

Editorial Introduction: *Zeitenwende* — Turn of Eras

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■ *A new wave of innovation disrupts our social and economic life as we have lived it in the 20th century. On the one hand, artificial intelligence (AI) has the potential to increase our efficiency and ability to cope with the changes that are coming. On the other hand, AI itself also causes disruptions that may be managed best by contributions from other fields. We aim to start an interdisciplinary discourse with this special issue and bring together a set of articles from AI researchers, sociologists, economists, and psychologists who discuss five basic questions: How can AI help? How will AI affect economy and work? How does AI affect democracy? How does AI affect our togetherness? And how does AI affect the human self?*

For the past seven decades, the industrialized world has been subjected to three major trends: globalization, demographic change, and scarcity of natural resources.

Globalization — After the end of the Second World War and later, after the end of the Cold War, the world saw a steadily increasing level of multilateralism, with the rise of international institutions such as the World Bank, the Organization for Economic Co-operation and Development (OECD), the World Trade Organization (WTO), and the European Union, as well as free trade agreements such as the North American Free Trade Agreement (NAFTA), the Association of Southeast Asian Nations (ASEAN) Free Trade Area, the Southern Common Market (MERCOSUR) in Latin America, and the Common Market for Eastern and Southern Africa (COMESA). Supply-chains and distribution of raw materials and goods dramatically increased international competition with globalized outsourcing. One side effect in the Western countries was a

major structural change: high unemployment in the 1970s and 1980s, and a multidecades-long stagnation of salaries for large segments of the population in many Western countries. At the same time, however, the number of people living in extreme poverty decreased worldwide from about 1.9 billion in 1990 to 730 million in 2015.

Demographic Change — The more industrialized a society becomes, the lower its birth rate. Worldwide, the average number of children per woman is down from 4.96 in 1960 to 2.49 in 2015. In the USA, it fell from 3.48 in 1960 to 1.87 in 2015. Even in Africa, it was 6.7 in 1960 and fell to 4.58 in 2015. At the same time, life expectancy increased. In 1950, a newborn anywhere in the world was expected to become 60.1 years old. By 2015, life expectancy has become 71.7 years. As a result, societies are getting older. The median age in the USA rose from 28.1 in 1970 to 38.2 in 2018. In Japan, it rose from 28.8 to 46.4, in the same timeframe. This trend strains social security systems. It affects democratic majorities, tipping the scale toward older generations at the expense of the younger. Arguably, it also influences the ability of a society to innovate.

Scarcity of Natural Resources — Ever-expanding commerce and an ever-growing world population are confronted with the finiteness of the world's riches. In 1961, the per-capita world gross domestic product was \$3,827 (inflation adjusted, in today's US dollars), or \$11.83 quadrillion total. In 2017, it was \$10,632 per capita, or \$80.25 quadrillion. During the same timeframe, the world's population grew from 3.03 billion to 7.53 billion. Crude oil production rose from 3,142 million tons annually in 1990 to 4,472 million tons annually in 2018. Growth is the orthodoxy of the prevailing economic theory, sustainability the mandate of finite resources.

At the Beginning of a New Wave of Innovation, New Megatrends Are Emerging

These were the three megatrends for seven decades. They were economic, political, and societal, and have cast a shadow over the second half of the 20th and the first decade of the 21st century. Now, we see some of these trends evolve, and others replaced, by newly dominating challenges. At the beginning of a new wave of innovation, new megatrends are emerging: digitization, gene technology, and decarbonization.

Digitization — Information has become an integral economic component. Fueled by more efficient centralized computing infrastructure, as well as new algorithmic approaches, data, insights, and knowledge, that are being acquired as part of regular business operations, have become economic assets in and of themselves. In its most disruptive form, this has given rise to a form of digital platform capitalism that has unhinged traditional business models in many industries, from advertising to

tourism, to transportation, retail, and the news and entertainment industries. At the same time, automation revolutionizes manufacturing and leads to deglobalization trends, while artificial intelligence (AI) affects the way we work, how we build and maintain friendships, and even how political will is formed and assessed.

Gene Technology — There can be little doubt that the advent of clustered regularly interspaced short palindromic repeats and gene drives will transform multiple fields, in particular healthcare and agriculture. The prospect of a prolonged, healthy life is met with the danger that some vital ecosystems may be disrupted in formerly unimaginable ways, as the 2019/2020 coronavirus disease pandemic outbreak has demonstrated all too clearly. Moreover, a further significantly increased life expectancy will exacerbate the demographic challenges we are already facing today.

Decarbonization — The biggest economic risk in the third decade of the 21st century is no longer the scarcity of natural resources, but one thing we have too much of: carbon dioxide, emitted to produce energy for ever-more people. The 2020 World Economic Forum in Davos-Klosters, Switzerland tied every major economic risk in 2020 to climate change. The infrastructure that humanity has erected in the past 150 years — factories, schools, hospitals, power plants, residential houses, streets, airports — all find themselves immovable, in locations that have served us well in our current climate. But changing coastlines, droughts, collapsing ecosystems, and mass migration endanger humanity's heritage, societal stability, and the standard of living for future generations.

The Answer to the Invention of the Assembly Line Was Not a Better Assembly Line

Digitization, gene technology, and decarbonization are some of the new megatrends that we are facing in the 21st century. Technological advances are the major driving force behind these changes. Approaches on how to mitigate potential negative side effects of these changes can likely be found in other disciplines, such as economics, and the political and social sciences.

That is why, in this special *AI Magazine* issue on AI — The Social Disruption, we hope to seed an interdisciplinary discourse of AI researchers with economists, psychologists, and social scientists. Simply put, the answer to the invention of the assembly line was not a different, better assembly line, but workers' rights, guaranteed time to regenerate, and health and unemployment insurance. The effects that AI technology will have on humanity might, in part, be mitigated by changes to the technology itself. However, the most important question will be how we will adapt our economic, political, and societal systems, to put the new technology



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into the service of humanity, rather than becoming passive objects of the changes that AI already brings to the way we work, interact, and organize ourselves.

For example, AI may decentralize production through automation and bring it back, closer to the consumer, leading to deglobalization trends within a globalized economy. AI may also alter the very nature of age-old professions. Diagnostic work for internal medicine may be replaced or augmented by cognitive assistants. Truck drivers may be replaced by self-driving technologies. Changes like these will create winners and losers within each profession and each society. They will create regions that thrive and regions that wither. They may even elevate entire countries while others fall behind. This is the essential characteristic of structural change: that it challenges the status quo and creates deviations from entitled positions. The main question is not only how AI technology should be adjusted to mitigate risks, but also how we can devise a new social contract that prevents social unrest and conflicts fueled by the envy and anger of people whose lives turn out differently than expected.

Everyone Is Affected and Hence, Everyone Is Invited to Contribute Their Thoughts and Ideas

As this Introduction suggests, much is at stake, and every major part of human life is affected. To structure this very wide field, we organized this special issue as follows:

How Can AI Help Humanity? Mary Cummings rethinks the maturity of AI in safety-critical settings.

How Will AI Affect the Future of Our Economy and Work? Thomas Kochan devises a proactive strategy to prepare for the work of the future.

How Does AI Affect Social Interactions and Mental Health? Peter Tu reviews community and self in the age of AI, and Mariano Sigman et al. foresee that AI will change the way we assess mental health.

How Does AI Affect Democracy and the Formation of Political Will? Suman Gupta reviews the perceived impact of AI on voting and contemplates procedural democracy.

How Can We Assure, Control, and Audit AI Technology? Been Kim and Finale Dochi-Velez review the state of the art in holding AI accountable, and Rhema Vaithianathan et al. illustrate AI oversight for an application in child protection.

We hope that this special issue will motivate the exploration of new ideas, seed new discussions between researchers in different disciplines, and will become a starting point for a broader societal discourse. Everyone is affected and hence, everyone is invited to contribute their thoughts and ideas of how to peacefully manage through this change as one unified, thriving humanity.

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