy supply |
| | 3 | Shortage of resources | Shortages of water, food, rare earths, key commodities, including impact of environmental damage | <ul style="list-style-type: none"> Approx. 1.2 billion people live in areas of physical water scarcity 70% increase in food is needed by 2050 to meet population growth demand |
| | 4 | Climate change | Prevention, adaptation and mitigation to address climate change | <ul style="list-style-type: none"> Greenland and Antarctica are losing 500 cubic km³ of ice annually Earth has warmed since 1880 with 10 of the warmest years occurring in the past 12 years By 2030, China's carbon dioxide emissions could equal the entire world's CO₂ production today, if the country's carbon usage keeps pace with its economic growth |
| Economics and Politics | 5 | Knowledge and information society | Prevalence of knowledge as basis for economic value, ubiquitous information, growing personalised education, increasing automation requiring highly skilled workforces | <ul style="list-style-type: none"> The United States will need to add 26 million workers to its talent pool by 2030 to sustain its average economic growth of the last twenty years Western Europe will need 46 million additional employees |
| | 6 | Economic shifts | Economic power of emerging market economies overtaking developed markets, increasing middle class and growing wealth | <ul style="list-style-type: none"> China's share of the world's total GDP is expected to grow from 7.1% in 2000 to 20.7% in 2020 By 2030, the middle class is likely to comprise 4.9 billion people, of which 80% will live in what is now considered the developing world |
| | 7 | Globalisation | Increasingly connected global economy and economic integration | <ul style="list-style-type: none"> 77% of the FTSE top 100 UK companies' income is derived from outside the UK |
| | 8 | New normal | Lower interest rates, greater public policy interventions, greater public debt, bigger defence budgets | <ul style="list-style-type: none"> The US public debt has risen from approximately 67.7% of national GDP in 2004 to 113.8% in 2014 |
| | 9 | Multi-Polar | Diffusion of power, rising nationalism, shift to networks and coalitions in a multipolar world. | <ul style="list-style-type: none"> Rising power of non-state actors and terrorist groups in the Middle East, North Africa, Asia |
| Social and Health | 10 | Demographic shift | Population growth, aging societies | <ul style="list-style-type: none"> World's population has almost tripled in 60 years, projected to reach 9.6 billion by 2050 |
| | 11 | Urbanisation and mobility | Growth of mega-cities, smart-cities, need for investment in critical infrastructure for safe, fast, ecologically sound mobility | <ul style="list-style-type: none"> World population in cities forecast to grow from 50% in 2010 to 70% in 2050 The world will add approximately one new city of a million inhabitants every five days until 2050 |
| | 12 | Health and wellness demands | Growing expectations for health and wellness, increasing risks of pandemics, burden of aging populations | <ul style="list-style-type: none"> The proportion of the world's population over 60 years from 2000 will double from about 11% to 22% |

Historical patterns continue to play out

There are five noticeable historical patterns that have left their mark on all aspects of the world's economic and social fabric, and active in the world today, namely:⁸

1. **Demographic and social change:** Factors such as the combination of increased life expectancy, declining birth-rates in many parts of the world, and extraordinary rates of human migration, accompanied by a gradual increase in the status of women and greater ethnic and social diversity within most countries.
2. **Shifts in global economic power:** Noticeable in this respect is the expansion of prosperity in emerging economies at a faster tempo than in the industrialised world, leading to significant changes in consumption patterns and an adjustment of international relations.
3. **Rapid urbanisation:** Of importance is the vast expansion of cities around the world, through a combination of migration and childbirth, with major implications for infrastructure, land use, traffic, employment, quality of life, and culture.
4. **Climate change and resource scarcity:** Prominent in this regard is the increasing demand for energy, food, and water, in a finite world with limited natural resources and even more limited capacity for carbon dioxide and a wide variety of other effluents.
5. **Technological breakthroughs:** Clearly obvious is the transformation of business and everyday life through the development and use of new types of digital innovations in fields such as biotechnology, nanotechnology, fabrication (including 3D printing), cloud computing, and the Internet of Things.

The above is already part of our current experience to a large extent. Consider, amongst other, aging Western populations, migration of economic activity toward Asia, explosive growth of cities around the world, depletion of forests and fisheries, and the exponential technologies that are already part of our experience.⁸ Akin to these views, EY in a 2015 report summarised six forces building on the historical patterns, and driving our future:⁵

1. **Digital future:** Technology is disrupting all areas of the business enterprise, across all industries in all geographies, driven by the conjunction of social, mobile, cloud, big data and increasing demand for anytime anywhere access to information.
2. **Entrepreneurship rising:** As technology is changing the ways that people work, with machines and software increasingly substituting humans, opportunities offered by digital advances are increasingly exploited by high-impact entrepreneurs that are building innovative and scalable enterprises; many of these being digital from inception.
3. **Global marketplace:** The divide between mature and rapid-growth markets continue to shrink with numerous emerging economies displaying high levels of innovation (e.g. Asia becoming a major hub), further stimulating global trade, investment and financial system links.

4. **Urban world:** Rapid urbanisation in emerging markets as well as continued urbanisation in mature markets cause the number and scale of cities across the world to grow continuously, and coupled with the associated thorny issues such as climate change and poverty, demand effective planning and policy responses.
5. **Resourceful planet:** Population growth, economic development and growing middle-class consumers are putting pressure on global demand for both renewable (via technological applications) and non-renewable natural (environmental degradation imperatives) resources, demanding more sustainable approaches to achieving economic growth whilst leveraging natural resource inputs.
6. **Health reimagined:** Health-care systems and providers are seeking more sustainable approaches because of cost pressures in the face of changing demographics, rising incomes in rapid-growth markets and a looming chronic-disease epidemic; a fundamentally different approach is required in moving beyond the delivery of health care to the management of health.

The inevitability of megatrends destined to collide is also apparent, causing disruptive transformations in nearly every industry globally. Although the specifics about these collisions are often uncertain, they are inevitable in one form or the other.

The collision of megatrends

Although it is impossible to predict exactly how two megatrends will interact, it is almost certain that megatrend collisions will push humanity across a threshold to a very different world⁸ (The unfolding of 4IR case in point). The exhibit below provides a useful representative sample of these collisions.

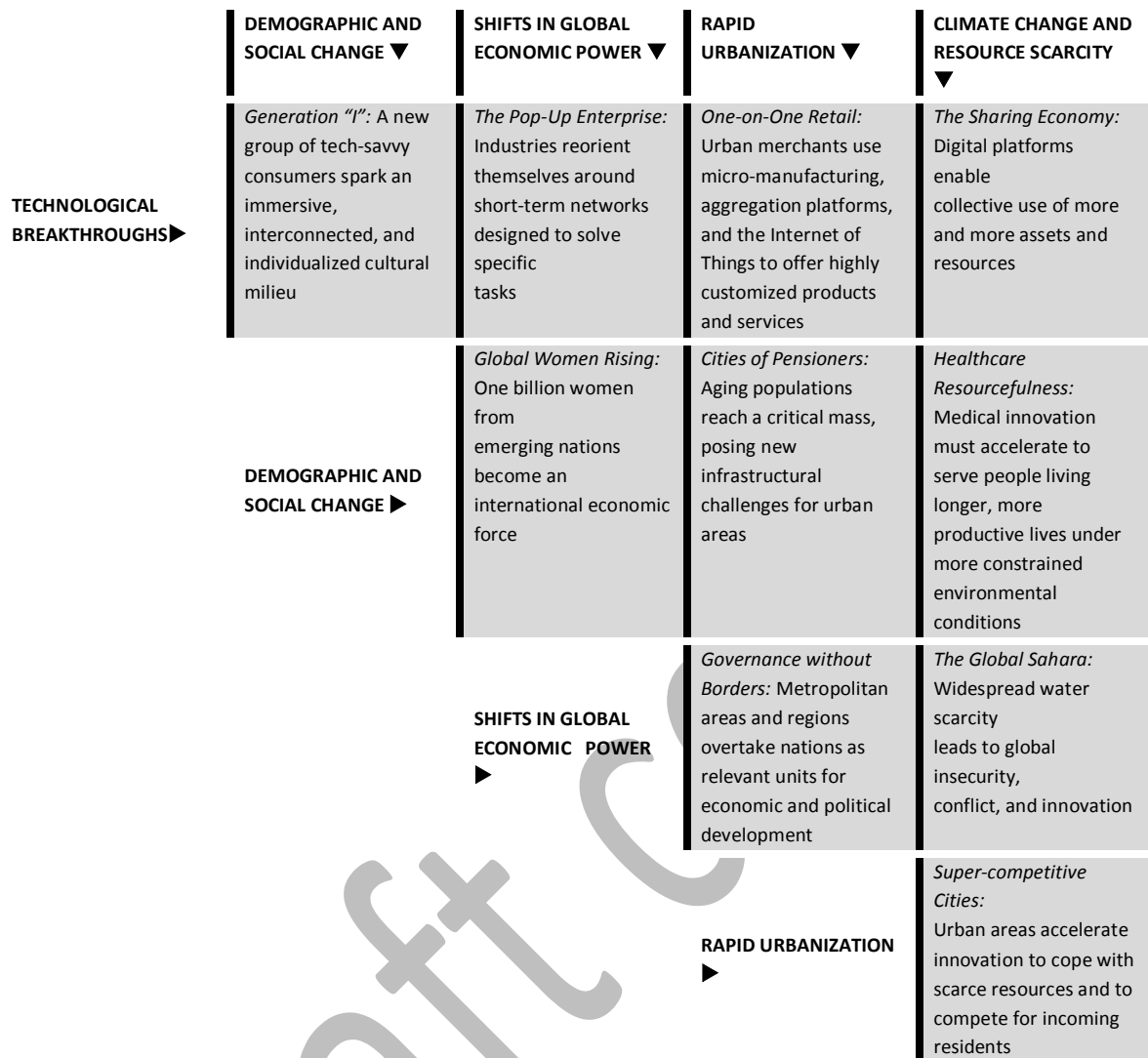


Figure 1: Example of megatrend collisions⁹

While many other collisions might occur with significant disruption to every industry and government, the above megatrends framework could be useful to private or public-sector leaders in facilitating reflection about complex external trends to develop an ordered, prudent, and proactive strategy for facing them.

Disruption leading to megatrends

More recently, and building on the preceding commentaries, EY investigated the root causes of the transformative trends behind the current wave of disruption, and identified three primary forces, namely (1) technology, (2) globalisation, and (3) demographic change. Embedded in the interface between these forces, eight global megatrends were identified in shaping the future; extensive, transformative trends that define the present and shape the future through their impact on businesses, economies, industries, societies and individual lives.¹⁰ Table 3 summarises the entire EY report on “Megatrends shaping 2016 and beyond.”

Table 3: Transformative trends shaping the future

| ← TECHNOLOGY → | | ← GLOBALISATION → | ← DEMOGRAPHIC CHANGE → |
|--|--|--|--|
| Megatrend | Characteristics | Upsides | Evaluate |
| <p>Industry redefined</p> <p>Is every industry now your industry?</p> | <ul style="list-style-type: none"> • Disruption is driving convergence • Technology underpins convergence • Customer empowerment drives demand for novel solutions • Companies should seek opportunity beyond their own industry walls | <ul style="list-style-type: none"> • Consumers benefit when disruptors enter a traditional industry space, reducing pain points and delivering better solutions. • Start-ups can leverage innate advantages such as lean operations and technical excellence, which means they can quickly grab market share. • Incumbents can look beyond their own industry walls for opportunities. They can also fend off disruption by acquiring or partnering with new competition or reinventing their own business models. • Bringing together many brains from many disciplines can help solve the world's biggest challenges — from climate change to chronic disease to poverty. | <ul style="list-style-type: none"> • Do you understand who your competitors are, and would your customers agree? • What are the fault lines to indicate your industry is ripe for convergence? • Putting aside what you do or make today, what new problems could your company help solve? • What will you do alone and what will you do as part of collaboration or an ecosystem of companies? • Will tomorrow's business landscapes still be comprised of individual sectors? |
| <p>The future of smart¹¹</p> <p>What intelligence will we need to create a smart future?</p> | <ul style="list-style-type: none"> • Smart brings technology to life • Robotics and AI launch smart to a new level • Smart is changing the world • The smart solution is holistic | <ul style="list-style-type: none"> • By improving access to and management of resources, smart can help to improve provision for underserved populations and communities. • Mitigating different forms of risk is made easier through smart, whether it's the detection of fraud or preventing network failures in various systems from energy grids to production lines. • Smart is a differentiator that adds competitive advantages. It enables better, more efficient and more agile use of existing assets. • Investments in smart have ancillary and far-reaching benefits. Smart grids raise the stakes in infrastructure and enhance market competition as well as a market's competitiveness. • Stakeholders will see different outcomes from smart. Some will see increased efficiencies and reduced costs, while others will see improvements in outcomes such as more accurate medical diagnosis. | <ul style="list-style-type: none"> • When AI controls decisions, who controls your company? • How can smart best combine efficient and effective? • Does your organization know enough to be smart? |
| <p>The future of work</p> <p>When machines become workers, what</p> | <ul style="list-style-type: none"> • An unprecedented reinvention of work is coming • Even white-collar and creative work will be affected | <ul style="list-style-type: none"> • The machine economy drives huge society-wide benefits — from fewer medical errors to reduced traffic fatalities. • Companies gain tremendous increases in efficiency and productivity. | <ul style="list-style-type: none"> • How will workers and citizens be motivated in the machine economy? • How will governments adapt to remain relevant for the future of work? |

| ← TECHNOLOGY → | | ← GLOBALISATION → | | ← DEMOGRAPHIC CHANGE → | |
|--|--|---|--|------------------------|--|
| Megatrend | Characteristics | Upsides | Evaluate | | |
| is the human role? | <ul style="list-style-type: none"> Moving from the gig economy to the machine economy 4. The future of work will disrupt business, government and society | <ul style="list-style-type: none"> Government regulation becomes more nimble, real-time and responsive to the needs of citizens. The “leisure dividend” frees up individuals to pursue other interests and unleashes a wave of entrepreneurship | <ul style="list-style-type: none"> How do you build a better working world in a world with less work? With massive labour displacement ahead, how will we address income inequality? | | |
| Behavioural revolution How will individual behaviour impact our collective future? | <ul style="list-style-type: none"> Behavioural economics will become a growing resource for business Global challenges and tech drive the growth of behavioural economics Inventive businesses are already employing behavioural economics 4. The next challenge: long-term behavioural change | <ul style="list-style-type: none"> Society benefits from minimizing the impact of looming collective-action crises, such as chronic disease and climate change. Governments avert the fiscal impact of these potential crises. Individuals lead healthier lives and have healthier savings. | <ul style="list-style-type: none"> How will societies improve collective behaviours without restricting individual freedoms? How can organizations be motivated to focus on the long term? How can we nudge individuals to save more — and save our collective future? How will we nudge people to adopt healthy behaviours — for the rest of their lives? | | |
| Empowered customer How will you change buyers into stakeholders? | <ul style="list-style-type: none"> Empowered customers know their worth Empowered customers want a piece of the action Customer empowerment is a business opportunity B2B must adopt B2C techniques to satisfy empowered customers Customers continue to evolve Invent the future with customers | <ul style="list-style-type: none"> Treating customers as stakeholders rather than buyers generates a virtuous cycle — customers benefit from better products and services and companies are more likely to meet their needs. Co-creation gets customers invested in the success of an idea and builds loyalty — even evangelism. Delivering rich experiences — either wrapped around products or services or standalone — has the potential to improve margins and create new revenue streams. Empowered customers carry their rights with them into other domains. Empowered citizens help governments to become more transparent and responsive, boosting efficiencies and helping to achieve policy goals. From maker spaces to crowdfunding to invention platforms, there are more ways than ever to get an idea off the ground. | <ul style="list-style-type: none"> Power has shifted to customers; what will they do with it next? If today’s customers are kings, will tomorrow’s customers be kingmakers? When experiences trump things, how will you delight your customers? What can you offer the customer that has it all? When you can go over-the-top to your customers, how will it change your value chain? | | |
| Urban world In a fast-changing world, can cities be built with long- | <ul style="list-style-type: none"> Asia and Africa will see the bulk of urban growth Innovation is at the heart of the cities of the future | <ul style="list-style-type: none"> Dense living promotes efficiencies, convenience and the exchange of ideas. Cities offer inhabitants a rich variety of jobs, services and cultural opportunities The clustering of talent, capital and supporting infrastructure make cities | <ul style="list-style-type: none"> Will we become citizens of cities not nations? In a world where income inequality is rising, how can urban growth be more inclusive? | | |

| ← TECHNOLOGY → | | ← GLOBALISATION → | | ← DEMOGRAPHIC CHANGE → | |
|---|---|--|---|------------------------|--|
| Megatrend | Characteristics | Upsides | Evaluate | | |
| term perspective? | <ul style="list-style-type: none"> • New cities are being built from the ground up • Mature cities must upgrade or replace infrastructure • Public-private partnerships will be the foundation of the urban world • Cities will become as powerful as nations | <ul style="list-style-type: none"> • perennial hotbeds of entrepreneurial activity. • Successful urbanization requires the private sector and the public sector to work together, • leveraging their respective competencies. • Cities hold the key to a sustainable future — pioneering the sharing economy, green architecture, microgrids, driverless transport and more. • Making cities smart and resilient is a trillion-dollar opportunity for product and services providers, small and large companies alike. | <ul style="list-style-type: none"> • How can cities be made resilient to the future’s known and unknown stressors? • New cities are built with “brains,” but how will they develop their hearts and souls? • How will the public and private sector co-author this century’s urban story? | | |
| Health reimagined With growing health needs, is digital the best medicine? | <ul style="list-style-type: none"> • Disruption and economic sustainability drive the health care revolution • The journey to Health 2.0 • The next wave of digital innovation will be even more disruptive • Fragmentation, adoption and behaviour patterns challenge Health 2.0 | <ul style="list-style-type: none"> • Entrepreneurial start-ups become the new health companies, creating and capturing value in innovative ways. • Incumbents become better aligned with health outcomes and the needs of the patients they serve. • Individuals become more proactive in managing their health. • Societies and governments benefit from improved quality, expanded access and reduced costs. | <ul style="list-style-type: none"> • When algorithms prescribe and diagnose, how will providers adapt? • In a world of fragmented health data, how do we see the big picture? • While everyone in health care is focused on the short term, how do we incentivize the long-term behavioural changes needed for tackling chronic disease? | | |
| Resourceful planet Can innovation make the planet resource rich instead of resource scarce? | <ul style="list-style-type: none"> • The resources transformation is at an inflection point • Industry convergence creates the fourth industrial revolution in natural resources • Energy storage will be a catalyst for disruption • Carbon and water solutions • Distributed resource innovation could transform lives in emerging markets • Disruptors will be the winners | <ul style="list-style-type: none"> • Energy technology and business model innovation could avert the worst impacts of climate disruption and drive economic growth. • Distributed energy and water innovations hold the potential to transform the lives of billions of people who lack access to centralized resources infrastructure. • Competitive differentiation based on resource optimization and an embrace of resource innovation will provide increasing value to global corporations. • Convergence of resource and smart technologies is empowering customers to share, trade and optimize resources. • Improving energy storage cost and performance factors will catalyse new value streams and business models that enable the next phase of the resources transformation. | <ul style="list-style-type: none"> • How will we link prosperity and sustainability? • Can business disruption also address climate disruption? • How is climate purpose reflected in your corporate purpose? • Who is your Chief Resources Officer? | | |

The EY approach as expressed in the table above provides a simplified and balanced perspective, narrowing the field of vision by focusing on three causes rather than a longer list of effects. It, however, also widens the field of vision, since focusing on new waves of primary forces reinforces that any list of megatrends is incomplete and will expand over time.

3. Multiplicity of 4IR drivers

High-level rundown

In concluding the discussion on drivers of 4IR, table 4, derived from the WEF “Future of Jobs”¹ report below serves as useful summary, containing, to a large extent, all the pertinent driver themes expressed in the preceding sections.

Table 4: High-level summary of the drivers of 4IR

| DRIVERS OF CHANGE (4IR) | |
|--|--------------------------------------|
| DEMOGRAPHIC & SOCIO-ECONOMIC DRIVERS | TECHNOLOGICAL DRIVERS |
| Changing nature of work, flexible work | Mobile internet, cloud technology |
| Middle class in emerging markets | Processing power, Big Data |
| Climate change, natural resources | New energy supplies and technologies |
| Geopolitical volatility | Internet of Things |
| Consumer ethics, privacy issues | Sharing economy, crowdsourcing |
| Longevity, ageing societies | Robotics, autonomous transport |
| Young demographics in emerging markets | Artificial intelligence |
| Women’s economic power, aspirations | Advanced manufacturing, 3D printing |
| Rapid urbanisation | Advanced materials, biotechnology |

The zig-zag line between the drivers embedded in the primary forces of demographic and socio-economic drivers, and technological drivers, serves to illustrate their concurrency, with each interacting in multiple directions and intensifying each another.

Closing remarks

Although 4IR is regarded as being driven by extreme automation and extreme connectivity¹², it is increasingly evident that disruption (resultant from 4IR) does not stem solely from technology, but is also influenced by demographic shifts, globalisation, macroeconomic trends and more.¹⁰ It would, therefore, be inadequate to examine the drivers of 4IR only through a technology-lens. Not that it would not be important per se, but it gives a partial view, and would be risky if taken as the whole. Human societies are just as complex as ecosystems, with many different types of players and environmental conditions¹³, and using a partial view as a lens through which to view an entire phenomenon becomes problematic; life does not break down into neat categories.¹⁴

As noted by EY, “some of the most disruptive technologies on the horizon (e.g., AI and robotics) will not only disrupt corporate business models, but also society as a whole – realigning income distribution, altering relationships between governments and citizens,

and perhaps even calling into question fundamental aspects of the human experience.”¹⁰ A cue from Alfonso Montuori might prove useful in our quest for better understanding the complexity of 4IR: “What is the phenomenon we are seeking to understand, and what aspects of our description would need to be sacrificed in a discipline-driven inquiry? How are the elements of the narrative interconnected, and how do their interconnectedness and the multi-dimensionality of the phenomenon require a transdisciplinary approach?”¹⁴

¹ World Economic Forum (WEF). 2016. *The future of jobs: Employment, skills and workforce strategy for the Fourth Industrial Revolution*. World Economic Forum, Geneva, Switzerland. [Online] Available: http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf [Accessed: 23 October 2017].

² Alcamo, J. & Gallopín, G. 2009. *Building a 2nd generation of world water scenarios*. World Water Assessment Programme Side Publications Series. Paris: UNESCO. [Online] Available: <http://unesdoc.unesco.org/images/0018/001817/181796e.pdf> [Accessed: 23 October 2017].

³ Schwartz, P. 1991. *The art of the long view*. New York: Currency Doubleday.

⁴ Schwab, K.M. 2016. *The Fourth Industrial Revolution*. Geneva, Switzerland: World Economic Forum.

⁵ EY, 2015. *Megatrends 2015: Making sense of a world in motion*. EYGM Limited. [Online] Available: [http://www.ey.com/Publication/vwLUAssets/ey-megatrends-report-2015/\\$FILE/ey-megatrends-report-2015.pdf](http://www.ey.com/Publication/vwLUAssets/ey-megatrends-report-2015/$FILE/ey-megatrends-report-2015.pdf)

⁶ O'Sullivan, M. 2013. Introducing our new megatrends framework. New York, NY: Credit Suisse Securities (USA) LLC. [Online] Available: <https://www.credit-suisse.com/media/sites/megatrends/doc/megatrends-usa.pdf> [Accessed: 23 October 2017].

⁷ Eager, R., Boulton, C. & Demyttenaere, C. 2014. The trends in megatrends: The most important megatrends and how to monitor them. *Prism*, **2**, 12-23.

⁸ Lancefield, D., Vaughan, R. & Boxall, R. 2015. When megatrends collide: How to prepare for the inevitable interactions between global forces and stay ahead of the competition. *Strategy + Business*, **78**, 1-10.

⁹ PricewaterhouseCoopers (PWC). 2017. Workforce of the future: The competing forces shaping 2030. [Online] Available: <https://www.pwc.com/gx/en/services/people-organisation/workforce-of-the-future/workforce-of-the-future-the-competing-forces-shaping-2030-pwc.pdf> [Accessed: 23 October 2017].

¹⁰ Ernst & Young (EY). 2016. *The upside of disruption: Megatrends shaping 2016 and beyond*. EYGM Limited. [Online] Available: [http://www.ey.com/Publication/vwLUAssets/EY-the-upside-of-disruption/\\$FILE/EY-the-upside-of-disruption.pdf](http://www.ey.com/Publication/vwLUAssets/EY-the-upside-of-disruption/$FILE/EY-the-upside-of-disruption.pdf) [Accessed: 24 October 2017].

¹¹ Ernst & Young. 2016. *Future of Smart*. EY Megatrends, 25. [Online] Available: <http://www.ey.com/gl/en/issues/business-environment/ey-megatrends-future-of-smart> [Accessed: 3 November 2017].

¹² Baweja, B., Donovan, P., Haefele, M., Siddiqi, L. & Smiles, S. 2016. *Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution*. UBS White Paper for the World Economic Forum Annual Meeting 2016. [Online] Available: <https://www.ubs.com/global/en/about> [Accessed: 3 November 2017].

¹³ Bloom, P.N. & Dees, G. 2008. Cultivate your ecosystem. *Stanford Social Innovation Review*, **6**(1), Winter, 47-53.

¹⁴ Montuori, A. 2013. The complexity of transdisciplinary literature reviews. *Complicity: An International Journal of Complexity and Education*, **10**(1/2), 45-55.