WHAT LIES AHEAD?

7 MEGATRENDS AND THEIR INFLUENCE ON CONSTRUCTION, REAL ESTATE AND URBAN DEVELOPMENT

BOUYGUES CONSTRUCTION x Usbek & Rica

Editorial

Faced with multiple uncertainties characterised by an accumulation and interplay of global issues, the analysis of megatrends and the major transitions and risks associated with them is today an essential prerequisite to the definition of long-term strategies. This holistic, quantified and rational vision of the future enables us to make the major investments needed to meet the challenges of the future with greater confidence.

What makes megatrends so exciting is that they enable leading companies to connect with the real story of the world and its future. So long as they are shared, they are places where visions and talents can meet and converge towards common goals. For the companies that learn from them, taking them into account reinforces their awareness of their own role in shaping change. They give meaning and they fuel the ability of people from different backgrounds to combine their talents and get involved in projects that can help make the world a better place.

An analysis of the trajectories of leading companies that have systematically factored megatrends into their long-term innovation plans over the last few years points to real progress towards more ambitious strategies that are more resilient to sudden shifts in the environment and more forward-looking and proactive with regard to major developments, whether they relate to climate and the environment, demographics and social issues, or technology. They are companies with the brightest future, if you will.

Finally, practically all the megatrends analysed have, directly for each of them, and even more so because of how they all interrelate, fundamental implications for the future of the entire infrastructure, urban planning and housing sector, highlighting major opportunities for applications and for developing all the skills of the Bouygues Construction Group.

It is also one of the advantages of a reasoned and detailed analysis of megatrends that it enables us to go beyond a general feeling of concern for the future and to bring out the expectations, the avenues for improvement and the opportunities for action associated with them.

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Contents

We live in an uncertain world, beset by a global pandemic, a growing number of natural disasters, widespread inflation, the return of war to Europe, geopolitical tensions and more all posing their own challenges. How can we anticipate and adapt quickly to changes in the world and in society? How can we better prepare for future crises?

With this in-depth analysis of current megatrends and the associated risks, the Bouygues Construction Strategic Foresight team invites you to explore the major trends that are shaping our societies as a whole, and to gain a better understanding of their influence on the sectors involved in building towns and cities and developing regions.

This holistic study is intended to share the global and structural dynamics over the long term, as well as the weak signals that are currently being generated and the breakthroughs that could arise. The aim is to provide an analytical framework and the keys to understanding that are needed for decision-making, to enable the emergence of real estate and urban development projects that are adapted to the issues and challenges we are facing.

So as to offer as complete a picture as possible, this document also sets out the transitions that have been implemented (major actions to counter or accompany these megatrends), which are having an impact on the future of construction, real estate and urban planning.

This is followed by a series of ideas on the challenges and solutions involved in designing, building, rehabilitating and developing towns and cities differently.

The philosopher Maurice Blondel wrote, "The future cannot be predicted, it must be planned." Through a global and systemic approach, we are presenting seven megatrends which will help us envisage the challenges and ruptures of tomorrow and prepare for the future. We all need to understand what lies ahead, so that we can adapt the way we build our towns and cities to the changing face of society. Enjoy your reading!

megatrend #1

Contrasted population growth

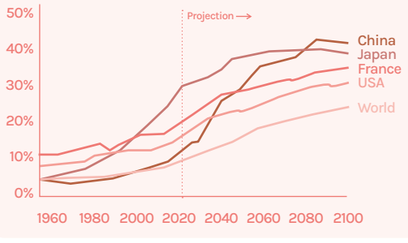
8 billion people: the symbolic number of humans on the planet was reached in November 2022. It's eight times more than in the 19th century. This figure is likely to rise to 9.7 billion by 2050, according to the latest UN and World Bank projections. It is striking to note that the increase of 1.7 billion is equivalent to more than the current population of Africa. **How can we meet the needs of a growing population against a background of climate change and an increasing scarcity of resources?** It is worth noting that the world's population is expected to decline around 2080 according to the UN, perhaps as early as 2064 according to a study[1] by researchers from the Institute for Health Metrics and Evaluation published in 2020 in the academic journal *The Lancet*... with all its geopolitical, economic and societal consequences.

Contrasting demographic growth

Over the coming decades, there will be considerable variations in population growth rates from one region to another, raising contrasting challenges. In societies with developed economies, such as Japan, Europe, South Korea and China, the question of ageing, not to say demographic collapse, is a major issue. Through a reduced proportion of people of working age, this trend poses fundamental problems with far-reaching consequences. According to the most recent UN estimations, the proportion of children under 15 in Japan has fallen from 23.10% to 11.77% in 40 years. Japan is followed by South Korea with 11.89%, Italy with 12.65% and Germany with 13.87% (UN figures for 2021). Demographic trends in these countries will depend on the immigration policies that are put in place. **When it comes to ageing towns and cities, what adaptations are needed for buildings, infrastructure and cities? What access should there be to services and transport? What can be done to improve the housing supply?**

Proportion of over-65s in the total population in G20 countries

Source: *UN World Population Prospects 2022*



29%

According to the World Bank, 29% of urban dwellers worldwide lived in slums in 2018. This figure rises to 54% for sub-Saharan Africa.

An increasingly urban population

Other younger and growing societies, such as those in sub-Saharan Africa and South Asia, will account for almost all population growth over the coming decades, with a rapid increase in urbanisation. According to the World Population Review, India has now overtaken China in terms of population. However, the strongest growth will be observed in sub-Saharan Africa, where the population is expected to double by 2050 (with half of the inhabitants below the age of 25). Although the demographic context in these countries will be favourable to their development, other challenges will arise: **will the public authorities be able to support this urbanisation with the infrastructure and services necessary for the economic development of their countries?**

300 million

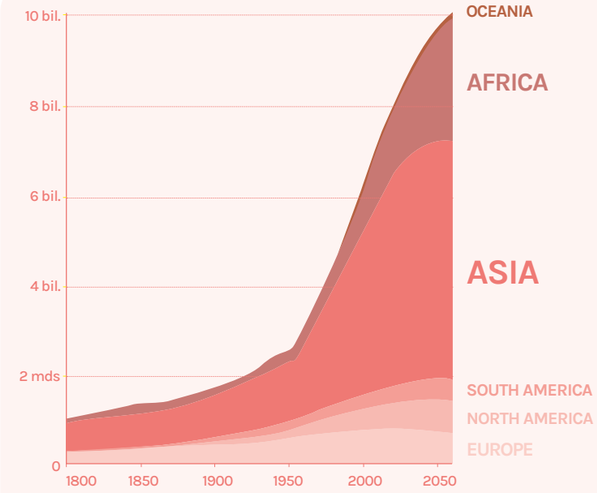
With the most densely populated cities located close to the coast, 300 million people could be at risk from rising sea levels by 2050[2].

Today, 55% of the global population lives in cities, but this is expected to rise to more than 2/3 by 2050. The bulk of this urban explosion will take place in Asia and Africa, with three countries expected to account for more than a third of additional city-dwellers according to the latest UN projections: India (+416 million), China (+255 million) and Nigeria (+189 million).

The effects of global warming are likely to render vast stretches of land uninhabitable in the future, exacerbating the displacement of populations. Three of the world's major regions are particularly affected: sub-Saharan Africa, South Asia and island territories (South Pacific, Indian Ocean, Caribbean). In 2020, the Internal Displacement Monitoring Centre (IDMC) reported 30.7 million new displacements, three times more than those for which conflict and violence are responsible.

216 million

The climate emergency could drive up to 216 million people to migrate within their own country over the next three decades[3].



World population by region

Source: ONU, World Population Prospects 2022

Construction, real estate, urban development

What challenges?

- Offering older people a more suitable living environment and easier access to care.
- Adapting existing housing stock to the needs of the elderly.
- Making everyday facilities more accessible without the use of a private car.
- Providing the infrastructure needed for growing urbanisation.
- Improving the living conditions of slum dwellers and preventing the creation of new slums.
- Adapting cities to make them more resilient in the face of climate change, particularly rising sea levels.
- Taking into account the phenomenon of a declining working population in the public policies of developed economies.

What solutions?

- Urban planning adapted, with public spaces accessible to all.
- Optimised location of everyday amenities, local services and shops ("Compact City" in Japan, or "fifteen-minute city").
- A rethink of the existing housing stock to offer solutions that meet needs as closely as possible: residential projects with a high degree of modularity, adaptability, flexibility and upgradability; re-embellishing nursing homes and similar institutions; building intergenerational residences, hybrid housing, etc.
- Use of new technologies to enable the elderly to remain at home independently for as long as possible (home automation, connected home solutions).
- Infrastructure and urban development projects in sub-Saharan Africa and Asia to meet demographic needs.
- Measures taken in coastal towns to anticipate rising sea levels.

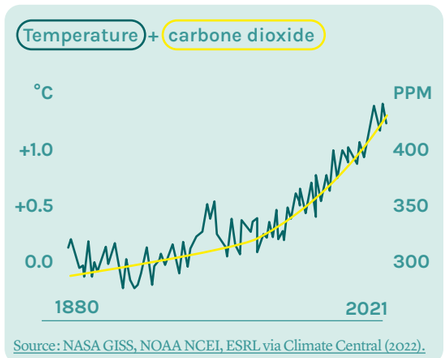
megatrend #2

Climate change and the collapse of biodiversity

Climate experts are adamant: the planet is heating up, and fast, as a result of the increase in greenhouse gases caused by human activity, leading to the health, environmental and humanitarian crises we are witnessing right now. With deadly floods in Pakistan, historic droughts in China, lethal heatwaves in India, Pakistan and Europe, torrential rain in the United States, floods in South-East Asia and giant forest fires in Spain and Portugal, **2022 was a year of devastating climate disasters in every corner of the world.**

The more the planet warms up, the more frequent and intense climate- and weather-related disasters become.

However, scientists agree that, as of 2022, all is not lost… as long as we drastically reduce our greenhouse gas emissions right now. This means radically transforming our society. **Our population is growing and our energy needs are increasing.**



Source: NASA GISS, NOAA NCEI, ESRL via Climate Central (2022).

According to the most pessimistic projection issued by the IPCC[4], if global emissions are not reduced, temperatures could rise by 5.7° C by 2100, causing irreversible damage to our ecosystems.

The construction and use of buildings and engineering structures are responsible for 38% of the world's annual CO_2[5] emissions. Decarbonising this sector is crucial if we are to limit global warming.

It has become crucial for our cities and regions to adapt to climate change. As stated in the 6th IPCC report published in March 2022, the aim is to reduce the exposure and vulnerability of human societies and ecosystems, to limit the negative impacts of potential climate hazards. The concept of "resilience" takes this a step further, by aiming to achieve a more resilient state, i.e. one in which human societies and ecosystems can continue to function regardless of major disasters (floods, droughts, pandemics, cyber-attacks, etc.) but also by reducing chronic stressors of everyday life (air pollution, social inequalities, ageing infrastructures, etc.) and by adapting now to the long-term constraints associated with irreversible changes (climate change, increasing scarcity of resources, erosion of biodiversity, etc.).

A recent study[6] released by the IPBES reveals that more than three quarters of our planet's land surface has been significantly damaged as a result of human activities. This is due to the rapid expansion and unsustainable management of farmland and grazing land, as well as rising greenhouse gas emissions. **The partial or total destruction of soil and the deterioration of oceans are the main causes of species extinction.**

According to the IPBES, **the pace of species extinction is particularly worrying**, with the current rate of extinction higher than the average for the last 10 million years and at an all-time high. Scientists are warning that biodiversity is collapsing, and some are even talking about a "sixth mass extinction". In response, scientists have theorised the notion of **the Anthropocene** as a new geological era or historical period. This new era is characterised by the significant geological influence of the human species on the environment, the biosphere and the entire Earth system.

Biodiversity is essential to ensure that ecosystems and the biosphere function properly. It also plays a part in regulating climate and atmospheric composition, and in providing drinking water.

28%

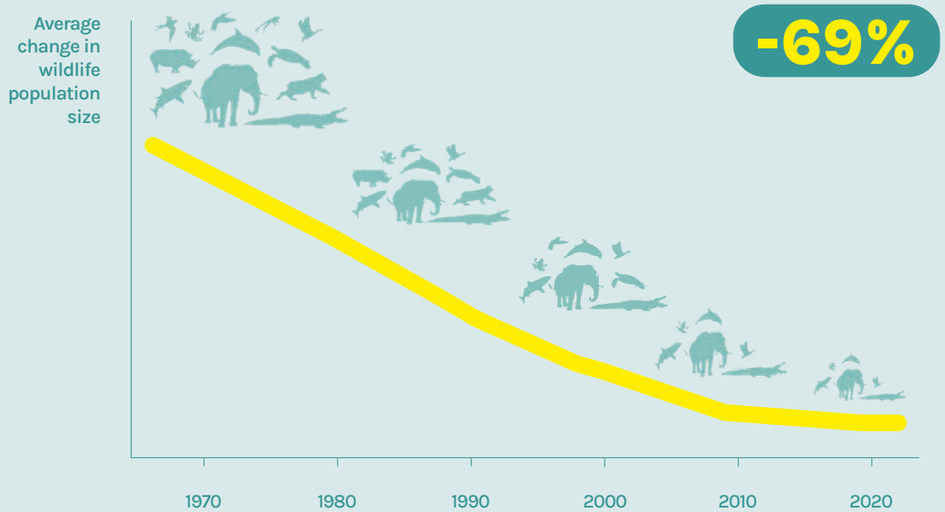
According to the IPBES, around 28% of animal and plant species studied are currently at risk of extinction, constituting over 1 million species[7].

50%

Natural ecosystems absorb around 50% of our CO_2 emissions.

It is a source of goods and services that humans depend on for vital needs such as breathing, eating and healthcare. It delivers roughly twice the value of what humans produce each year.

Climate change is also affe cting food production and access to clean water in many areas, affecting the well-being of an estimated 3.3 to 3.6 billion people[8], leading to increased socio-economic tensions and **increasing migration**.



Average loss of wild animal populations according to the Living Planet Index 2022.

Source: WWF, 2022

Construction, real estate, urban development

What challenges?

- Reducing the impact of construction, real estate and urban development on both the environment and biodiversity.
- Reducing the carbon footprint and energy consumption of cities and buildings.
- Adapting buildings to climate risks.
- Training all branches of the construction industry to take on these new challenges
- Ensuring that new regulations are introduced to encourage new ways of building cities.
- Improving climate and food resilience in cities.
- Protecting and restoring biodiversity and ecosystems.
- Achieving carbon neutrality by 2050.
- Achieving zero net artificialisation by 2050.

What solutions?

FOR BIODIVERSITY

- Protection, preservation and promotion of biodiversity at all levels.
- Implementation of policies of blue-green infrastructure and zero net artificialisation to encourage the mobility of species and to protect natural, agricultural and forested land.
- Organising urban areas and land, both constructed and planted, to encourage the development and maintenance of biodiversity.
- Planting of roofs and facades of buildings.

FOR MITIGATING CLIMATE CHANGE

- Rebuilding the city within the city: refurbishment, renovation or conversion before building new
- Insulation of existing buildings.
- Use of biosourced or geosourced materials.
- Development of new, more environmentally-friendly construction methods: off-site construction, digitalisation, industrialisation, 3D printing, etc.
- Design of reversible buildings.
- Encouragement of the hybridisation and intensification of building uses.
- Sensible use of digital technology: “right tech”.
- Experimentation with “materials bank” buildings: dismantling, reuse, recycling.
- Greater development of recycling and recovery streams for construction materials.
- Increased use of public transport and soft mobility.

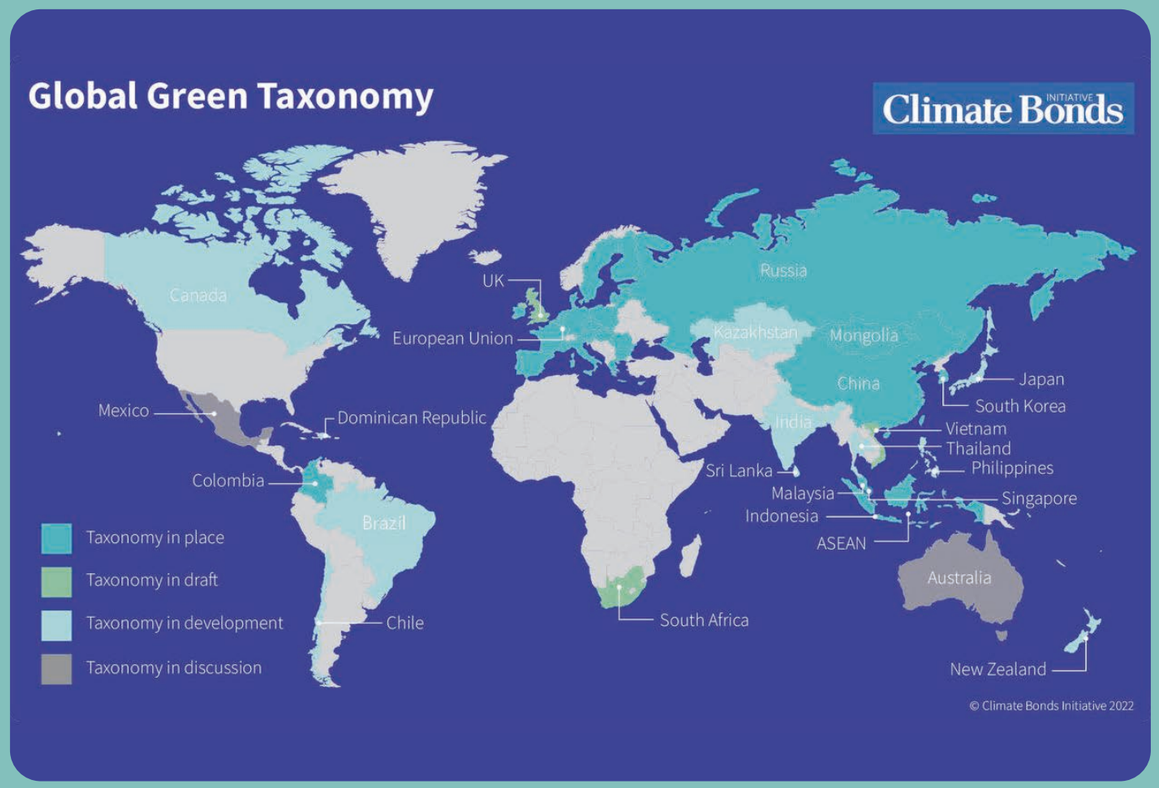
FOR ADAPTATION TO CLIMATE CHANGE

- Factoring in climate risks more fully (megafires, heavy rainfall and flooding, heatwaves, drought, etc.) when building and developing urban areas.
- Setting up local resilience projects.
- Less soil sealing (e.g. schoolyards)
- Greening of cities.
- Encouragement of knowledge sharing and cooperation between public and private players.
- More widespread use of local diagnostics to identify the vulnerabilities and resources of each area.
- Involvement of citizens in co-constructing projects for greater resilience
- Raising awareness and providing support to remove obstacles to change

Taxonomies as a driver of change

Source: Climate Bonds

Over the past few years, many jurisdictions around the world have introduced or are in the process of introducing taxonomies to establish classification systems for sustainable finance. If well designed, taxonomies can be used as tools to direct financial flows towards sustainable investments. They can cover a range of environmental goals, such as mitigation of climate change, adaptation to climate change, water protection, circular economy and waste treatment, pollution, biodiversity. They can also include social and governance goals. Although taxonomies may vary from one country to another, one of the challenges will be to make it easier for green capital to be invested internationally, despite the different approaches taken in each country.



megatrend #3

Exceeding the planet's limits and depleting our natural resources

The Earth has long been regarded as an inexhaustible source of materials, but **scientists are now warning us about human impact on natural resources**. Every year, the NGO Global Footprint Network publishes the date of Earth Overshoot, the day on which the Earth's resources are exceeded, which highlights the ecological limits of human over-consumption. Since 1970, our ecological impact on the Earth has exceeded its capacity, and the gap is only widening.

A study published in 2009 by a team of scientists led by Johan Rockström for the Stockholm Resilience Centre identified **nine planetary boundaries that must not be crossed**, failing which humanity will experience an irreversible change in the state of its ecosystem. By the end of 2021, 4 global limits had been crossed: climate change, the erosion of biodiversity, the phosphorus and nitrogen cycles and land system change. In May 2022, two further planetary boundaries were crossed – those of chemical pollutants and of the green freshwater cycle. For the first time, scientists have distinguished "blue water", i.e. the part of water from atmospheric precipitation that flows through rivers to the sea or is collected in lakes, aquifers or reservoirs, from "green water", i.e. water from atmospheric precipitation that is absorbed by plants. This study highlights the important role of green water in soil moisture, in the resilience of the biosphere, in securing terrestrial carbon sinks and in regulating atmospheric circulation. The conclusions point to significant disruption of the water cycle, with alarming consequences.

"Water is the blood of the biosphere. But we are in the process of profoundly changing the water cycle. This will affect the health of the entire planet and make it much less resistant to shocks."

— Lan Wang-Erlandsson, Stockholm Resilience Centre researcher, 2022.

Of the 9 planetary boundaries, **the only 2 that have not yet been crossed are the acidification of the oceans and the depletion of the ozone layer.**

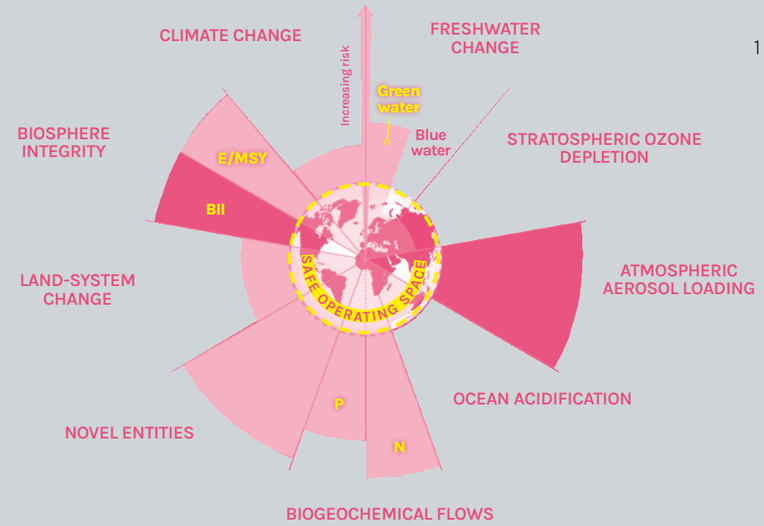
Added to this is the issue of the increasing scarcity of natural resources. These resources are either renewable (water, forests, fish, etc.) or non-renewable (oil, gas, minerals, etc.), depending on whether or not there is a natural process to replenish them. Over the coming decades, population growth and rising incomes are expected to lead to a **sharp increase in global demand for goods and services.**

"Earth Overshoot Day" occurs earlier and earlier.

Source : ID Info durable and ADEME

Planetary boundaries

Source : Stockholm Resilience Centre, 2022



1½

In 2022, annual consumption was already a planet and a half. By 2050, annual consumption could reach the equivalent of three planets[9].

167 Gt

Global use of materials is expected to more than double, rising from 79 Gt in 2011 to 167 Gt in 2060[10].

Are we heading towards a metals war?

The transition to low-carbon energy raises the question of a greater need for certain materials and pressure on new resources (cobalt, copper, lithium, nickel and rare earths). 90% of resources in cobalt (used in batteries) and copper (used in power grids and transport) known today could be consumed by 2050 in a 2°C scenario (compared with 25% for lithium)[11]. Given the high level of demand, questions arise **not only about the availability of resources, but also about supply dependency**, with resources concentrated in a few producer countries or countries specialising in metal refining, such as Chile, China, Australia and Russia. We also need to focus on "the hidden face of the energy and digital transition," to borrow the title of a book by Guillaume Pitron[12], an associate researcher at IRIS specialising in critical raw materials, who writes about the social, environmental and public health consequences of current technological development. Aurore Stéphant, a geological mining engineer specialising in the environmental and health risks of the mineral industry, also points out the need to prioritise uses, and to move increasingly towards energy efficiency and economy.

Risk of a global water crisis

On 22 March 2023, the first United Nations Water Conference in forty-six years opened. UN experts believe that between 2 and 3 billion people suffer from water shortages for at least one month a year, and that this figure could rise sharply in the coming years without greater international cooperation in this area. In view of this situation, the UN is warning of the "imminent risk of a global water crisis."

"There is an urgent need to establish strong international mechanisms to prevent the global water crisis from spiralling out of control. Water is our common future, and it is essential to act together to share it fairly and manage it sustainably."

— Audrey Azoulay, UNESCO Director-General.

Sand, a resource under pressure

The world's second most used resource after water, supplies of sand were long thought to be inexhaustible, but they are now increasingly limited (desert sand is unsuitable for industrial use). Being the principal component of cement, concrete, asphalt and glass, the primary use of sand is in construction, which accounts for almost 90% of total consumption.

2/3

2/3 of the planet's constructions are built of concrete, and 2/3 of this concrete is made up of sand[13].

×3

World demand for sand has tripled in 20 years[14].

4

China has consumed as much sand in 4 years as the United States has in a century[15].

With the depletion of land-based sand quarries, the extraction of marine sand (currently 2.5% of total sand production) is set to accelerate, leading to numerous environmental and social problems: **coastal erosion, disruption of ecosystems, exploitation of workers, use of freshwater for sand desalination**, etc. In India, organised crime syndicates are involved in the illegal trafficking of 2 billion tonnes of sand[16].

Timber: one answer to the challenges of sustainable construction

By comparison with concrete, wood has a number of advantages as an alternative building material: it is renewable, it is biosourced, and it can store and capture carbon. On the other hand, although wood is an environmentally-friendly material, **irresponsible forestry practices can have very serious social and environmental consequences, including loss of biodiversity, erosion, water pollution or disruption of the water cycle**, and even deforestation.

Added to this are the water requirements of the industry and the artificialisation of land due to construction and regional planning. By making surfaces impermeable, **soil artificialisation reduces the biodiversity of natural environments and disrupts the water cycle**. Flood risks increase during periods of heavy rainfall. Mineral surfaces also contribute to the formation of heat islands by absorbing more solar radiation than natural surfaces. It is therefore essential to take into account the function of the soil upstream of any urban development project.

20 million

Every year, 20 million hectares of land are artificialised around the world. In France, the rate of artificialisation has risen four times faster than population growth since the 1980s. The French Ministry of the Environment estimates it as between 20 000 et 30 000 hectares per year (equivalent to the size of 28,000 to 43,000 football stadiums per year).

Construction, real estate, urban development

What challenges?

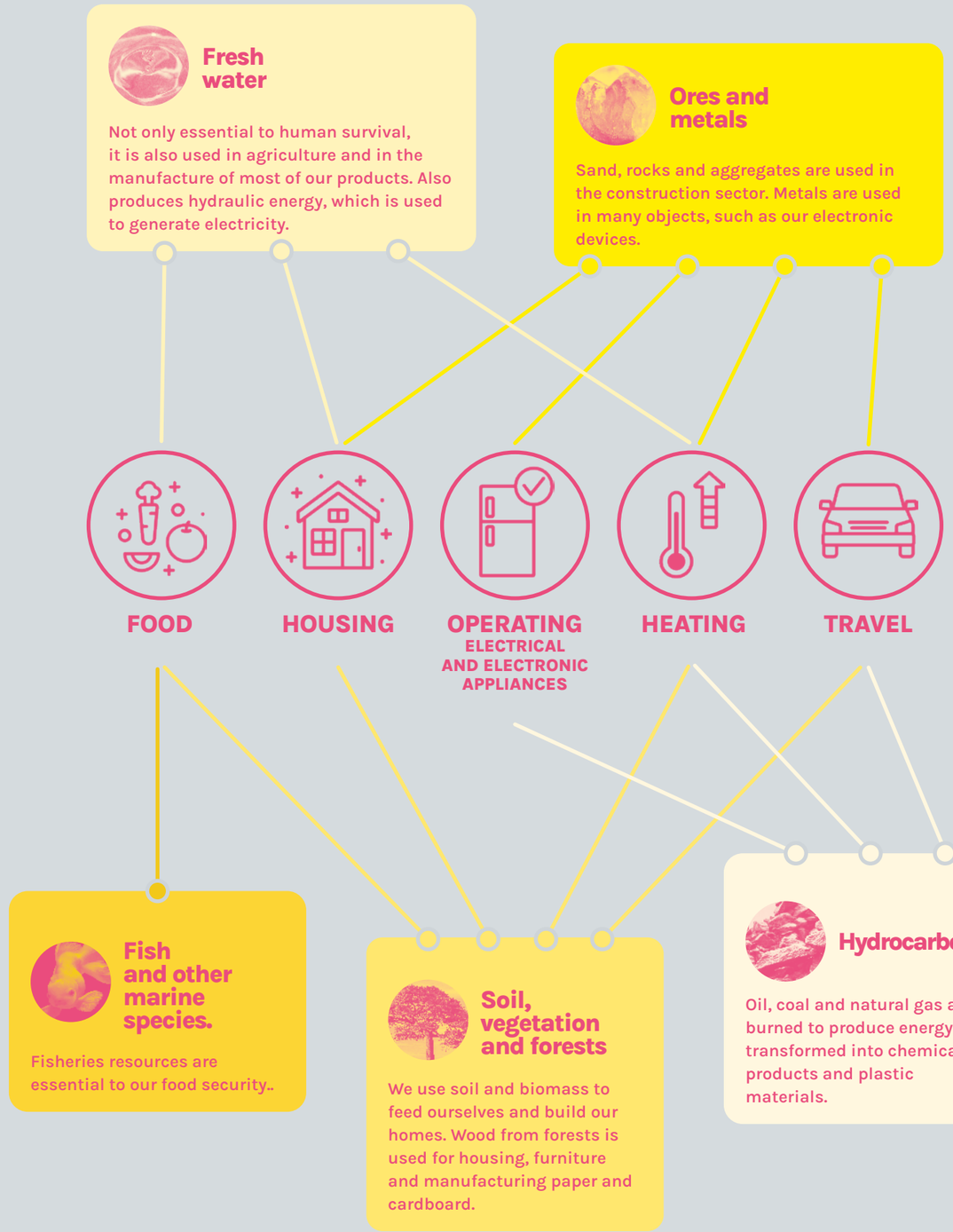
- Making a paradigm shift in the construction, real estate and urban planning sectors: "doing better with less".
- Developing sustainable timber construction; biosourced and geosourced materials streams.
- Developing re-use and recycling streams.
- Removing cultural and insurance barriers to new sectors.

What solutions?

- Containing urban sprawl: building on urban wasteland, increasing the density of already built-up areas, transforming derelict sites.
- Refurbishing rather than demolishing and rebuilding.
- Transformation of existing uses (e.g. conversion of offices into housing).
- Eco-design: natural light, natural ventilation, energy efficiency, bioclimatic design, rainwater management, biomimicry, etc.
- Biosourced and geosourced materials, local materials.
- Promotion of the circular economy: reuse of equipment, dismantling of buildings or infrastructures, recycling of aggregates, "materials bank" buildings.
- Hybridisation and intensification of uses to ensure that buildings are put to better use.
- Diversified materials supply sources.
- Reduced consumption of natural resources.
- Long-term reversibility of buildings or infrastructures.

Humans are totally dependent on natural resources

Source : ADEME



megatrend #4

The acceleration of technology and digital deployment

The list is long: artificial intelligence (AI), biotechnology, robotics, automation, new materials, autonomous vehicles, the Internet of Things, the blockchain, factories 4.0, 3D printing, virtual reality/augmented reality and metaverses. Technological innovation is accelerating and profoundly changing society. Although the use and sustainability of certain technologies have yet to be proven, the accelerating pace of technological change over the next two decades should offer new opportunities and new challenges. In 2022, a turning point seems to have been reached in the field of technology, with the release of generative AI such as ChatGPT, DALL-E, Mid Journey, DeepMind and Bard, capable of generating new content, such as text, images, video, music or 3D models, from machine learning data. At the same time, **the global race for technological domination is set to intensify, particularly in the fields of AI, quantum computing and 5G.**

16 bn

In 2022, there were around 16 billion connected devices. This figure could rise by anywhere between 50 and 200 billion by 2025 (the differences in estimates are due to a lack of international harmonisation of the definition of IoT)[17].

Progress in almost all sectors

Technological innovation has the potential to generate major social breakthroughs, whether in **healthcare** (telemedicine, remote surgery, disease diagnosis, etc.), **energy** (renewable energies, smart grids, etc.), **industry** (robotisation of repetitive, arduous and sometimes dangerous tasks, etc.), construction (decarbonisation of the sector, etc.), real estate (development of services, etc.), **transport** (more efficient traffic management, digital twins for vehicles, connected and driverless vehicles, etc.), and **agriculture** (*in situ* remote sensing, climate monitoring, predictive maintenance technologies, etc.).

A hyper-connected world

The pandemic and the related lockdowns massively ramped up the role of digital technology in our daily lives: teleworking, remote schooling, telemedicine, etc. A host of technological innovations have emerged, fundamentally changing our economic models, our lifestyles and our practices in a hyper-connected world.

Numerous issues raised

The use and development of these technologies raises a **number of environmental issues** (electronic waste, water consumption, extraction and processing of raw materials, etc.), **social issues** (digital divide, anxiety, etc.), **political issues** (population control, risk of cyber-malware and acts of disinformation, etc.) and **economic issues** (impact on certain jobs, cybersecurity risk, etc.). The development of AI raises and will continue to raise ethical concerns, especially about the level of human involvement in decision-making. While the emerging generative AI market has become highly competitive, hundreds of big tech players, in an open letter signed in March 2023, are calling for a moratorium on the development of advanced AI in order to provide a framework for research in this field. While it is unlikely that there will actually be a hiatus, this request deserves credit for raising legislators' awareness of the risks generated by the development of these technologies.

Technological discernment: the right technological response

In view of this, the "right-tech" concept is based on a frugal approach to innovation: doing better with less. It involves practising "techno-discernment", as advocated by Philippe Bihouix, a specialist in the finiteness of natural resources, in *The Age of Low-Tech*. In other words, this entails responding to an identified and genuine need, while complying with strict environmental constraints. This approach means not systematically resorting to high-tech, but favouring technologies that are adequate and sufficient, and reflecting on our real needs.

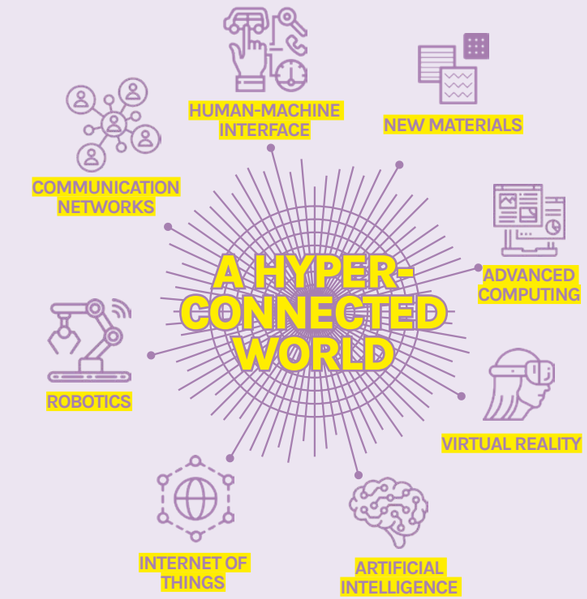
4%

Digital technology is responsible for approximately 4% of the world's carbon emissions and produced 53.6 million tonnes of electrical and electronic equipment waste worldwide in 2019, 21% more than in 2014, according to the Global E-waste Observatory.

8 in 10

Experts are increasingly concerned about the cybersecurity risks associated with the development of a digital society. In 2020, 8 in 10 companies were targeted by a cyber attack, according to the CESIN (the French club of information and digital security experts).

Source: *Global Trends 2040 (NIC).*



Construction, real estate, urban development

What challenges?

- **Using new technologies appropriately** to maximise their potential but minimise their impact and risk on the environment and society.
- **Strengthening IT security** to protect industrial process data and the integrity of their operations.
- **Protecting data** despite the globalisation of trade and the growing use of new technologies.

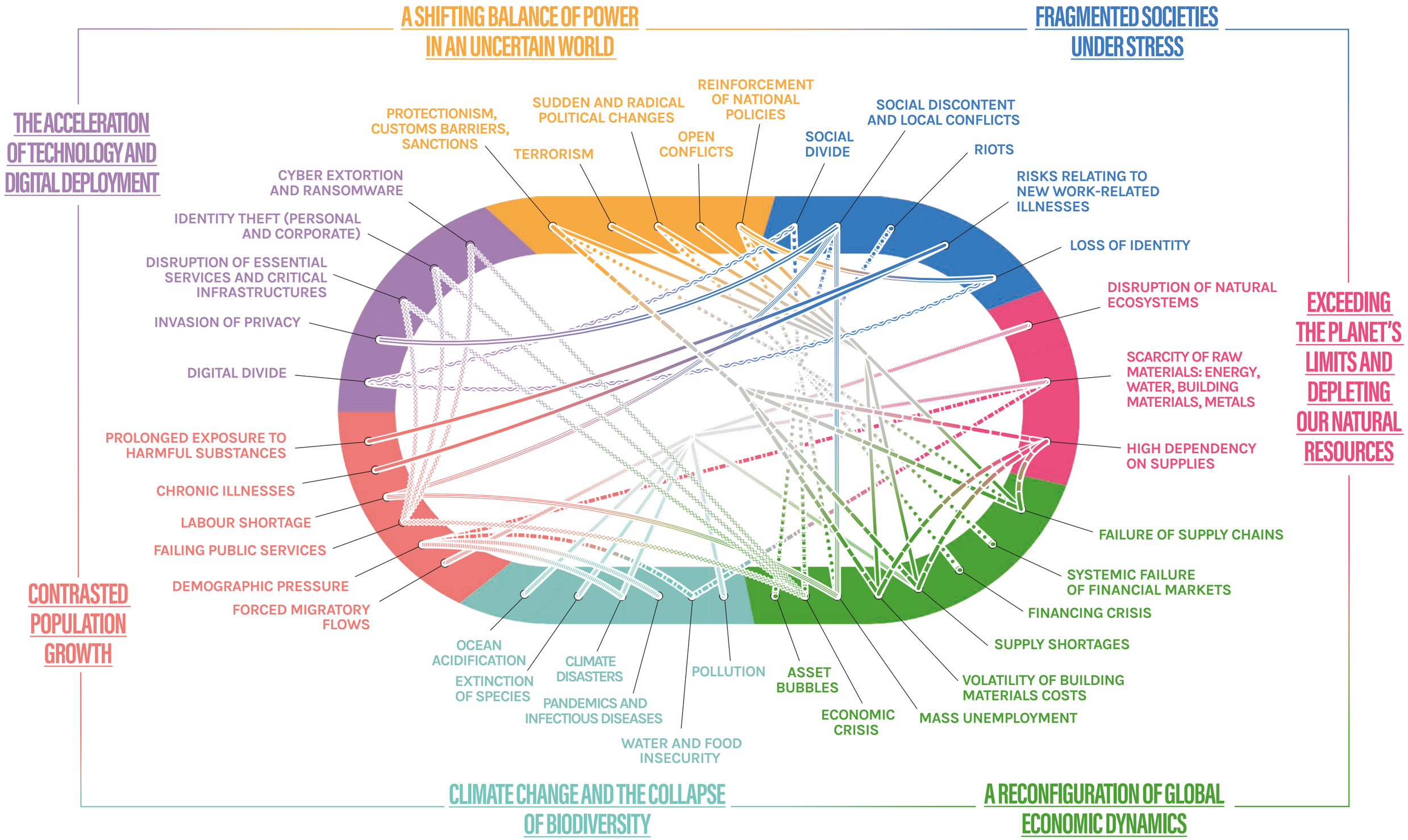
What solutions?

- **Automation** (robotics and Internet of Things) to encourage more rational use of resources by measuring and controlling inputs.
- **Data and IoT to support the energy transition,** enabling energy performance to be monitored via sensors in housing (smart homes), collective infrastructures and buildings (smart building), energy networks (smart grids), transport and, more widely, connected cities (smart cities).
- **Improved services** and user experience.
- **Use of data for construction:** BIM, digital project management platform (electronic documentation, real-time management), connected concrete (technical traceability).
- **Blockchain technology** to develop a more circular economy, by providing easier traceability of materials and components.
- **Digital twins** to simplify design processes, products and buildings.
- **Virtual, augmented and mixed reality** to increase operational efficiency (e.g. connected workers assisted by exoskeletons)
- **New construction methods:** off-site construction, industrialisation, 3D printing, etc.
- **Innovation in building materials** (lightweight concrete, etc.)
- **New commercial models,** in particular servitisation (selling services rather than products, e.g. "Energy as a service").
- **Frugal buildings and frugal cities:** low-tech or right-tech.

Deciphering megatrends through associated systemic risks

The diagram below illustrates the interconnections between risks arising from megatrends. For greater legibility, several different types of lines are used to represent these links*.

* No hierarchy between the various risks presented should be inferred from the style of line chosen.



megatrend #5

Fragmented societies under stress

Substantial progress has been made in the fight against poverty: the rate of extreme poverty worldwide has been divided by four over the last three decades, even though the world's population has risen by 2.5 billion over the same period; global inequalities have been declining over the last 20 years; and low- and middle-income countries have experienced stronger growth than wealthier countries over the last few decades. Nonetheless, as Anne Brunner writes in the latest report from the Observatoire des Inégalités, a French think tank, published in February 2023, "we are still a long way from widespread prosperity."[18] To benefit from improved living conditions (housing, food, health, education, etc.), people require a minimum income. Yet 44% of the world's population live on less than $5.50 a day (€150 a month), according to World Bank estimates (2017 data). In countries where the middle classes and the affluent have become richer, inequality has worsened[19].

50%

In 2021, 50% of the world's population owned 2% of the world's wealth, while the wealthiest 10% owned 76%[20].

Global poverty by poverty line

Source: World Bank, reference year 2017.

	$1.90 per day threshold	$3.20 per day threshold	$5.50 per day threshold
Global number of poor, in millions	696	1821	3269
Proportion of the world population, in %	9	24	44

The women's liberation movement, which developed in Western countries from the 1960s onwards and has gradually spread to other regions of the world, revolutionised relations between the genders. This movement set in motion a process of equalising conditions for women and men, particularly in the labour market, higher education and politics. Inequalities persist, however, whether in terms of pay, representation in high-level positions, or the sharing of domestic tasks[21]. In 1990, women's share of earned income throughout the world was around 30%; today it stands at less than 35%[22].

In addition, the world is still facing other inequalities, as international organisations such as the UN have pointed out, such as geographical location, age, ethnic origin, disability, sexual orientation, social class and religion.

Are individuals and societies becoming more vulnerable?

In the face of climate and public health risks, conflicts and inflation, **people's sense of security is now at an all-time low** in almost all countries, including the richest. Experts questioned in the latest AXA report[24] consider that people around the world are increasingly vulnerable to risks (growing geopolitical tensions, market volatility, climate crisis, public health risks, etc.).

According to the National Intelligence Council (NIC), populations around the world are better equipped, informed and connected, and governments are finding it more difficult to provide for the needs of their people. As a result, **people's complaints to their governments are likely to increase**[26].

65 million

A study published by Oxfam in April 2022[25] argues that rising global food prices will push 65 million more people into extreme poverty.

Loss of confidence in experts and authorities

This growing vulnerability seems to be accompanied by **a loss of trust in experts and authorities**. The most recent annual Edelman barometer of public confidence in government, business, the media and NGOs shows that no Western country now scores higher than the barometer's 60-point mark.

The coming years could see a further decline in public confidence, as technological developments make it **increasingly difficult to determine what is true and what is false** (e.g. deep fakes).

Increasing polarisation on social issues?

The "yellow vest" protest movement in France, passionate and divisive debates around the world over issues like national identity, immigration, the retirement age, etc., more or less violent reactions to the growing recognition of and support for LGBTQ+ rights... examples abound of increasingly fragmented and tense societies. As the NIC points out, **social media are reinforcing this social polarisation**, creating echo chambers that become increasingly powerful over time[27].

Changing household composition and working patterns

Changes in people's lifestyles, fewer children per family and the break-up of the family unit have all contributed to a **decline in the average size of households**. At the same time, economic pressures are forcing young people to stay with their parents and/or live in shared accommodation for longer.

New technologies have led to a boom in remote working for some city dwellers, and they appear to be triggering new residential strategies, **with the balance shifting in favour of medium-sized towns.**

A more responsible approach to consumption?

As the rapid development of globalisation spreads the model of consumer societies to almost every corner of the planet, **a new profile of consumer seems to be emerging:** more demanding, looking for goods and services that are local, healthy and sustainable. This trend can be observed in both developed and developing countries, as shown by a study carried out in 2021 by the Economist Intelligence Unit for WWF.[28]

Construction, real estate, urban development

What challenges?

- Creating a greater sense of security in cities.
- Designing more inclusive urban spaces and real estate projects.
- Protecting the health of users, occupants and residents.
- Developing production capacity in towns and surrounding areas to provide more local supplies.

What solutions?

- More focus on cities that are inclusive, relational, good to live in. Cities of short distances, child-friendly cities, etc.
- Encouraging social interaction to improve resilience and mutual aid (shared gardens, third places, spaces dedicated to social economy players, etc.)
- Encouraging more consultation, more citizen participation, more co-construction in real estate and urban projects.
- Improved access to isolated areas by redesigning public transport infrastructure.
- Development of new types of product (co-living, apart-hotels, participative housing, intergenerational housing, etc.) and multifunctional, future-proof buildings.
- Redesigning business models to encourage the development of social economy projects in real estate and urban projects.
- Offer of shared services.
- Opening up the ground floor of buildings to the neighbourhood.
- Spaces made available to social enterprises.
- Making best use of common areas.
- A preference for short supply circuits.

megatrend #6

A reconfiguration of global economic dynamics

The economic rise of Asia and other emerging economies

Since the early 1980s, **Asia has seen exceptional economic growth**. The rise of China, and more recently India and South-East Asia, has shaken up the world economic order, undermining Western economic dominance. In 2021, according to World Bank data, China accounted for 18% of global GDP (compared with 24% for the United States and 18% for the European Union). This growth is exceptional bearing in mind that China represented only 4% of world GDP in 2000.

In the coming decades, economic activity will slow down in the Western world and shift towards emerging markets with dynamic demographics, and more specifically boom in the East Asia-Pacific region. In terms of economic activity, the world's current leading countries could be overtaken by the emergence (in addition to China) of India and Indonesia[29]. Some consider that sub-Saharan countries such as Nigeria will be among the world's top ten economies by 2050, but it should be said that these projections do not take certain factors into account, such as political instability, pandemics, the impact of climate change and the increasing scarcity of resources.

The concept of "friend-shoring"

From 1993 to 2008, trade liberalisation went hand in hand with an expansion in international trade and the intensification of global value chains (segmentation of production processes between different countries). Since the 2008 economic and financial crisis, that period of rapid growth seems to have come to an end. A number of factors explain this post-crisis dynamic, including the fact that China refocused on its domestic market and **many trade restrictions were implemented at a global level**. However, although the global rate of trade openness has fallen, this does not necessarily mean that there will be a substantial downward trend in the years ahead[31].

The Covid-19 pandemic and the subsequent lockdowns imposed by governments have disrupted global supply chains, **highlighting how countries are interdependent** and the associated risks (shortages of medical equipment, production line shutdowns, etc.). The public health crisis has reinforced pre-existing trends, leading to **a reconfiguration of global supply chains:** relocation of industrial activities, supplier diversification, warehousing. Will we see "friend-shoring," as the U.S. Secretary of the Treasury, Janet Yellen, suggested in April 2022?

Regional agreements demonstrate new regional trade links, such as the RCEP (*Regional Comprehensive Economic Partnership*), a free trade agreement between fifteen different countries around the Pacific Ocean, which was signed in 2020.

In this globalised economic context, the "currency war" is a major point of contention, with some countries having implemented a "competitive devaluation" policy to support their export trade. The United States, for example, is accusing China of deliberately undervaluing its currency (renminbi or yuan).

An increase in sovereign debt

Global government debt has been increasing since the 1970s, and is set to continue rising over the coming decades as a result of repayment of loans taken out during the Covid-19 pandemic, the economic costs of ageing economies, etc.

$226,000 billion

In 2020, global debt saw the largest one-year increase since the Second World War, reaching 226,000 billion dollars.

An uncertain macro-economic context

The World Bank expects global growth to slow down to 1.7% in 2023 (the third lowest rate in thirty years after the recessions of 2009 and 2020)[32], and is warning that **this could lead to a global recession and excessive debt**. Emerging and developing countries are particularly vulnerable, and are expected to experience a "sharp and sustained" slowdown in economic activity. The reasons include inflation, rising interest rates and their impact on the profitability of real estate investments, reduced investment, particularly high levels of public debt, etc.

Several factors such as the increasing scarcity of resources, the ecological transition and changes in globalisation seem to combine to suggest that tomorrow's world will be more inflationary than yesterday's.

For the first time, the top 10 risks identified by experts in AXA's annual report include **three economic risks: financial instability, macroeconomic risks and risks linked to monetary and budgetary policy.**

Job market trends

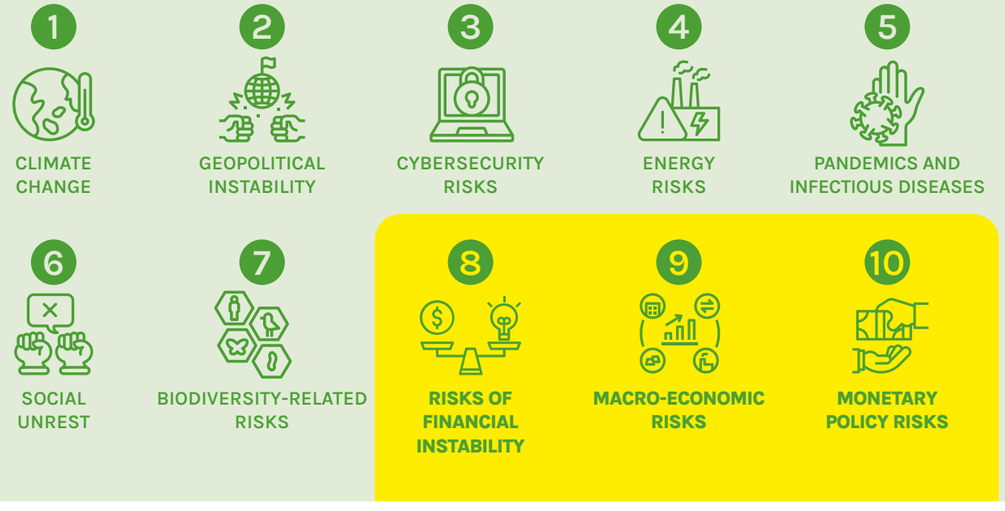
Smart, automated systems are transforming entire sections of the employment market, and will continue to do so. Although automation may lead to the redundancy of certain jobs, it could also lead to the creation and transformation of others. According to BCG economists, **the challenge is to train people and upgrade their skills** to be able to take on the future jobs created by technology[34].

What economic model for a world in contraction?

Faced with the threat of ecological collapse, economists such as Timothée Parrique, winner of the Terre Solidaire Foundation thesis prize for *The Political Economy of Degrowth*, are warning that a drastic change of model is needed. "Degrowth"

Experts rank the world's top 10 emerging risks

Source : AXA Future Risks Report 2022



is seen as a temporary macro-economic model that could enable us to return to a stationary economy that is in line with ecosystems' carrying capacity, in a spirit of social justice and with a focus on well-being[35].

Jean-Marc Jancovici, founder of Carbon 4 and the Shift Project think tank, draws attention to the reality of degrowth as a reduction in the physical flows that structure the economy. He calls for degrowth to be incorporated into economic thinking in order to avoid the worst-case scenario, putting aside the myth of "green growth"[36].

"Counting on a perpetual expansion of the 'physical' economy to solve the problems of a world in contraction is, by definition, a material impossibility."
— Jean-Marc Jancovici[36].

Construction, real estate, urban development

What challenges?

- Being able to plan ahead in difficult macroeconomic conditions (widespread inflation, soaring energy costs, rising interest rates, general lack of financing, etc.)

- Being able to attract investments that have moved away from traditional real estate (particularly offices and retail premises) towards less cyclical sectors that benefit from major trends in demographics, climate change and technology (e.g. new energy infrastructures).

- Anticipating disruptions in supply chains (vulnerability of networks and a globalised economy).

- Anticipating disruptions linked to new technologies.

- Supporting training formations in new approaches to construction, real estate and urban development.

What solutions?

- Responsible adaptation to long-term structural changes in the real estate sector and to the wider challenges of environmental, social and governance issues.

- Support for the transition to a functional economy through innovative urban and real estate projects.

- Developing new forms of cooperation, new partnerships between stakeholders.

- A new paradigm: thinking in terms of use value rather than asset or financial value.

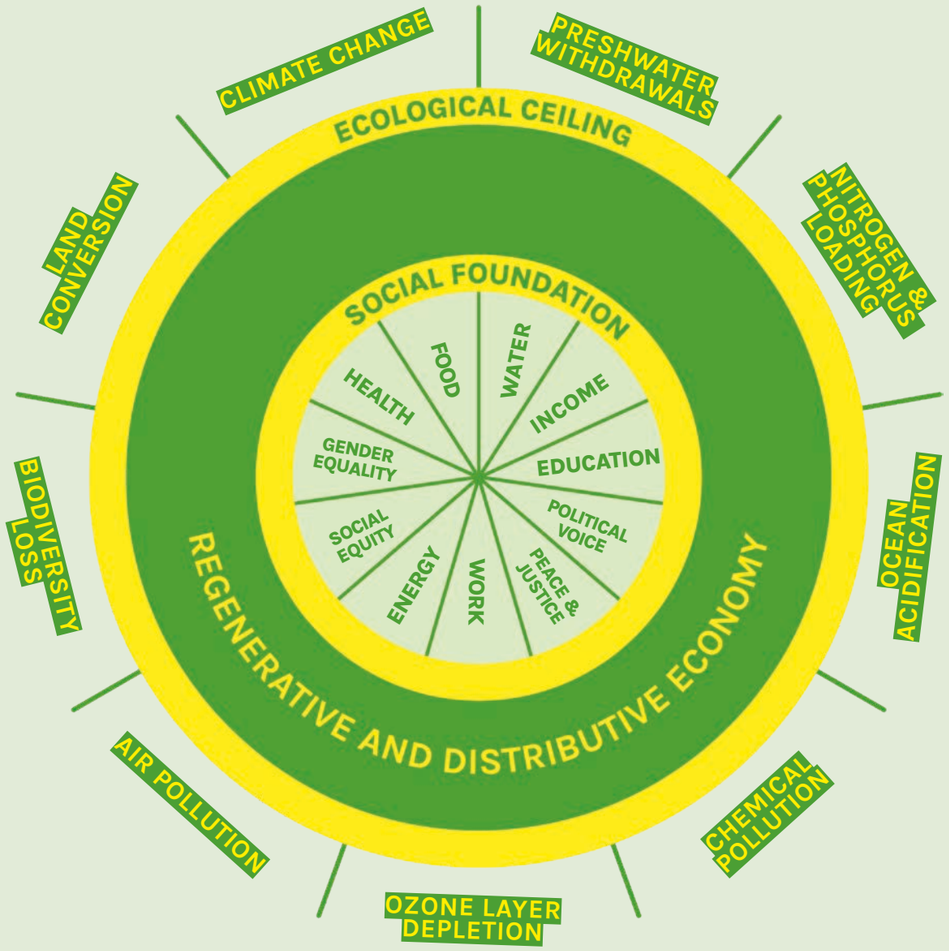
- Implementation of triple accounting.

- Developing a model of the regenerative city / regenerative real estate.

Economist Kate Raworth's vision of the Doughnut Economy

Source : Oxfam France

Faced with the social and environmental challenges of the 21st century, economist Kate Raworth[37] presents an economic model that combines environmental issues with social justice: the "Doughnut". The circle at the centre of the doughnut represents the "social foundation", the threshold to be maintained in terms of minimum social standards (access to water, food, education, etc.). Beyond the outer circle is the ecological ceiling that must not be crossed (the planet's limits). The doughnut formed between these two circles represents the safe and just space for humanity in which an inclusive and sustainable economy can thrive.



megatrend #7

A shifting balance of power in an uncertain world

The changing international order

The world's geopolitical balance has undergone a **major shift over the last three decades with the spectacular rise of China and the end of the United States' domination** of the world. According to the geopolitical analyst Pascal Boniface, the growing rivalry between China and the United States will be "the major issue of the coming decade, and perhaps even beyond.". The way in which this rivalry evolves will structure international relations, and will continue to have an impact on international law and multilateral cooperation[39].

57%

According to a report by the US-based Peterson Institute for International Economics, China has only purchased around 57% of the US goods and services it had pledged to buy.

The return of war to Europe with **the Russian invasion of Ukraine** has consequences that go well beyond these two states, as evidenced by the upheavals in the usual supply and production chains and the associated risks (the conflict has highlighted the vulnerabilities represented by the dependence of economies on foreign supplies). "In the long term," points out Tatiana Kastouéva-Jean, Director of IFRI's Russia/Newly Independent States Centre, "the conflict could give rise to a new international system whose contours have not yet become clear."[40]

According to the National Intelligence Council (NIC), the lack of a dominant power or global consensus in certain key areas could lead to other players assuming a greater role: major powers (Russia, the EU, Japan, the UK, and potentially India), regional powers (Australia, Brazil, Indonesia, Iran, Nigeria, Saudi Arabia, Turkey, the United Arab Emirates) or other non-state players such as NGOs, religious groups or leading technology companies. The expansion of the Shanghai Cooperation Organisation reflects a desire to counterbalance Western influence, both geopolitically and economically, by creating strategic partnerships that can act as a counterweight to American power.

> **"The growing rivalry between China and the United States will be the major issue of the coming decade, and perhaps even beyond."**
>
> — Pascal Boniface, geopolitical analyst.

A new configuration of power

Recent years have seen a shift in the sources of power, combining conventional and strategic weapons, cyber-activity targeting civilian and military infrastructures, and the environment of disinformation[41]. In a world of global interdependence, power is measured by a variety of factors: demographics, military capabilities, economy, technological edge, ability to control the main sites of exchange (telecommunications, finance, data flows, supply chains, etc.), role in defining international standards (as illustrated by the battles for influence between US and Chinese representatives on international standards committees), and capacity for influence and persuasion (soft power). "In a complex and interdependent world," writes the political scientist Pierre Hassner, **"real power consists in manipulating this interdependence or, better still, in defining the rules of the game."**[42]

95%

95% of experts believe that geopolitical tensions will become more persistent and 94% predict them to spread around the world[43].

2nd

According to the experts surveyed in AXA's latest Future Risks Report (2022), geopolitical tensions rank second as a risk after climate change, as they exacerbate both cyber risks (third) and energy risks (fourth).

An increase in geopolitical risk

International tensions and geopolitical risk are once again taking centre stage: Russia's invasion of Ukraine, conflicts in the Middle East, the risk of conflict in the Indo-Pacific region, the Sino-American trade war, instability on the Korean peninsula, the actions of terrorist groups, etc. Against a background of heightened international tensions and inter-state dependency (e.g. raw materials), **how can we deal with geopolitical risks?**

How geopolitics can dominate economic factors

As **companies become more international** and increasingly expand into foreign markets, the geopolitical factor and the associated risks play an ever greater role in their business[44]. In an article published in October 2021, the economist Jean Pisani-Ferry noted that "geopolitical choices, in several recent trade conflicts, have tended to prevail over economic logic" and wrote of "the takeover, most often hostile, of the international economy by geopolitics." **Foreign policy is back in the spotlight**, as shown by **the trade war between the United States and China** (or technology war) or the Aukus pact to share advanced defence technologies signed between the United States, the United Kingdom and Australia.

It should be noted that strategic rivalries between world powers are not all that is at stake. **Various global issues** will increasingly dominate the international agenda, including climate change, health, biodiversity, inequality and migration, all of which raise questions about players' ability to implement common solutions.

Construction, real estate, urban development

What challenges?

- Managing geopolitical opportunities and risks in an uncertain international context (e.g. dependence on Taiwan for semi-conductors).
- Factoring geopolitical risk into overall risk analysis.
- Anticipating supply chain disruptions caused by strategic rivalries between countries.

What solutions?

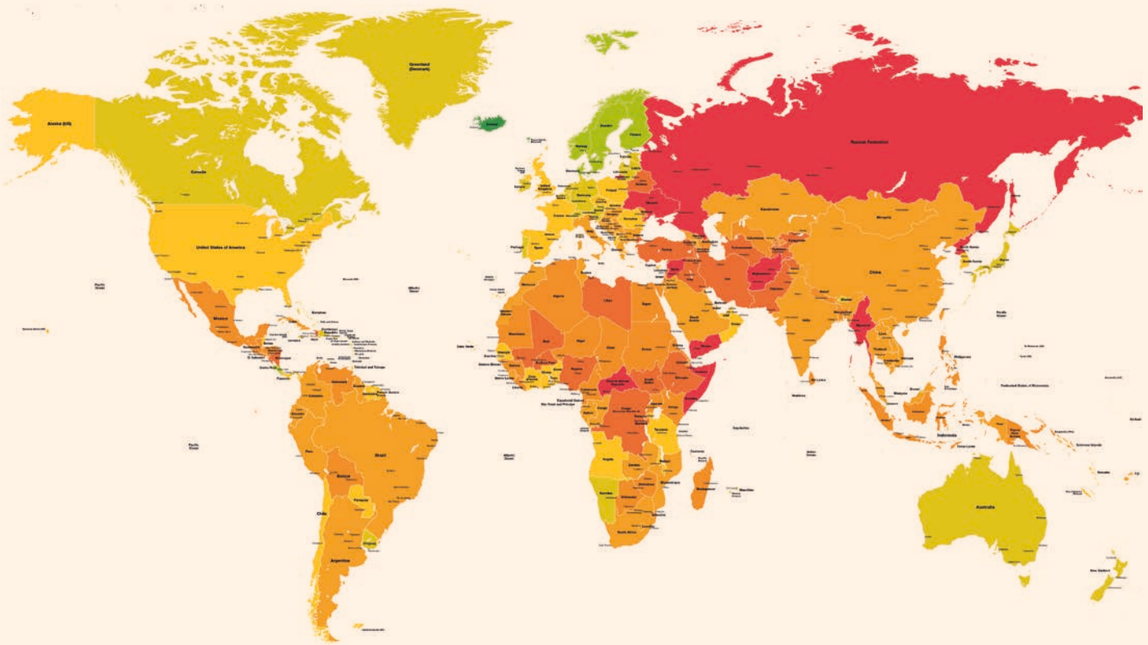
- Restructured supply chains that support the resilience of the sector in a context of growing geopolitical tensions.
- Design of resilient, productive cities.
- A preference for short supply circuits.
- Development of resilience strategies based on strategic foresight scenarios.

Business risk forecast

Source : Business Risk forecast 2023

This is an outlook for the business risk environment in each country on a ten-point scale. The score is a composite risk score that factors in political, security, operational, regulatory and cyber risks. Each rating reflects our outlook regarding overall risks to business at the end of 2023 taking into account known or anticipated trends and developments that could impact the business environment during the year.

1 Very low, stable
2 Very low, increasing
3 Low, stable
4 Low, increasing
5 Medium, decreasing
6 Medium, stable
7 Medium, increasing
8 High, stable
9 High, increasing
10 Very high, stable



Conclusion

An analysis of megatrends prompts us to rethink our economic and social models in depth. The challenges we face demand urgent action. We are in a historic situation where we need to act differently, where we need to reinvent our relationship with the world, in order to ensure the habitability of our planet.

The construction, real estate and urban development sectors all form part of a long-term perspective. An analysis of global phenomena and associated risks is an essential tool for ensuring that the projects we design and develop address the issues and challenges we are facing. By highlighting the interrelationships between the various megatrends, this study shows the clear need for a holistic approach to decision-making.

This study highlights many of the major challenges facing the urban planning and regional development sector, such as protecting people's livelihoods, infrastructure and quality of life in the face of climate change; achieving carbon neutrality and beyond, protecting biodiversity and using resources efficiently; promoting health-friendly urban planning; switching to an economic model that is compatible with the planet's limits and social needs; making the best use of new technologies; developing a model of society based on humanist values and social justice; and taking geopolitical risks into account.

Underlying this study is the challenge of anticipating the world to come. We have to focus on equitable and desirable construction, real estate and urban development projects that are in line with megatrends and resilient in the face of major risks, and we have to clearly understand what lies ahead so that we can place our human activities in a "safe and just space" that meets everyone's needs without ever overshooting our ecological boundaries.

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Strategic foresight at Bouygues Construction

In the face of climate and social challenges, high expectations are placed on the construction sector. Conscious of its responsibility as a major player in the construction industry, Bouygues Construction offers an open, shared approach to the future of cities and regions.

We base our forward-looking research and analysis on scientific facts and systemic strategic intelligence. Our role is to identify and decipher changes underway, as well as emerging trends, in order to cast a positive light on the Group's operational and strategic positioning.

Most of the challenges we face are global and systemic, so we share our prospective studies in order to adopt a partnership-based, multi-disciplinary approach, with the aim of encouraging the emergence of urban and regional projects adapted to the issues and challenges of today. Our mission is to act today to prepare for tomorrow.

Credits

This publication reflects a forward-looking research process based on the analysis of various scientific studies, the viewpoints of multidisciplinary experts, and contributions from employees of both the Bouygues group and Bouygues Construction.

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