Technology: creative & destructive

The winners and losers in an age of digitalization, automation and modernization

A new industrial revolution has arrived, fueled by technologies encompassing digitalization, artificial intelligence, automation, biotechnology, fintech and clean technologies . The spread of technology offers the opportunity to address both major environmental challenges, such as climate change, and social issues, such as the need to empower women. But technology is also leading to significant company and sector disruption and therefore presents risks and opportunities for investment portfolios.

Digital technologies which are enabling more individuals and businesses to gain access to financial services via mobile phones and the internet will assist G20 efforts to increase financial inclusion. According to the World Bank,[1] there are an estimated 1.7 billion working-age adults with no access to financial services, and a disproportionate number (56% of them) are women. The delivery of financial services is also part of the solution to a number of the United Nations' Sustainable Development Goals, such as gender equality and ending poverty, and fostering good health and well-being. Research by McKinsey Global Institute also finds that broadening access to financial services could increase the GDP of all emerging economies by 6% by 2025.[2] This would represent additional economic growth of 3.7 trillion U.S. dollars, equivalent to adding an economy the size of Germany to global GDP.

Meanwhile, we believe environmental or clean technologies such as wind, solar and water efficiency (blue tech) and electric vehicles, which are increasingly viable due to improved cost competitiveness, will also have a transformative impact. Solar photovoltaic (PV) costs have declined by over 80% since 2009.[3] Renewables represent just 8.4% of total global power generation but accounted for almost 50% of the growth in 2017.[4] In our view, these technologies will trigger not just a transformation of the power-generating sector globally but also curb carbon emissions across other parts of the economy. Electric vehicles threaten to disrupt traditional auto makers significantly, given that more and more countries are introducing bans on the sale of petrol and diesel cars, in some instances as soon as in 2030. That the 25 largest auto manufacturers make up just 20% of the market cap of the world's 15 largest tech companies today, compared to 60% eight years ago, shows the extent of the sector repricing that is taking place.[5] Many of the new technologies are being deployed to address air, land and water contamination as well as the broader objectives of the Paris climate agreement and the United Nations' Sustainable Development Goals.

Petra Pflaum
EMEA Co-Head of Equities & CIO for Responsible Investments

In a nutshell

- The world has moved into a new technological age
- This new age offers the chance to address the major environmental and social challenges of our time
- But technological change can also disrupt sectors and even whole countries by increasing income inequality and putting social cohesion at risk.

[1] World Bank (April 2018). The Global Findex Database 2017
[2] McKinsey Global Institute, (September 2016). How digital finance could boost growth in emerging economies
[3] Irena (January 2018). Renewable Power Generation Costs in 2017
[4] BP Statistical Review 2017 (June 2018)
[5] KMPG (January 2018). The changing landscape of disruptive technologies 2018

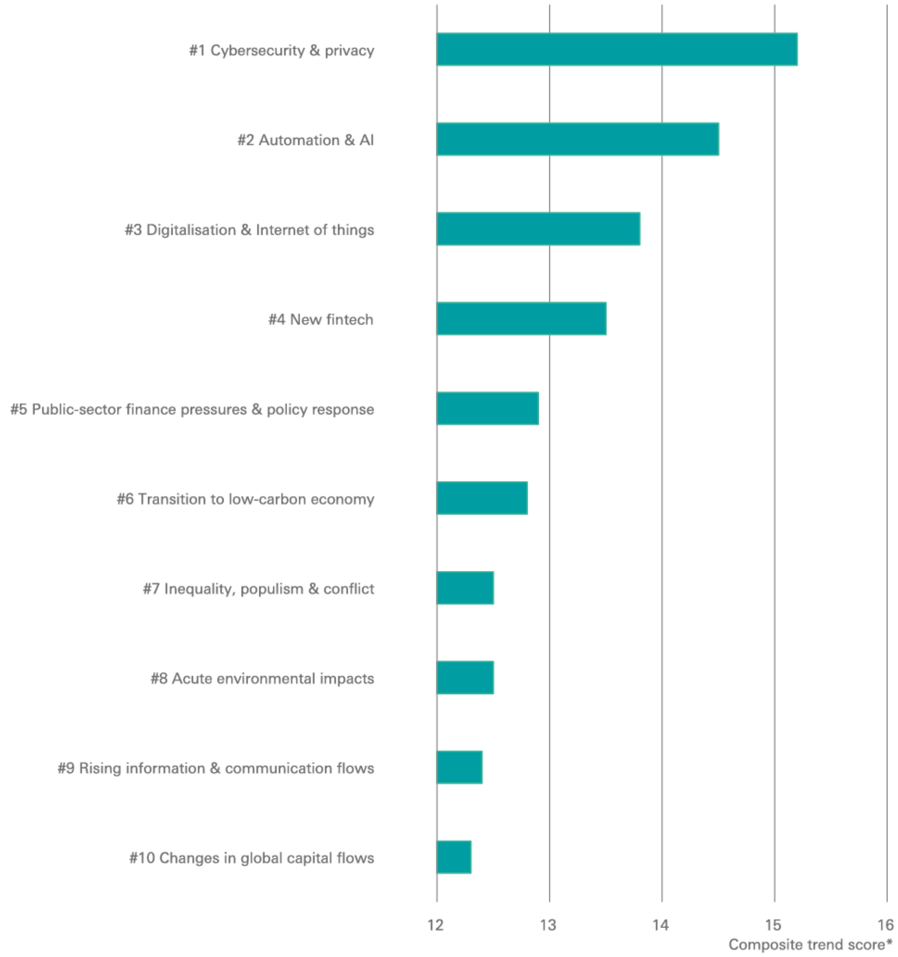
Technology is also bringing smart farming techniques to help cope with the increasing demands on the food sector from global population growth, rising incomes and climate change. Technologies can help to deliver more site-specific weather intelligence and disease-probability mapping, which can enable a more optimal crop production process. This, in turn, can help fertilizers and pesticides to be used more efficiently. These and other techniques can also reduce the ecological footprint of farming. In addition, lab-grown meat from cultured cells could cut the environmental costs of producing meat and reduce the unethical treatment of farm animals.

Technology will, in our view, also contribute to the building of smarter and more sustainable cities. Cities account for almost 70% of the world's energy consumption and a similar share of global CO_2 emissions[6]. Part of the improvement will come from technological advances in the energy, transportation and real-estate sectors.

However, technology also has a dark side. Digital currencies can be used for criminal activity, and cyberattacks or malware can cause large-scale economic damage. For example, in 2017, the NotPetya cyberattack meant that the most affected companies reported quarterly losses of around 300 million U.S. dollars.[7] Technologies such as robotics, sensors and machine learning could also enable capital to replace labor in an expanding range of jobs and sectors, with potential negative implications for income equality and social cohesion. Understanding these risks and capturing the opportunities will determine many of the successes and failures of investment strategies in the years ahead.

[6] C40 Cities https://www.c40.org/why_cities
[7] World Economic Forum (January 2018). The Global Risks Report 2018

Technological advances are viewed as top-four risks



Source: PRI and Willis Towers Watson (December 2017). Responding to megatrends. Survey among asset managers, asset owners and service providers in the asset-management industry.
* Composite trend score reflects the addition of severity of impact and difficulty of management

Glossary

Emerging markets (EM)

Emerging markets (EM) are economies not yet fully developed in terms of, amongst others, market efficiency and liquidity.

G20

The **Group of 20** are the largest industrialized and emerging economies in the world.

Gross domestic product (GDP)

The **gross domestic product (GDP)** is the monetary value of all the finished goods and services produced within a country's borders in a specific time period.

Risk warning

Investments are subject to investment risk, including market fluctuations, regulatory change, possible delays in repayment and loss of income and principal invested. The value of investments can fall as well as rise and you might not get back the amount originally invested at any point in time.

Investments in Foreign Countries – Such investments may be in countries that prove to be politically or economically unstable. Furthermore, in the case of investments in foreign securities or other assets, any fluctuations in currency exchange rates will affect the value of the investments and any restrictions imposed to prevent capital flight may make it difficult or impossible to exchange or repatriate foreign currency.

Foreign Exchange/Currency – Such transactions involve multiple risks, including currency risk and settlement risk. Economic or financial instability, lack of timely or reliable financial information or unfavorable political or legal developments may substantially and permanently alter the conditions, terms, marketability or price of a foreign currency. Profits and losses in transactions in foreign exchange will also be affected by fluctuations in currency where there is a need to convert the product's denomination(s) to another currency. Time zone differences may cause several hours to elapse between a payment being made in one currency and an offsetting payment in another currency. Relevant movements in currencies during the settlement period may seriously erode potential profits or significantly increase any losses.

High Yield Fixed Income Securities – Investing in high yield bonds, which tend to be more volatile than investment grade fixed income securities, is speculative. These bonds are affected by interest rate changes and the creditworthiness of the issuers, and investing in high yield bonds poses additional credit risk, as well as greater risk of default.

Hedge Funds – An investment in hedge funds is speculative and involves a high degree of risk, and is suitable only for "Qualified Purchasers" as defined by the US Investment Company Act of 1940 and "Accredited Investors" as defined in Regulation D of the 1933 Securities Act. No assurance can be given that a hedge fund's investment objective will be achieved, or that investors will receive a return of all or part of their investment.

Commodities – The risk of loss in trading commodities can be substantial. The price of commodities (e.g., raw industrial materials such as gold, copper and aluminium) may be subject to substantial fluctuations over short periods of time and may be affected by unpredicted international monetary and political policies. Additionally, valuations of commodities may be susceptible to such adverse global economic, political or regulatory developments. Prospective investors must independently assess the appropriateness of an investment in commodities in light of their own financial condition and objectives. Not all affiliates or subsidiaries of Deutsche Bank Group offer commodities or commodities-related products and services.

Investment in private equity funds is speculative and involves significant risks including illiquidity, heightened potential for loss and lack of transparency. The environment for private equity investments is increasingly volatile and competitive, and an investor should only invest in the fund if the investor can withstand a total loss. In light of the fact that there are restrictions on withdrawals, transfers and redemptions, and the Funds are not registered under the securities laws of any jurisdictions, an investment in the funds will be illiquid. Investors should be prepared to bear the financial risks of their investments for an indefinite period of time.

Investment in real estate may be or become nonperforming after acquisition for a wide variety of reasons. Nonperforming real estate investment may require substantial workout negotiations and/ or restructuring.

Environmental liabilities may pose a risk such that the owner or operator of real property may become liable for the costs of removal or remediation of certain hazardous substances released on, about, under, or in its property. Additionally, to the extent real estate investments are made in foreign countries, such countries may prove to be politically or economically unstable. Finally, exposure to fluctuations in currency exchange rates may affect the value of a real estate investment.

Structured solutions are not suitable for all investors due to potential illiquidity, optionality, time to redemption, and the payoff profile of the strategy. We or our affiliates or persons associated with us or such affiliates may: maintain a long or short position in securities referred to herein, or in related futures or options, purchase or sell, make a market in, or engage in any other transaction involving such securities, and earn brokerage or other compensation. Calculations of returns on the instruments may be linked to a referenced index or interest rate. In such cases, the investments may not be suitable for persons unfamiliar with such index or interest rates, or unwilling or unable to bear the risks associated with the transaction. Products denominated in a currency, other than the investor’s home currency, will be subject to changes in exchange rates, which may have an adverse effect on the value, price or income return of the products. These products may not be readily realizable investments and are not traded on any regulated market.

Hong Kong

The contents of this document have not been reviewed by any regulatory authority in Hong Kong. You are advised to exercise caution in relation to the investments contained herein. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice. This document has not been approved by the Securities and Futures Commission in Hong Kong nor has a copy of this document been registered by the Registrar of Companies in Hong Kong and, accordingly, (a) the investments (except for investments which are a “structured product” as defined in the Securities and Futures Ordinance

All opinions and claims are based upon data on 12/17/18 and may not come to pass. This information is subject to change at any time, based upon economic, market and other considerations and should not be construed as a recommendation. Past performance is not indicative of future returns. Forecasts are based on assumptions, estimates, opinions and hypothetical models that may prove to be incorrect. DWS Investment GmbH

CRC 062902 (12/2018)

(Cap. 571 of the Laws of Hong Kong) (the "SFO")) may not be offered or sold in Hong Kong by means of this document or any other document other than to "professional investors" within the meaning of the SFO and any rules made thereunder, or in other circumstances which do not result in the document being a "prospectus" as defined in the Companies (Winding Up and Miscellaneous Provisions) Ordinance (Cap. 32 of the Laws of Hong Kong) ("CO") or which do not constitute an offer to the public within the meaning of the CO and (b) no person shall issue or possess for the purposes of issue, whether in Hong Kong or elsewhere, any advertisement, invitation or document relating to the investments which is directed at, or the contents of which are likely to be accessed or read by, the public in Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to the investments which are or are intended to be disposed of only to persons outside Hong Kong or only to "professional investors" within the meaning of the SFO and any rules made thereunder.

Singapore

Singapore Interests in the funds mentioned herein are not allowed to be made to the public or any members of the public in Singapore other than (i) to an institutional investor under Section 274 or 304 of the Securities and Futures Act (Cap 289) ("SFA"), as the case may be, (ii) to a relevant person (which includes an Accredited Investor) pursuant to Section 275 or 305 and in accordance with other conditions specified in Section 275 or 305 respectively of the SFA, as the case may be, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Important Information

DWS is the brand name of DWS Group GmbH & Co. KGaA. The respective legal entities offering products or services under the DWS brand are specified in the respective contracts, sales materials and other product information documents. DWS Group GmbH & Co. KGaA, its affiliated companies and its officers and employees (collectively "DWS Group") are communicating this document in good faith and on the following basis.

This document has been prepared without consideration of the investment needs, objectives or financial circumstances of any investor. Before making an investment decision, investors need to consider, with or without the assistance of an investment adviser, whether the investments and strategies described or provided by DWS Group, are appropriate, in light of their particular investment needs, objectives and financial circumstances. Furthermore, this document is for information/discussion purposes only and does not constitute an offer, recommendation or solicitation to conclude a transaction and should not be treated as giving investment advice.

DWS Group does not give tax or legal advice. Investors should seek advice from their own tax experts and lawyers, in considering investments and strategies suggested by DWS Group. Investments with DWS Group are not guaranteed, unless specified.

All opinions and claims are based upon data on 12/17/18 and may not come to pass. This information is subject to change at any time, based upon economic, market and other considerations and should not be construed as a recommendation. Past performance is not indicative of future returns. Forecasts are based on assumptions, estimates, opinions and hypothetical models that may prove to be incorrect. DWS Investment GmbH

CRC 062902 (12/2018)

Investments are subject to various risks, including market fluctuations, regulatory change, possible delays in repayment and loss of income and principal invested. The value of investments can fall as well as rise and you might not get back the amount originally invested at any point in time. Furthermore, substantial fluctuations of the value of the investment are possible even over short periods of time. The terms of any investment will be exclusively subject to the detailed provisions, including risk considerations, contained in the offering documents. When making an investment decision, you should rely on the final documentation relating to the transaction and not the summary contained herein. Past performance is no guarantee of current or future performance. Nothing contained herein shall constitute any representation or warranty as to future performance.

Although the information herein has been obtained from sources believed to be reliable, DWS Group does not guarantee its accuracy, completeness or fairness. No liability for any error or omission is accepted by DWS Group. Opinions and estimates may be changed without notice and involve a number of assumptions which may not prove valid. All third party data (such as MSCI, S&P, Dow Jones, FTSE, Bank of America Merrill Lynch, Factset & Bloomberg) are copyrighted by and proprietary to the provider. DWS Group or persons associated with it ("Associated Persons") may (i) maintain a long or short position in securities referred to herein, or in related futures or options, and (ii) purchase or sell, make a market in, or engage in any other transaction involving such securities, and earn brokerage or other compensation.

The document was not produced, reviewed or edited by any research department within Deutsche Bank and is not investment research. Therefore, laws and regulations relating to investment research do not apply to it. Any opinions expressed herein may differ from the opinions expressed by other Deutsche Bank departments including research departments. This document may contain forward looking statements. Forward looking statements include, but are not limited to assumptions, estimates, projections, opinions, models and hypothetical performance analysis. The forward looking statements expressed constitute the author's judgment as of the date of this material. Forward looking statements involve significant elements of subjective judgments and analyses and changes thereto and/or consideration of different or additional factors could have a material impact on the results indicated. Therefore, actual results may vary, perhaps materially, from the results contained herein. No representation or warranty is made by Deutsche Bank as to the reasonableness or completeness of such forward looking statements or to any other financial information contained herein.

This document may not be reproduced or circulated without DWS Group's written authority. The manner of circulation and distribution of this document may be restricted by law or regulation in certain countries, including the United States.

This document is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction, including the

All opinions and claims are based upon data on 12/17/18 and may not come to pass. This information is subject to change at any time, based upon economic, market and other considerations and should not be construed as a recommendation. Past performance is not indicative of future returns. Forecasts are based on assumptions, estimates, opinions and hypothetical models that may prove to be incorrect. DWS Investment GmbH

CRC 062902 (12/2018)

United States, where such distribution, publication, availability or use would be contrary to law or regulation or which would subject DWS Group to any registration or licensing requirement within such jurisdiction not currently met within such jurisdiction. Persons into whose possession this document may come are required to inform themselves of, and to observe, such restrictions.

Unless notified to the contrary in a particular case, investment instruments are not insured by the Federal Deposit Insurance Corporation ("FDIC") or any other governmental entity, and are not guaranteed by or obligations of DWS Group.

Publisher: DWS Investment GmbH, Mainzer Landstraße 11-17, 60329 Frankfurt am Main, Germany

All opinions and claims are based upon data on 12/17/18 and may not come to pass. This information is subject to change at any time, based upon economic, market and other considerations and should not be construed as a recommendation. Past performance is not indicative of future returns. Forecasts are based on assumptions, estimates, opinions and hypothetical models that may prove to be incorrect. DWS Investment GmbH

CRC 062902 (12/2018)