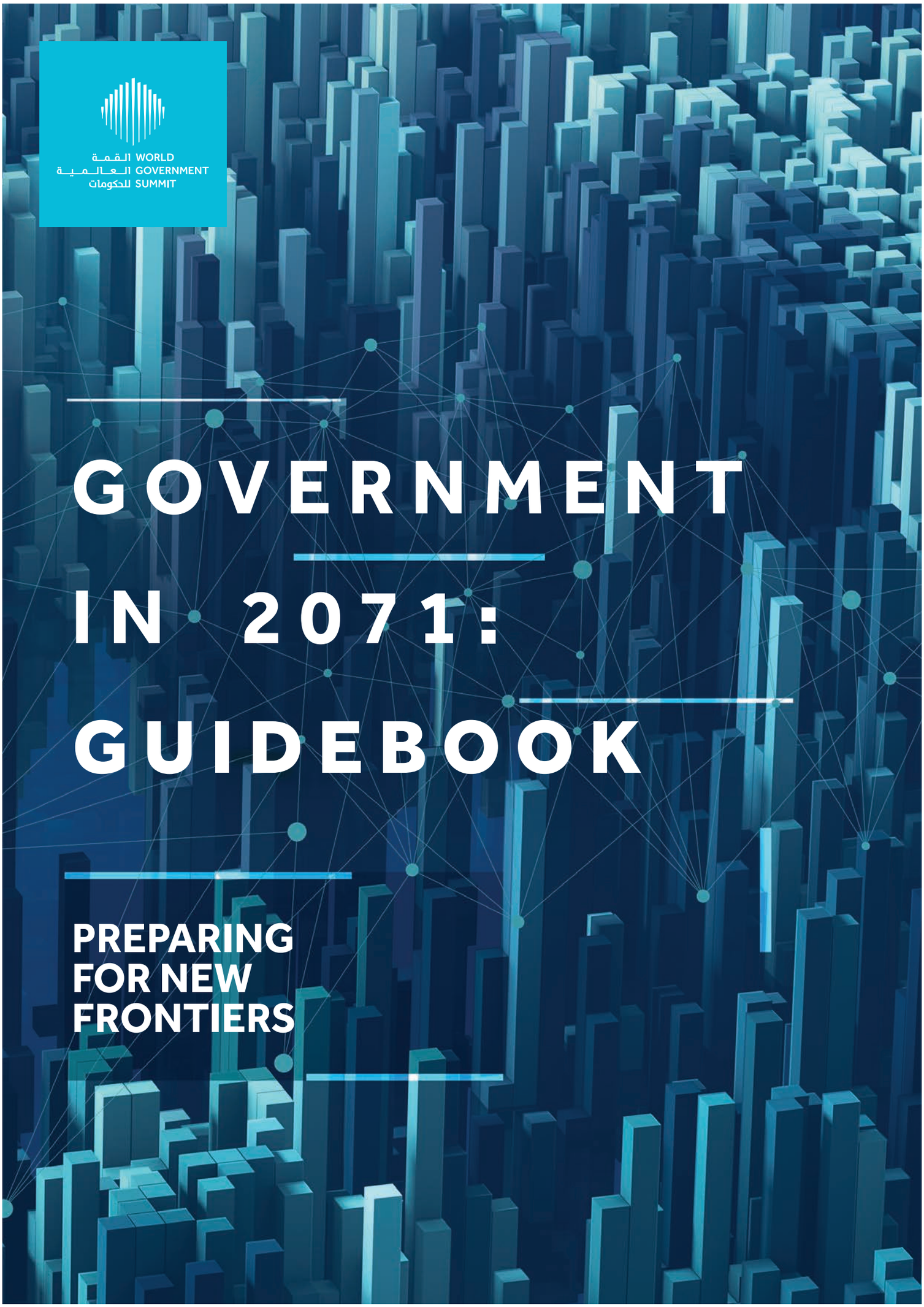
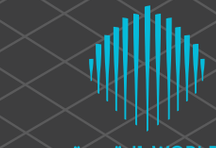


GOVERNMENT IN 2071: GUIDEBOOK

PREPARING FOR NEW FRONTIERS



January 2018

Dubai, United Arab Emirates

Acknowledgements

Produced by:

World Government Summit

Led by the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai, the World Government Summit is a global knowledge exchange platform dedicated to shaping the future of government worldwide. Each year, the Summit sets the agenda for the next generation of governments with a focus on how they can harness innovation and technology to solve universal challenges facing humanity. Operating at the intersection of government, futurism, technology and innovation, the World Government Summit is a thought leader and networking hub for policymakers, experts and pioneers in human development.

Government in 2071: Guidebook

Preparing for new frontiers

Macro-megatrends, led by automation, robotics and climate change, are impacting humanity. These megatrends are posing to exponentially challenge our very existence, while also providing incredible possibilities for development. Generational government strategies are required to effectively approach these acute challenges and harness their potential. Therefore, governments, individually and collectively, should explore these megatrends to successfully drive them towards the betterment of humanity and our ecosystem.

The Government in 2071: Guidebook is intended to elicit diverse thinking and perspectives when looking at the future of government. Viewed as a guide, it paints the possibilities for the future of government across the next 50 years. Its purpose is to inspire government leaders and policy makers to understand the possibilities, and how to navigate expected dramatic shifts that could impact governments. The Guidebook visualizes the projected view of future government interactions with citizens and other stakeholders through a concise look at key innovation megatrends affecting society and the economy of nations. Such trends are anticipated to bring about new eras focused on connectivity, exploration and techno-humanitarianism. The future is shifting humanity from a "problem-solution" to an "opportunity-exploration" paradigm, which is explored in this Guidebook.

At the World Government Summit, we see that 'human will', led by successful global and national leadership, can preserve and strengthen humanity's promise, and successfully explore the developing megatrends. What is needed is a guidebook to plan for the unexpected. After all, no one can predict the future, but 2071 is not far away, and today's leaders can guide how we shape future governments.

Mohammad AlGergawi
Chairman of the World Government Summit
Minister of Cabinet Affairs & the Future

Contents

Preface

Welcome to *The Government in 2071: Guidebook*, an introductory evaluation of global trends and their impact on the future of government through the next 50 years. The work is referred to as a Guidebook, rather than an informational report, given the actionable nature it defines for government in preparation of the expected future megatrends.

Humanity is experiencing powerful megatrends led by artificial intelligence, robotics, and climate change, which pose exponential challenges to our very existence. They also provide incredible possibilities for expanding humanity's potential and aspirations. These megatrends require different national and international governance approaches and strategies, which need to start now to provide the kind of long-term solutions required. Such an approach also necessitates governments to transcend near-term stakeholder needs and political cycles.

The **purpose** of the *Guidebook* is to inform and inspire policy makers, government strategists, business leaders, and civil society worldwide to start planning for the dramatic shifts governments will be facing through the next 50 years. Predicting the exact future is not our goal. However, given the high-level of certainty around wide-scale and long-term societal trends, and the exponential growth of technological developments, a pragmatic approach has been taken to evaluate plausible scenarios that governments should begin planning for.

The overall **approach** entails analyzing best-case scenarios of megatrend developments across Scientific, Technological, Environmental, Economic, Political and Social factors for long range, global change. Given the key and pivotal role technology will play in shaping the future, the Guidebook extracts technologies into separate 'Technology Megatrends' for analysis, and clubs Scientific, Environmental, Economic, Political and Social factors under 'Societal Megatrends'. Plausible best-case innovation outcomes are then determined based on the intersection of 'Societal Megatrends' with available 'Technology Megatrends'.

The analysis is further supported by understanding historical patterns of change, while taking into consideration that relative to the change of socioeconomic and geopolitical trends, technology-led innovations and their adoption have been progressing at a significantly higher rate. While it took decades for the corded telephone to reach 50% of US households starting before 1900, it took under five years for the cellular phones to achieve the same penetration in 1990[1]. Today the global adoption of the internet, smartphones and ever-more agile robots has been unprecedented. Given this rate of change, innovations such as space tourism, self-aware sentient cities, advanced human augmentation for health and education,

1 The Pace of Technology Adoption is Speeding Up, Harvard Business Review, Nov 25, 2013.

and criminal artificial intelligence are all fathomable developments across the next 50 years. Such developments will have significant impact on government policies, and require action now.

Alongside the best-case scenarios focused on in this Guidebook, **alternative scenarios** have been acknowledged in the form of mixed-bag and worst-case scenarios. The analysis also discusses unpredictable "**shock events**", such as catastrophic wars, disease outbreaks, and extreme weather, to showcase the resulting abrupt shift in geopolitical and/or socioeconomic trajectories. The analysis has been informed by extensive interviews with sociologists, futurists, technologists, and other experts, as well as the voice of future citizens (Generation Z/Millennials) through surveys and social data analysis.

This work aims to present:

- A comprehensive view on key innovations and trends affecting society and the economies of nations over the coming 50 years
- A projected view of future government functional areas, including primary KPIs
- A projected view of future government interactions with their citizenry, communities, educational services and economic environments
- An introductory guide for planning successful future government strategies

Three distinct eras of innovation development are defined in the Guidebook, the "**Digital Connectivity Era**" (2018-2030); the "**New Exploration Era**" (2030-2050); and the "**Techno-Humanitarian Era**" (2050-2071). For each era an impact assessment on future government functions and stakeholder interactions for governments is discussed at a high-level, focusing on the best plausible innovation outcomes trajectory. Finally, recommendations for governments to begin planning for the future are presented. In subsequent editions of the Guidebook, it is intended to provide customizable tools — allowing individual governments to evaluate the details of various specific scenarios, based on their unique conditions, and model the resultant impact on their nation and citizenry.

Governments — individually and collectively — must address the developing powerful megatrends to successfully steer towards the betterment of humanity and our planet. This *Guidebook*, along with subsequent planned tools and resources, aim to be key enablers in helping governments become more resilient as they navigate the challenges the future could bring. We welcome you to join us as we embark on this journey.

Government in 2071: Insights for the Future

VIEWS FROM TOMORROW'S FUTURE CITIZENS

The voice of GenZ and Millennials

GLOBAL SURVEY

Exclusive global survey of 14-34 year olds

Top Priorities:
For government services (Basic Rights)

1st	2nd	3rd
EDUCATION	HEALTH	ENVIRONMENT PROTECTION
81%	76%	68%

Most dissatisfied with:

1st	2nd	3rd	4th
ENVIRONMENT PROTECTION	SOCIAL PROTECTION	EDUCATION	HEALTH
74%	62%	62%	61%

KEY VIEWS ON POLICIES

More Open Trade	80% Agree
More Open Immigration	56% Agree
More Taxes - Mixed Views	35% Agree 43% Disagree 22% Neutral
More Local Government Led Policies	76% Agreed

SOCIAL MEDIA SENTIMENT

1.1 million exclusive social media interactions:

Top Needs: Health, Education, Security
Discussed by stakeholders on government social media accounts.

Negative Interactions: 75%
on 'Stakeholder Needs' topics.

- Positive | 1.8K
- Neutral | 5.8K
- Negative | 22.6K

The above percentages are derived from the global citizen survey as well as the social media interaction captures.

SELECT DRIVERS THROUGH 2071
(Plausible best case scenario)*

CLIMATE CHANGE

Likely 2°C temp rise by 2071*

Most areas of Bangkok, Mumbai, Shanghai, Miami, Manhattan and Central London will be submerged.

JOB SHIFTS

BY 2071...

52.6 million
Current OECD government jobs **to be replaced by automation.**

29.5 million
New high-skilled OECD government jobs **to be created.**

38.2 million
Current Global 500 corporate jobs **to be replaced by automation.**

21.4 million
New high-skilled Global 500 corporate jobs **to be created.**

* All data sources cited in Chapter 2 and 3.

DEMOGRAPHICS

MEDIAN AGE

29.6 (2030) | **40** (2071)

WORLD POPULATION

146 million people in Lagos, Delhi and Kinshasa — world's largest three cities by 2071.

Middle class to grow from 1.8 billion to 4.9 billion by 2030. Almost 90% of next 1 billion entrants from Asia.

ARTIFICIAL INTEL

↑ US $16 trillion by 2030

Artificial intelligence (AI) systems estimated to boost global GDP by US$16 trillion in 2030.

Guidebook Overview

The overall approach to *The Government in 2071: Guidebook* entailed developing a plausible best-case scenario of innovation megatrends in the future and then assessing their impact on government functions and policy. The analysis is broken down into three distinct time-periods to facilitate a better understanding of the progression of megatrends (2018-2030; 2030-2050; 2050-2071). Based on the impact assessment, an initial action plan for governments is proposed to kick-start their 2071 future strategy.

1.1 Approach

Following are five key aspects of the Guidebook's approach:

1. **Baseline current government services** (Chapter 2): An initial scope of today's government stakeholders and their needs profile was mapped, with current government functions, key performance indicators (KPIs), and current stakeholder engagement methods.

2. **Determine key future drivers** (Chapter 3): The approach evaluated key future drivers of stakeholder needs, across three eras (2018-2030; 2030-2050; 2050-2071), based on developing societal megatrends and available technologies.

3. **Derive resulting innovation megatrends** (Chapter 4): The 'Future Innovation Megatrends Model' (Figure 1) is applied to derive interactions between key future drivers to projecting resulting innovation megatrends across the eras. Alternative scenarios are also acknowledged.

4. **Link innovation megatrends to future government functions and benchmarks** (Chapter 5,6): Based on best-case scenarios innovation trend, an impact assessment on future government functions, KPIs and stakeholder interactions are presented.

5. **Recommend an initial action plan** (Chapter 7): Recommendation of an initial action plan is presented, for governments to begin charting a successful course towards a future strategy for the next 50 years.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Determining Innovation Megatrends

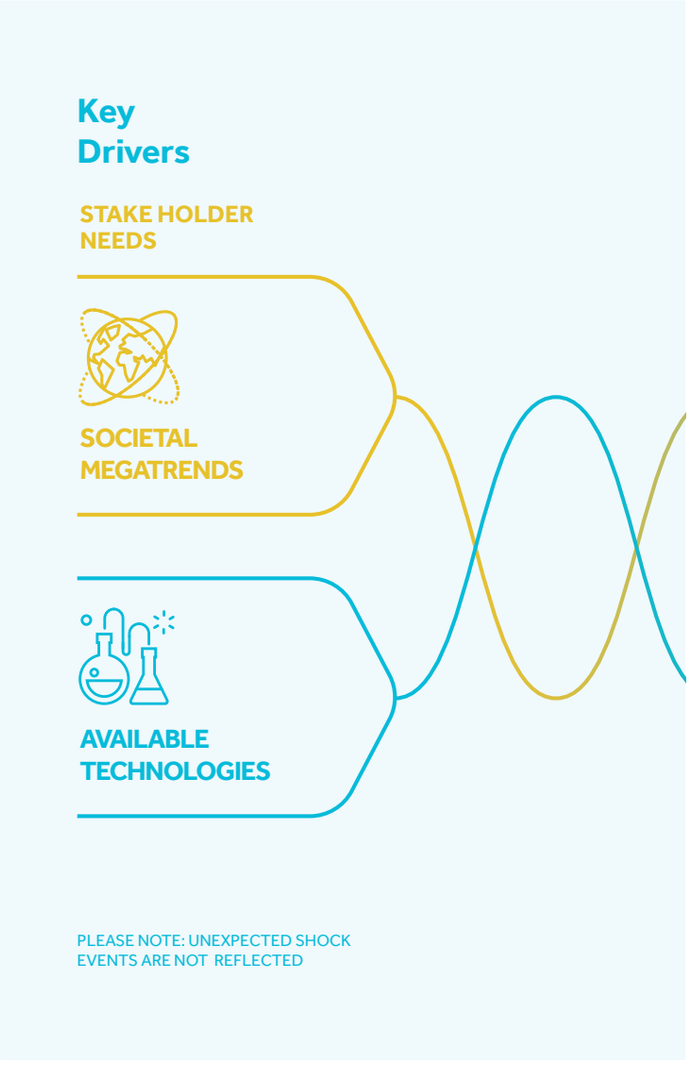
The approach to determine innovation megatrends across the next 50 years has been based on the intersection of societal megatrend developments (comprising of climate change and population growth, among others) and available technology megatrend developments (comprising of Artificial Intelligence, robotics and nanotechnology, among others), all of which link to the evolving needs of stakeholders. Through this synthesized approach we were able to determine plausible best-case innovation outcomes through to 2071 (See Figure 1).

While we mainly present a best-case scenario, we also acknowledge alternative scenarios in the form of mixed-bag and worst-case scenarios, as well as how unpredictable "shock events" (e.g. catastrophic wars, disease outbreak, extreme weather events) result in an abrupt shift in geopolitical and/or socioeconomic trajectories, so as to present a range of possible outcomes.

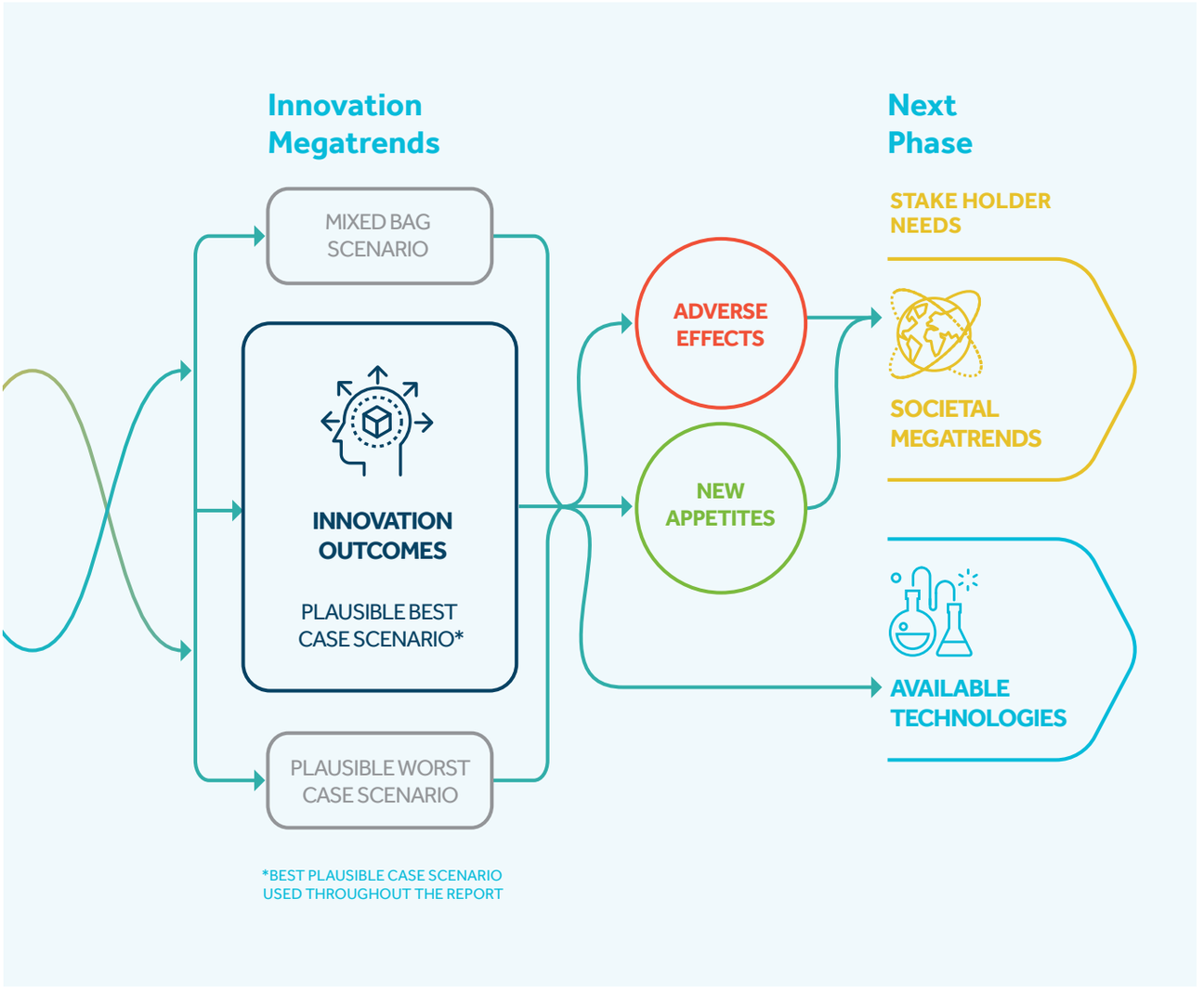
Further to a detailed review and combination of key societal and technological megatrends, we have also made a number of key assumptions to determine outcomes in a best rational case scenario. These key assumptions are as follows:

1. Governments are benevolent and have the best interest of the people in mind
2. Corporations are motivated, primarily, by the pursuit for higher profit
3. No major unforecastable crises/wars/attacks will occur
4. Governments will enact and enforce appropriate regulations and legislature to ensure optimum outcomes
5. Humanity will persevere and survive

Figure 1 FUTURE INNOVATION MEGATRENDS MODEL



6. Not all stakeholder needs are addressed by the enabling innovations (e.g. the innovation trends analysis in this Guidebook does not address ideological topics such as racism, nationalism). However, these are identified as areas of focus of Governments to address leveraging innovations


Innovation Megatrends
MIXED BAG SCENARIO
INNOVATION OUTCOMES
PLAUSIBLE BEST CASE SCENARIO*
PLAUSIBLE WORST CASE SCENARIO
ADVERSE EFFECTS
NEW APPETITES
Next Phase
STAKE HOLDER NEEDS
SOCIETAL MEGATRENDS
AVAILABLE TECHNOLOGIES
*BEST PLAUSIBLE CASE SCENARIO USED THROUGHOUT THE REPORT

Future Government Functions and Benchmarks

Our impact assessment of future innovations on future government functions derives insights from the best plausible innovation megatrend outcomes described earlier and presents the consequent impact on future government functions and their stakeholder interactions.

The structure of this guidebook aligns to core government function themes defined as: Governance and Resilience; Economy and Society; Environment and Health; and Future and Progress (Figure 2). The function themes are further classified into sub-level government functions, and again detailed into services, introduced in Chapter 2. Based on the impact assessment on future government functions, the Guidebook also presents key future benchmarks for governments to plan for (Chapter 5).

Initial Action Plan for Governments Preparing for the Future

Finally, the Guidebook presents initial recommendations for governments to begin planning for the future. An overarching framework is designed with high-level, concrete initial steps, for government leadership to start with (Figure 3). In addition, the Guidebook concludes with a recommended initial structure of priority future policy areas that need to be evaluated for an overall future government policy framework.

Figure 2 CORE GOVERNMENT FUNCTION THEMES

Governance & Resilience

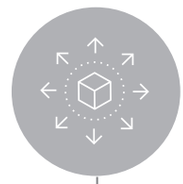
Protecting citizens and ensuring their peace and security within the nation's borders.

Economy & Society

Economic growth and social wellbeing of citizens through a variety of services.

Environment & Health

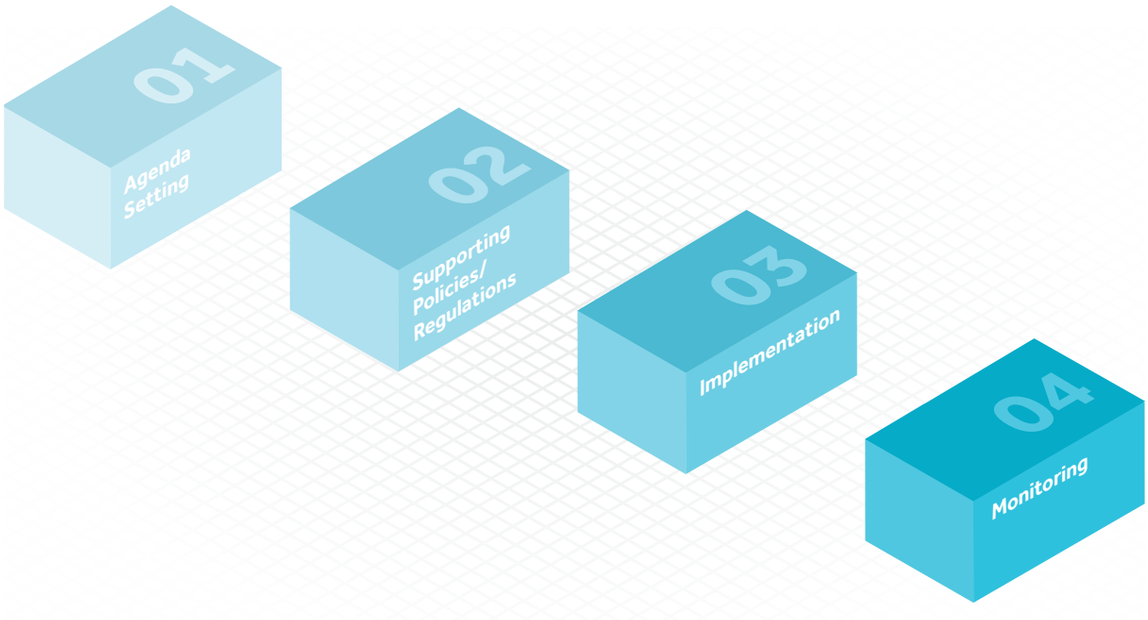
Preserving and enhancing the natural environment and the health of citizens.



Future & Progress

Undertaking research and development and the promotion and adoption of innovative education for future preparedness.

Figure 3 FUTURE READINESS STRATEGY MODEL

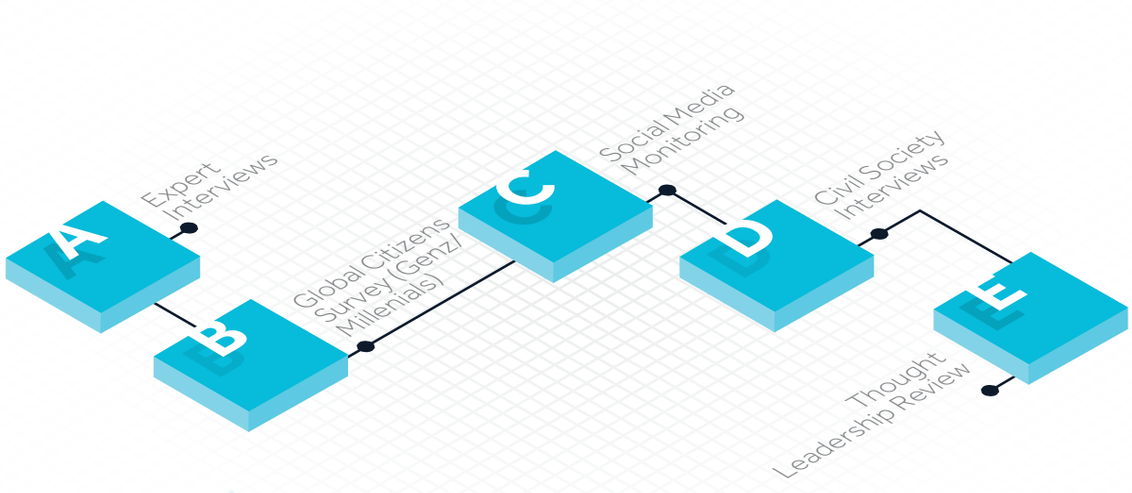


1.2 Methodology

The Guidebook's methodology included a mix of primary research, alongside a thorough analysis of existing research and thought leadership.

Primary research methods included futurist and visionary leadership interviews, as listed in Figure 4. In addition, input was captured from the future adult constituents of government services — today's Generation Z and Millennials (ages 14-34, as of 2017) through a global citizens survey, as well as a snap shot from social media posts and conversations around the topics presented within the Guidebook.

Figure 4 METHODOLOGY TOOLS UTILIZED



Methodology Tools

A. Expert Interviews
B. Global Citizens Survey
C. Social Media Monitoring
D. Civil Society Interviews
E. Thought Leadership Review

A. Expert Interviews

A key source of insights on developing innovation trends has been global thought leaders representing technologists, futurists, business innovation leaders, and select industry experts. Eleven select phone interviews were conducted with the following experts between August and September 2017. The experts interviewed provided their perspectives on governments prioritization to address future trends and managing change.

Peter Schwartz
Senior Vice
President Strategic Planning
Salesforce

Anab Jain
Co-Founder & Director
Superflux

Josh Steiner
Head of Industry Verticals
Bloomberg, LP

Michell Zappa
Founder
www.envisioning.io

Nicholas Negroponte
Founder & Chairman
MIT Media Lab

Brenda Cooper
Science Fiction Author, Futurist
Chief Information Officer,
City of Kirkland

Tim O'Reilly
Founder & CEO
O'Reilly Media
Author of the book *WTF? What's the Future and Why It's Up to Us*

Robert Jacobson , Ph.D. (UCLA)
Chairman & Strategist
Atelier Tomorrow Inc.

Ramez Naam
Co-Chair
of Energy and Environment
Singularity University

Josh Calder
Futurist
Partner, Foresight Alliance

Dr. David Kingham
CEO
Tokamak Energy Ltd

B. Global Citizens Survey

- Computer aided web interviewing (CAWI) was conducted between August 12-23, 2017 for the global survey. The survey ascertained citizens' needs, their level of satisfaction, and expectations from government services. The survey received **1344 responses from 105 countries with a regional distribution reflecting projected future population worldwide.**

- **Survey Audience (Figures 5-11): Generation Z and Millennials were the primary focus of survey,** as they reflect the future constituents of 2071. Hence, 21% of respondents were aged 14-17, 49% aged 18-24, 30% aged 25 to 34.

- **Lower income citizen households** were a significant **focus of the survey, given that the majority of the global population is in that socio-economic bracket.** 50% of respondents reported household income less than $16,000/year, 19% between $16,000-$29,999, 11% between $30,000- $72,999, and 5% at more than $73,000/year.

- **Statistical validity** of the data carries a confidence level of 95%, based on the size of the sample, and the margin of error is 2.67%. As for limitations of the study, it is worth noting that the survey was conducted mainly online and that it was available in English and Arabic.

Figure 5 SURVEY RESPONDENTS GEOGRAPHICAL DISTRIBUTION

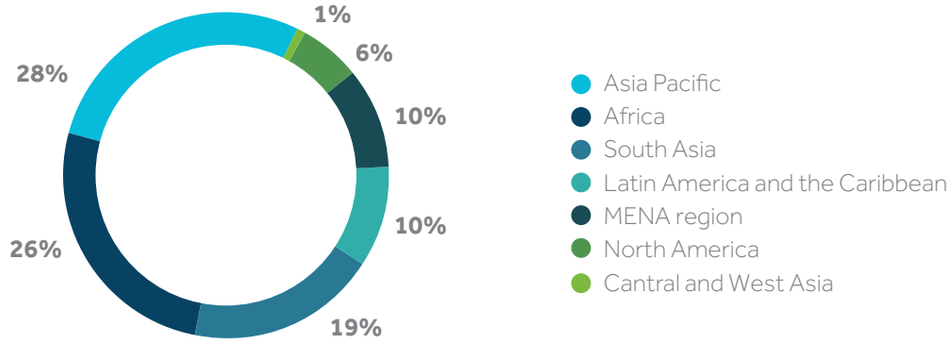


Figure 6 SURVEY RESPONDENTS AGE DISTRIBUTION

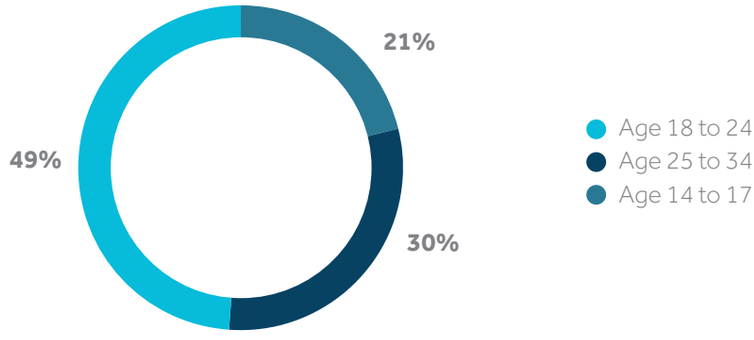
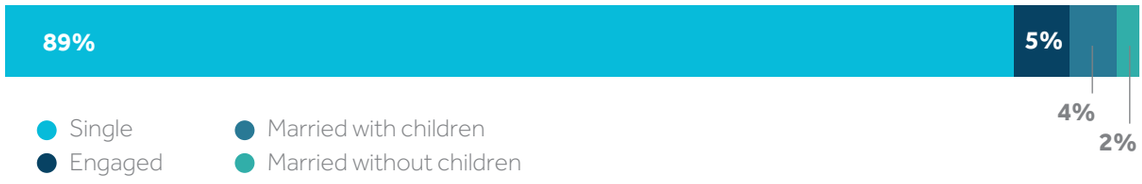


Figure 7 SURVEY RESPONDENTS MARITAL STATUS



- Single
- Engaged
- Married with children
- Married without children

Figure 8 SURVEY RESPONDENTS GENDER

- Male
- Female

Figure 9 SURVEY RESPONDENTS PROFESSION

- Students
- Private sector
- Business owners
- Unemployed
- Government employees
- Homemakers

Figure 10 SURVEY RESPONDENTS EDUCATION

- Completed university/college
- High school degree
- Postgraduate degree
- Other

Figure 11 SURVEY RESPONDENTS CITIZENSHIP

- Citizens
- Long-term residents
- Other

C. Social Media Monitoring

- **Social data analysis** was utilized to gather the young citizens' views on the future of governments, given the prominence of social media interactions. **A total of over 1.1m data points were captured, including 860,600 social media interactions and 316,000 social media mentions.**

- **Facebook** was used as a de facto platform because it dominates the social media landscape, with 2 billion active users worldwide. Facebook data is the only major social platform whose data could be reliably segmented, which was necessary for this analysis. All 'likes', posts, comments and shares' related to the key government research areas analyzed, were captured from a 2 week listening period, August 9-23, 2017. The social data was gathered from Facebook users across all age groups and genders, globally, with all data in English analyzed. The social data gathered covered six key government research area topics: 1) Core needs of government stakeholders, 2) Government interaction means, 3) Top innovation trends affecting government services, 4) socio-demographic changes impacting governments and stakeholders, 5) Gaps in government services, 6) Projected government models of stakeholder engagement.

- **Social media 'interactions'** were captured by inputting key words and hashtags, in relation to specific government research topics, as well as selecting age profiles, genders, demographics and languages. Separately, select government and government services social media accounts were tracked. A social media data aggregation platform, Nuvi (nuvi.com), was utilized for Facebook data analysis purposes. The coverage was global, including all languages, although keywords and hashtags had to be in English, so other language interactions were captured only if the English hashtag or keyword was mentioned.

D. Civil Society Interviews

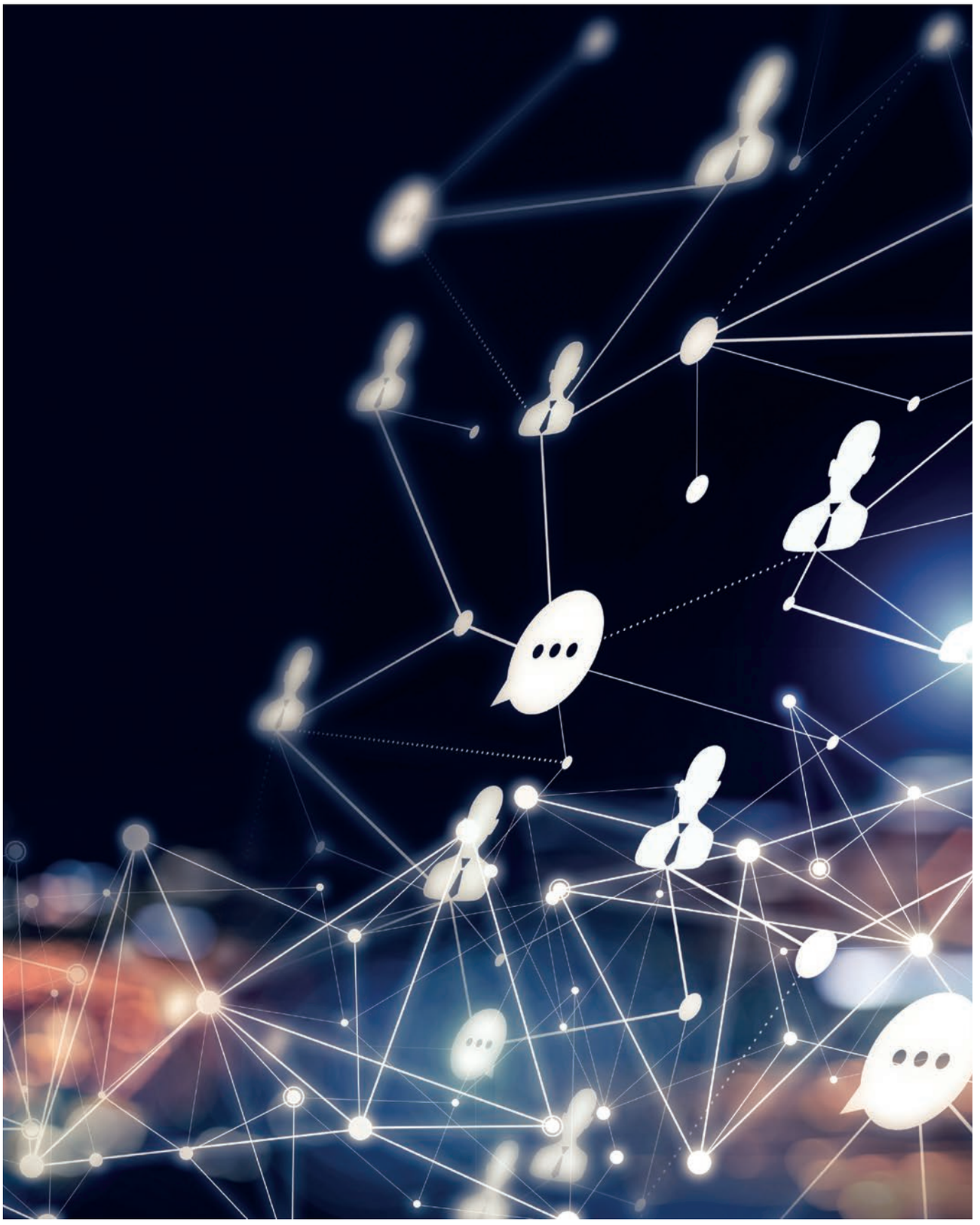
Select civil society institutional interviews were also conducted using both CAWI and phone calls in 2017, from the 18th of August to the 4th of September, to ascertain the needs of civil society institutions, their level of satisfaction, and expectations from government services. Nine interviews were conducted with respondents from eight countries (Figure 5). These were conducted using both CAWI and phone calls from August 4th-September 4th, 2017.

The time and valuable input from the following civil society institutions is much appreciated:

- Emerging Market Private Equity Association — EMPEA (USA)
- Catch22 (UK)
- Freeland Foundation (Thailand)
- Pacific Asia Travel Association (Thailand)
- Indian Muslim People's Organisation For Social and Educational Development (India)
- Maareif Foundation (Egypt)
- United Aid for Azerbaijan (Azerbaijan)
- Center for Economic and Social Development (Azerbaijan)
- Bahrain Women Association for Human Development (Bahrain)

E. Thought Leadership Review

Secondary sources including research reports, academic studies, articles, government data, and publications from international institutions were consulted.



Baseline: Government of Today

While government systems may vary across the world, their primary goal remains meeting the needs of their citizens and residents, alongside a wider set of stakeholders. To achieve this goal, governments make policies and provide services across key areas to ensure the security and wellbeing of their stakeholders. The following section provides an overview of the current government models, identifying various current stakeholders and their needs; a description of how governments strive to meet those needs through the provision of diverse public services; and an examination of how government performance is currently measured across the world. This section serves as a baseline for projecting governments' future evolving needs through to 2071.

2.1
Current Government Stakeholders and Their Needs

A stakeholder is defined as "any person, group, or organization that can place a claim on an organization's attention, resources, or output or is affected by that output".[1]

In the context of public decision-making and public services delivery, this Guidebook presents government stakeholders as primary stakeholders and secondary stakeholders. Primary stakeholders are directly affected by the organization's efforts, whether positively or negatively. Secondary stakeholders can influence the outcome of the organization's efforts and may play an intermediary role in achieving it.[2]

Primary stakeholders include citizens, the business sector, and the wider civil society. Secondary stakeholders include the media and the international community, including international governmental and non-government entities. As primary stakeholders, citizens, the business sector, and civil society are the main constituents of government efforts in terms of addressing their needs through policies and services. Meanwhile, the media plays an important role as a secondary stakeholder by giving primary stakeholder a "voice" in areas of policy making and service delivery.[3]

The international community also plays an important role as an intermediary. International actors may offer support to governments in public service delivery and policy making, to ensure governments fulfill their primary stakeholders needs. In Figure 12, the needs of the primary government stakeholders are categorized and identified using the UN Human Rights charter for citizens' needs and a number of government and business websites[4].

It is worth noting that there is a debate regarding the inclusion of the "natural environment" (land, air, water, animals) of a nation as a government stakeholder[5], since this "natural environment" affects and is affected by decision-making. However, those opposing its inclusion[6] argue that to include non-humans (constituents lacking in

1 Ricardo Corrêa Gomes, "Who Are the Relevant Stakeholders to the Local Government Context?," Brazilian Administration Review 1, no. 1 (2005): 34-52 , accessed September 10, 2017

2 UNDP, "What Are the Key Steps in Identifying Partners?" Public Private Partnership for the Urban Environment.

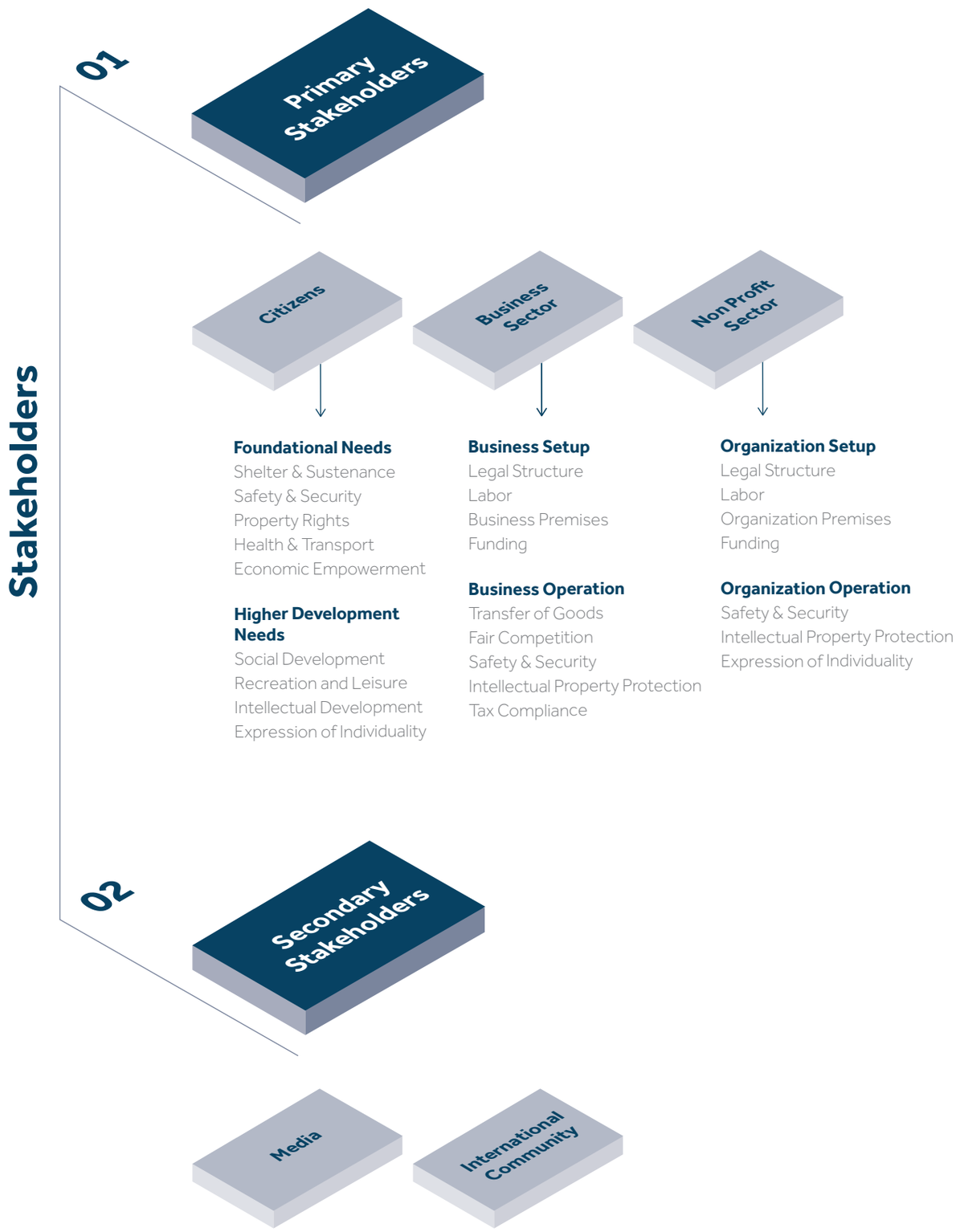
3 UNESCO, "Media and Good Governance."UNESCO Website, 2016, accessed September 10, 2017

4 "Business Rights and Responsibilities." Website of the Central Highlands Development Corporation of Australia, http://chdc.com.au/

5 Mark Starik, "Should Trees Have Managerial Standing? Toward Stakeholder Status for Non-Human Nature." Journal of Business Ethics 14, no. 3 (1995): 207 – 217.

6 Robert Boutilier, A Stakeholder Approach to Issues Management. New York: Business Expert Press, 2011.

Figure 12 STAKEHOLDERS



agency and ability to negotiate), would broaden the stakeholders' theory. This may have to change for the future, but given current practices, we have not identified it as a benchmark stakeholder.

The citizens' needs can be categorized into foundational and high development needs. Foundational needs encompass the basic physical needs for survival such as food, shelter, health, marriage and family, and earning a basic income as well as the need for safety and security. High developmental needs center around achieving one's full potential by being able to develop intellectually and socially, express themselves freely and enjoy recreational activities.

The needs of business and civil society are similar, to a large extent, especially with regards to setup. In the setup stage, both business and civil society need certain elements for creating their organizations, such as creating a legal structure, getting offices, labor and funding (in case needed). In terms of operation needs, both entities also have similar logistical and personal safety needs, as well as the need for protection of physical assets and intellectual property.

Due to their differing nature they do also have unique needs. Businesses need safeguards for their ability to compete, trade facilitation, and tax compliance. While civil society entities require safeguards for their ability to represent interests of their stakeholders.

2

Global Citizens' Insights

The global citizens' survey conducted to supplement this Guidebook focused on Millennials and Generation Z from around the world. It provided valuable insights from the generation that will constitute the actual beneficiaries of government services in the next 50 years. Below are key insights from the citizens' survey regarding their priority needs and satisfaction levels:

Priority Needs, Basic Rights, and Current Satisfaction
(See Figure 13 and 14)

- **Education, Health & Environment protection identified as high priority areas by citizens:** While "education", "health", and "environmental protection" were "High Priority" areas for government services to focus on, "recreation & culture" had the lowest rating.

- **Regional variations:** While "education" and "health" were identified as top high priority areas across all regions with only slight variations, "environmental protection" had a large variation across regions. 77% of respondents from Europe (including Russia) rated it as a high priority area, while only 59% from the MENA region did the same. Both the MENA region and South Asia rated public order and safety higher than environmental protection.

- **Same priorities across income levels:** It is worth noting that there were no major variations in terms of high priority areas across the different income categories surveyed.

- **High level of dissatisfaction in priority areas:** Satisfaction with government functions was low in almost all areas. The area where citizens were **satisfied the most** was defense (39%.) Unfortunately, three of the top four areas dissatisfied with were identified as top priorities.

- Social protection had the lowest satisfaction rating among all priority areas across all regions except North America: The lowest level of satisfaction with social protection was in Latin America & Caribbean (7%) and the highest was in Asia Pacific (15%).

Figure 13 GOVERNMENT SERVICES (BASIC RIGHTS) — IMPORTANCE VS. SATISFACTION

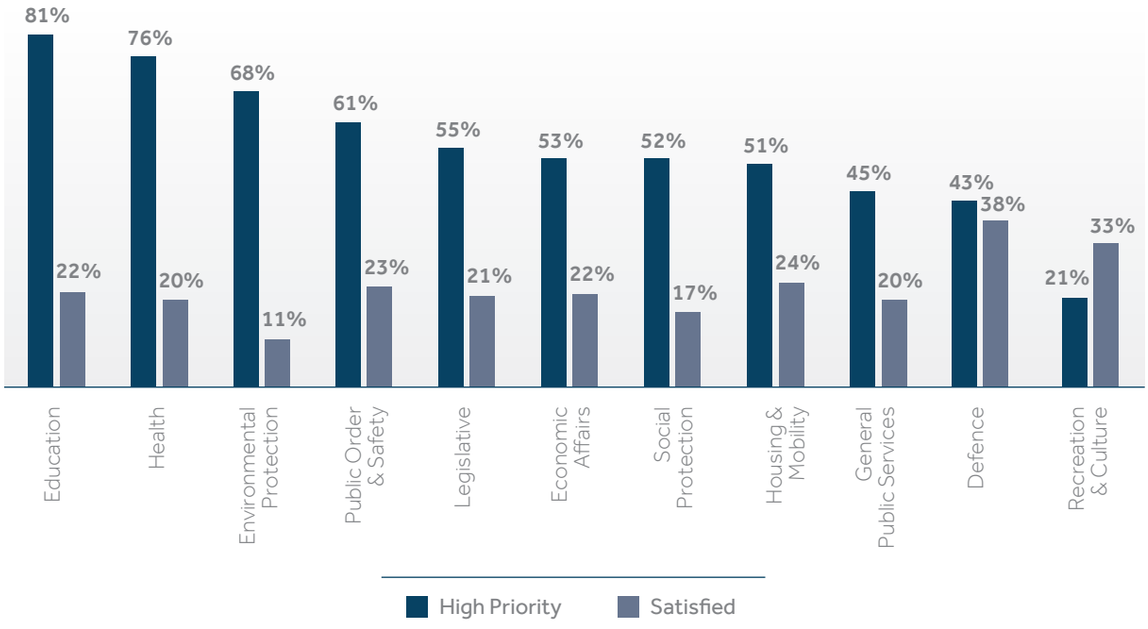


Figure 14 "HIGH PRIORITY" GOVERNMENT SERVICES — GEOGRAPHIC VARIATIONS[7]

	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5
Africa	Education	Health	Environmental Protection	Public Order & Safety	Housing & Mobility
Asia Pacific	Education	Health	Environmental Protection	Public Order & Safety	Economic Affairs
Europe & Russia	Health	Education	Environmental Protection	Social Protection	Public Order & Safety
Latin America & Caribbean	Education	Health	Environmental Protection	Public Order & Safety	Legislative
Middle East & North Africa	Education	Health	Public Order & Safety	Environmental Protection	Defense
North America	Education	Health	Environmental Protection	Social Protection	Housing & Mobility
South Asia	Education	Health	Public Order & Safety	Legislative	Environmental Protection

7 Central/West Asia Region is not included in geographic comparisons due to small number of respondents in the sample.

Views on Major Government Policies
(See Figure 15)

- **Overwhelming support for promoting open trade agreements with other countries:** 80% of respondents agreed that their country should promote open trade agreements. There was some variation across regions; the highest level of agreement was in Africa (87%) and the lowest in North America (72%).

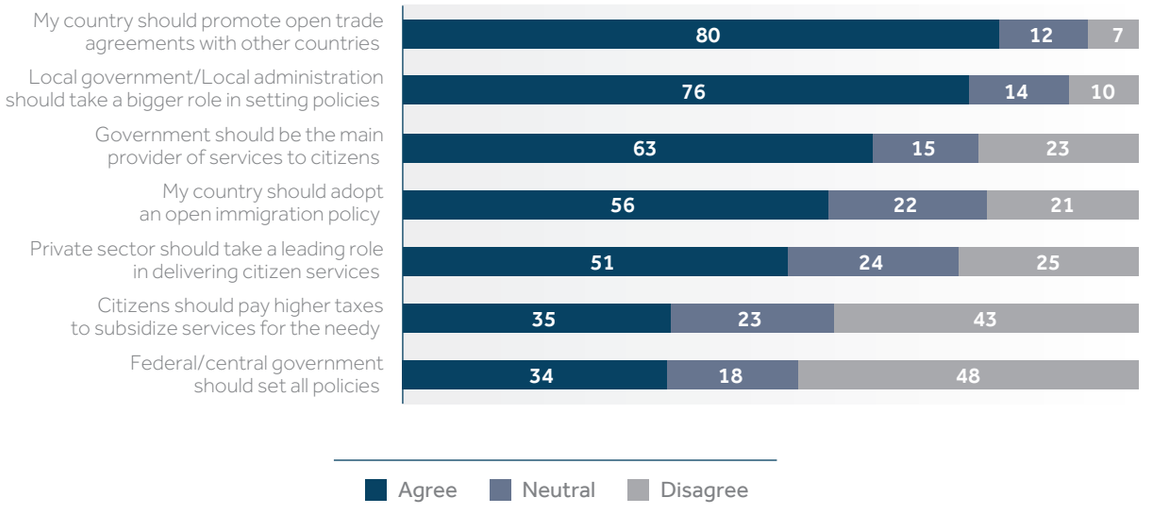
- **Significant support toward open immigration:** 56% of the respondents agreed that their countries should have open immigration policy. However, there was some variation between regions with South Asia having the lowest level of agreement (49%) and Latin America and the Caribbean having the highest (67%).

- **Mixed views on taxes:** 43% of respondents disagreed that citizens should pay higher taxes to subsidize services for the needy. There is a considerable level of variation on the idea of citizens paying higher taxes across the regions surveyed, as well as income levels. In terms of regions, less respondents from Asia Pacific, Africa and MENA, as opposed to North America, supported the idea of higher taxes to support services for the needy.

- **Bigger role for local administration:** 76% of those surveyed agree that local governments should take a bigger role in setting policies. Respondents from North America had the least level of agreement (16%) on the idea that the federal/central government should set all policies, while Asia Pacific had the highest (47%).

- **More public-private partnership:** While 63% of respondents agreed that government should be the main provider of services to citizens, 51% also agreed that private sector should take a leading role in delivering citizen services. Respondents from Europe (including Russia) had the least level of agreement (33%) on the idea that the private sector should take a leading role in delivering citizen services, while the MENA region had the highest (62%).

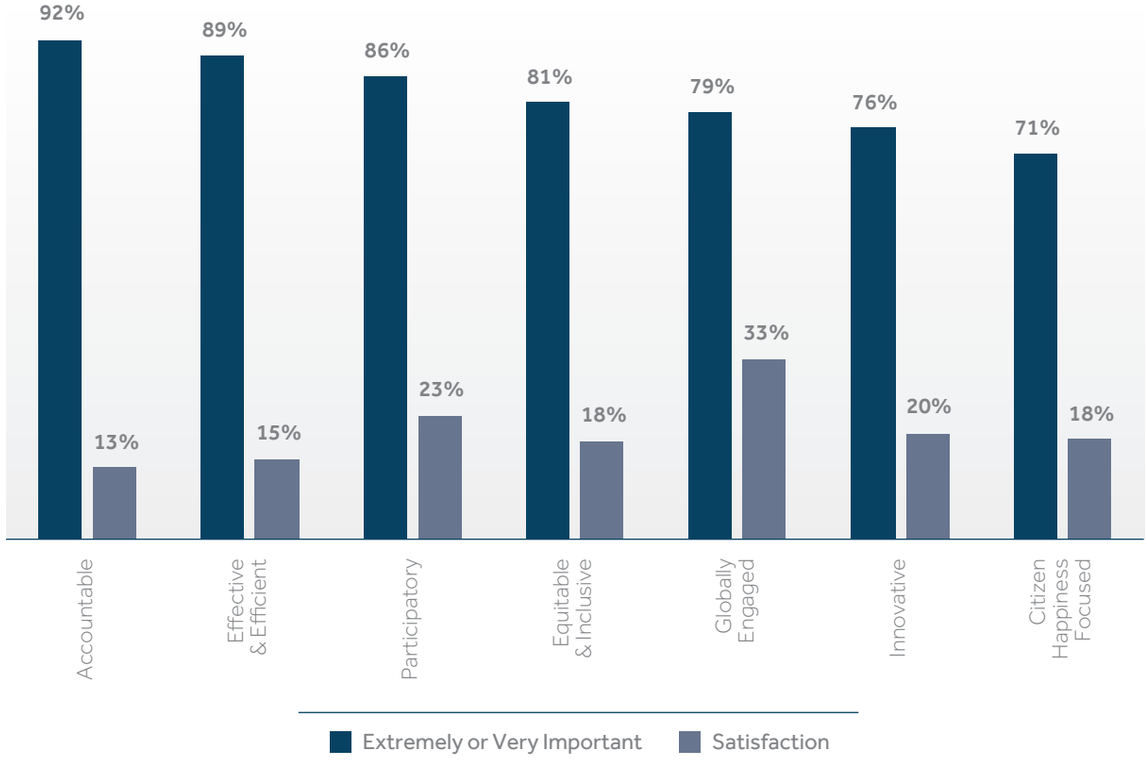
Figure 15 CITIZEN VIEWS ON MAJOR GOVERNMENT POLICIES



Government Attributes and Current Satisfaction
(See Figure 16)

- **Accountability is the most important government attribute:** Over 92% of respondents rated "accountability" as extremely or very important, reflecting importance of corruption-free, trust worthiness as a key attribute.
- **Considerable variation in perceiving the importance of government being innovative across regions:** There was variation across regions in regards to importance of 'innovativeness of a government. The highest level of importance was assigned in Africa (81%) and the lowest was in North America and Europe (including Russia) (61% each).
- **High level of dissatisfaction:** Satisfaction with government attributes is quite low in all areas. The attribute that citizens were satisfied with most was being globally engaged (33%) and the attribute they were satisfied with the least was being accountable (13%).
- **Asia Pacific was the best rated region across all government attributes:** Respondents from Asia Pacific were most satisfied with their governments relative to other regions. The attribute they were satisfied with the most was being globally engaged (42%) and the attribute they were satisfied with the least was being equitable and inclusive (19%).

Figure 16 GOVERNMENT ATTRIBUTES — IMPORTANCE VS. SATISFACTION



Civil Society Insights

In order to incorporate views from civil society organizations, nine different institutions, from eight different countries, provided their input on future expectations of government.

Institutions' Needs and Satisfaction

When asked about the services they need from their governments, most respondents mentioned licensing and funding. Some respondents mentioned tax services, work permits and residence/ immigration services for foreign staff and their families.

As for their level of satisfaction with current government services, many respondents expressed their dissatisfaction mainly with the "long duration" government takes for administrative procedures. A respondent from an international organization working in Thailand mentioned the difficulty of procedures since all documents are in the Thai language only.

A respondent mentioned the need for "indexing NGOs so that they can cooperate and coordinate their efforts".

Engagement and Satisfaction

When asked about government engagement, many respondents mentioned that their institutions were being informed by government of policies and services, and were involved and consulted in decision making.

Only one respondent mentioned collaborating with government in final decision making, while two respondents mentioned that there were no engagement efforts undertaken by their governments to engage them.

In regards to satisfaction with current engagement level, only one of the respondents mentioned being satisfied. For the rest of the respondents, the reason for their dissatisfaction included engagement being ineffective "not real" or "on paper" and not timely. When asked about ways to improve engagement, some respondents mentioned creating "advisory councils" and forums for "policy debates".

As one of the respondents put it "organizations are happy to help and provide guidance and feedback, when asked. They are all stakeholders in the country's success, so why not engage them."

Innovation Trends

Hyper connectivity and cyber security were the top two technologies the respondents answered will have the biggest impact on government function. This was followed by clean and renewable energy, biotech/ genome medicine, artificial intelligence/ robotics, virtual/augmented reality, and 3D printing.

The respondents believed these trends could affect the job market and require new government regulations in new areas. As one respondent mentioned "the world as we know it will evolve quickly and government needs to stay forward-looking to understand the impact of innovation on human safety and well-being and regulate where and when needed".

Some respondents mentioned the need for changes to the educational system to mitigate the effect of increased automation on job opportunities. In terms of how these innovation trends could affect future government engagement with institutions, most respondent saw the effect as positive with expected rise in e-services and faster and more efficient engagement. One respondent mentioned that with these innovation trends "government needs to work closely with international organizations to prepare our society and our leaders for the Digital Connectivity Era".

Socio-demographic changes

With regard to the socio-demographic changes that governments should prepare for, education topped the list followed by population age shifts and climate change, followed by urbanization and increase in global population (11 bill est. by 2050). Many respondents mentioned cooperation with NGOs and the private sector being needed to better prepare for these socio-demographic changes.

Social Media Snapshots of Stakeholders Needs

A snap-shot of social media interactions by citizens worldwide gave an added view, alongside the global survey conducted (see methodology section for profile.) An aggregate sentiment analysis across all key government related topics showed an overwhelming 47% of all interactions as negative sentiment, 32% were neutral and only 21% were positive. Below are the key findings:

What are the core needs of government stakeholders?

Key findings

Health, education and security are amongst the top needs discussed by government stakeholders. "Health" and "education" represented 29% and 23% respectively across all categories discussed amongst government social media accounts, and 47% of all negative terms discussed were in relation to "security, threat and violence."

Race equality was the number one social issue amongst government stakeholders. Seven of the top ten topics discussed on Facebook, were in relation to race equality, human rights and race climates.

Implication

Citizens are most concerned with government providing services that meet their educational and health needs in an affordable way. Security is top of the agenda amongst stakeholders, with many discussing their governments' security measures as being a negative service. Easing racial relations is an important issue as well.

From a **total of 300 thousand data points captured,** the United States represented 65% of all data captured, with 194 thousand interactions, and 77% of that data having negative sentiment. The United States was closely followed by Australia, Philippines and India. Interestingly, in the **United States individuals aged 45 and above represented 66% of the entire data points captured.** This implies that older generations in the United States are most concerned with their needs being addressed by the government, whereas in eastern countries, younger generations are more concerned with their future.

Based on an algorithm that factors in the conversational tone of social media, data shows **an overwhelming 75% of interactions were with negative sentiment.** Countries which expressed the largest share of negative sentiment were United Kingdom (90%), Australia (85%) and Philippines (84%). From the 13 official government social media accounts tracked, an overwhelming 43% of all data was negative.

SELECT FACEBOOK INTERACTIONS

Health and Security

Somewhere in Nigeria, a lady delivered her baby at night with my mother's Nokia torchlight. There was no light and there was no money to buy diesel for the generator. Our government hospitals are in a horrible state. Nigeria, till when.....?

How are socio-demographic changes affecting government and its stakeholders?

Key findings

"Climate change" was the most discussed socio-demographic issue globally and especially among Millennials followed by "immigration" issues and "racial tension". 38% of all data captured on socio-demographic issues came from individuals aged 18-34 years. 64% of all topic interactions recorded were in relation to climate change.

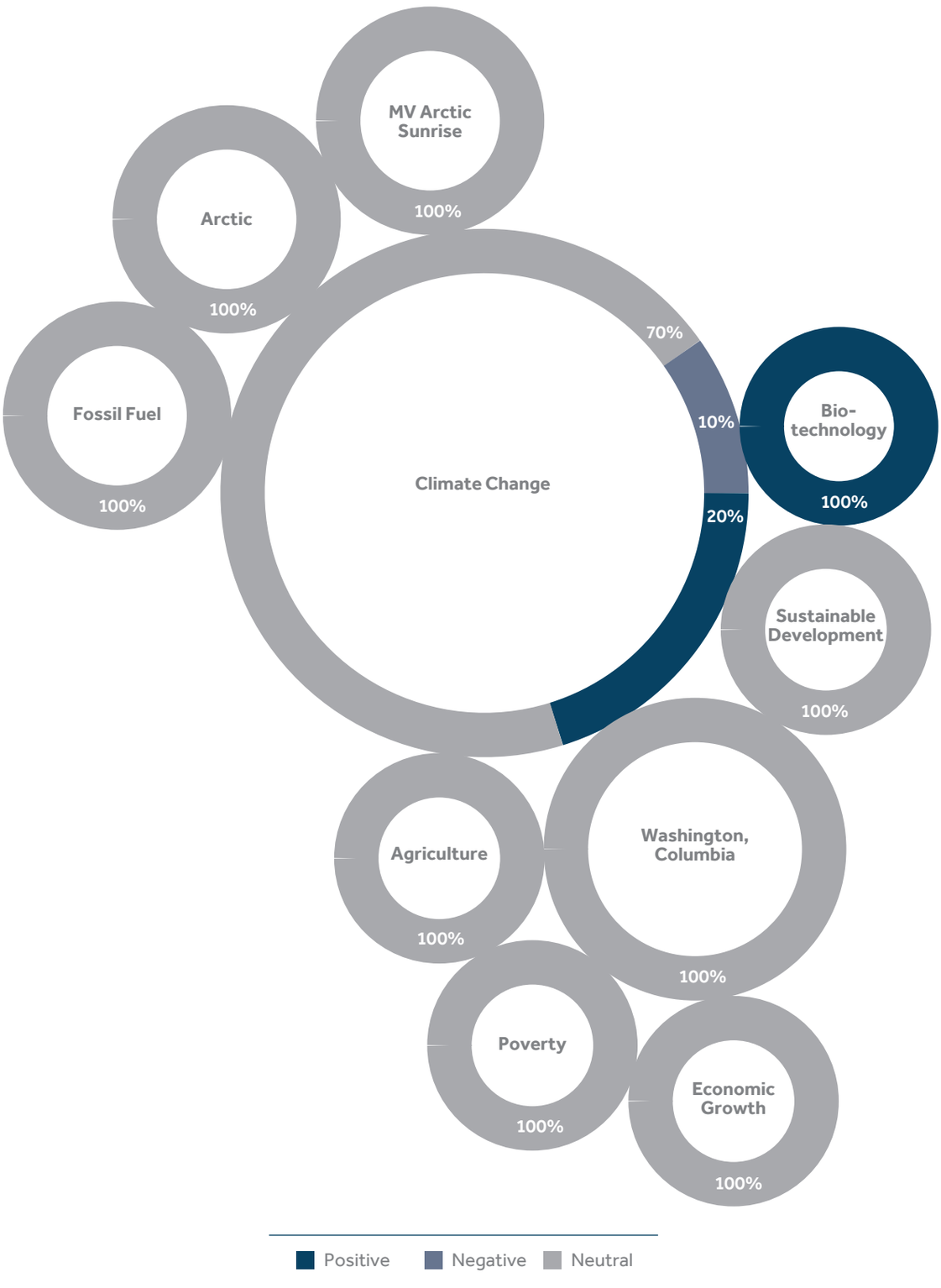
Implication

Millennials are most concerned about how governments are addressing climate change, global warming and environmental impact across the globe, showing strong signs of stakeholders demanding government to align with their humanitarian values. Strong themes captured also suggest stakeholders are demanding better government immigration mechanisms in line with their values and views that help immigrants integrate in society.

From **a total of 71,200 data points captured the top countries where stakeholders were engaged with discussion around 'Socio-Demographic Impact', were United States (30.2 thousand interactions), India (13.3 thousand interactions), and Australia (3.1 thousand interactions).** Across all countries, individuals aged 18-34 were the most engaged in this topic, representing 43% of all interactions on social media, signifying that Generation Y and Generation Z are voicing their views and concerns on the socio-demographic impact to their future and their country.

When analyzing sentiment by topics discussed on Facebook, key socio-demographic topics became apparent, such as climate change, sustainable development, poverty, economic growth, fossil fuel and agriculture. Climate change represented 64% of all topics discussed on Facebook with all other topics representing less than 10% (See Figure 17). All of these topics are in relation to global warming and environmentalism. The top hashtags used were #agriculture, #sustainability, #fuel and #climate -change alongside other specific terms.

Figure 17 SENTIMENT DISTRIBUTION OF "SOCIO-DEMOGRAPHIC" TOPICS



How are innovation trends affecting government services now and in the future?

Key findings

Innovation in government related, technology education initiatives were the highest regarded by stakeholders. Specific topics on new technology colleges launched in India and Australia by the government received 100% positive sentiment and interactions on Facebook.

Implication

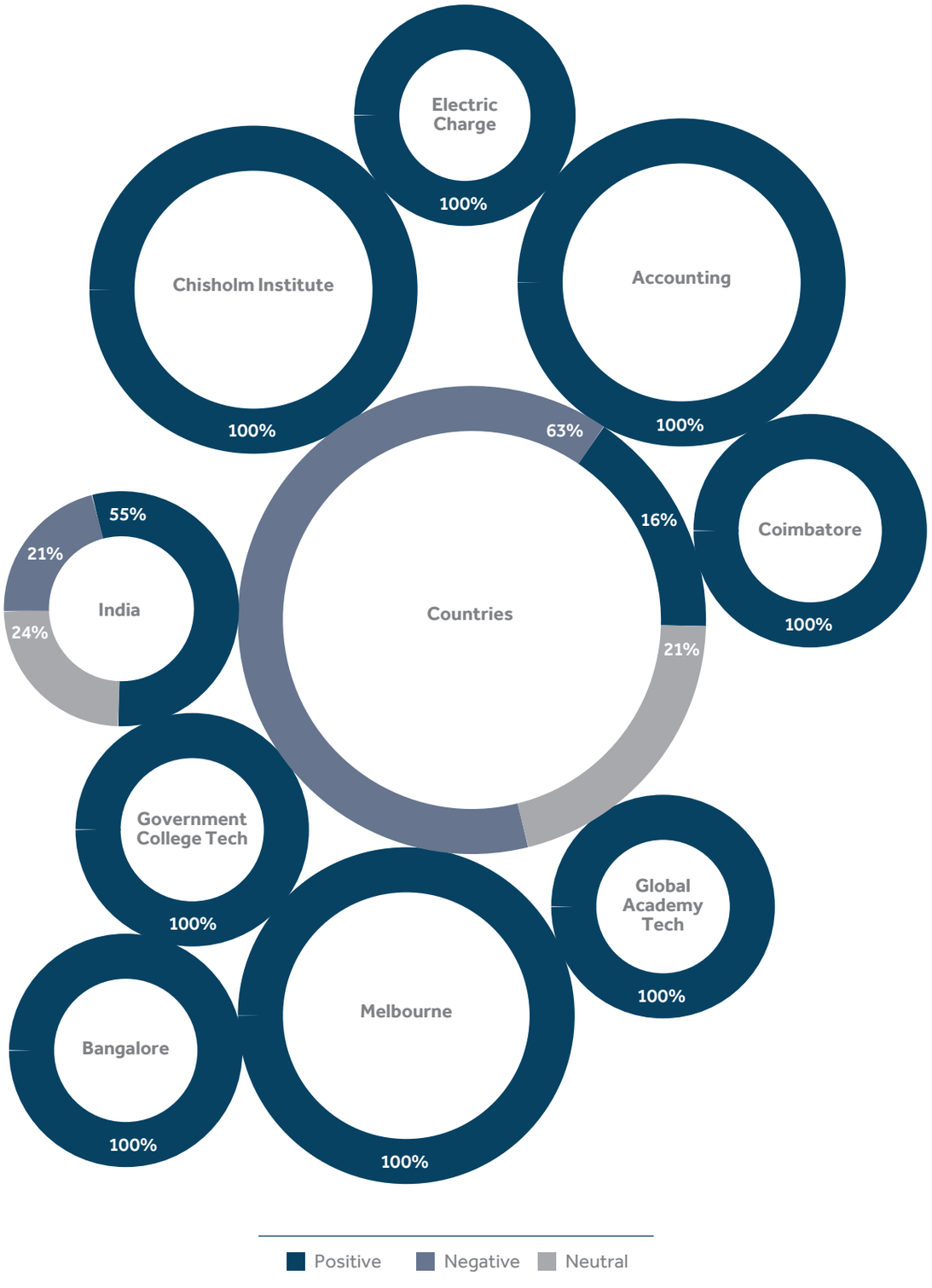
This implies that government funded, innovation related institutes are a positive asset that stakeholders view as an advancement to the government's role within their country.

From a **total of 200,000 data points captured, the top countries where stakeholders were engaged with discussion around government innovation by volume of interactions, were the United States (37%) and India (18%).** Individuals aged 45 years and over represented over 67% of all interactions in the United States where **individuals aged 18-34 years represented 79% of all interactions in India.**

Based on an algorithm that factors in the conversational tone, **32% of interactions were with positive sentiment, 34% were neutral, and 34% were negative. This was the only research area where positive sentiment was above 30% and in close equal representation to negative sentiment.** Countries which had the largest amount of positive sentiment were India (63%) and Nigeria (33%). Contrasting this is the United States and United Kingdom, which had negative sentiment of 53% and 67%, respectively.

From across the 'Government Innovation' interactions captured, the most common topics were in relation to government funded innovation technology institutes in India and Australia. Each had 100% positive sentiment. The top relative topics on Facebook were: 'Countries', 'Melbourne', 'Chisholm Institute', and 'Government College of Technology Coimbatore' (See Figure 18). The most used relevant hashtags included; #innovation, #startups, and #citypreneurs. It is clear that individuals are most enthused and concerned with government advancing the education and number of opportunities for technology and entrepreneurship.

Figure 18 SENTIMENT DISTRIBUTION OF 'GOVERNMENT INNOVATION' TOPICS



What are citizens expectations on government communication tools?

Key findings

"Cyber crime", "Internet security" and "security of data" are the biggest concerns of government stakeholders with respect to government communication tools and methods. The top 3 topics discussed on Facebook were in relation to the lack of government security against hackers and a lack of security on government technologies arose as a key emerging theme from select interactions.

Implication

Government stakeholders do not trust to use government Internet based services and technologies due to the poor security infrastructure and risk of data being exposed and hacked.

From a **total of 32,600 data points captured on this topic,** the United States represented 38% of all data captured followed by India at 10%, and all other countries representing less than 10%. Based on an algorithm that factors in the conversational tone, an overwhelming 48% of interactions were with negative sentiment. The United States had the largest portion of negative sentiment with 70% of all data being negative. When analyzing sentiment by topics discussed on Facebook, the majority of topics have a large share of neutral sentiment with the only topic, 'Internet', having a significant negative sentiment of 100%.

SELECT FACEBOOK INTERACTIONS

On Government Communication

"Passing information to the public is an important part of communication."

"This is paradise for statistics and infographics lovers."

2.2
Current Government Operations

Governments are organized in many different ways. Even amongst the most effective governments, the operational structure is vastly different.

However, government functions and their metrics are common across most governments as cataloged by various multilateral bodies. Presented here are common government functions that serve as the benchmark for our future impact analysis. We also present existing performance indicators to see how they will be impacted by future developments.

Current Functions

Governments strive to fulfill stakeholder needs through the provision of public services. To structure the identified areas of stakeholder needs, this guidebook aligns to the to core government function themes of Governance and Resilience; Economy and Society; Environment and Health; and Future and Progress.

- **Governance and Resilience:** Governments work to maintain their resilience as well as protect citizens. They ensure their resilience by providing general public services, including carrying out legislative, executive, financial and fiscal duties. They also defend citizens against external enemies and maintain public order and safety through the provision of police services, fire-protection services, law courts and prisons.

- **Economy and Society:** Governments seek to create the conditions for economic growth and to ensure the prosperity of citizens. This is fulfilled through management of economic affairs in general and the provision of a variety of services in areas of recreation, culture, housing and mobility, and social protection for the vulnerable.

- **Environment and Health:** Governments coordinate environmental and health policies and programs to preserve and enhance the health of the natural environment and the nation's citizens. These are done through the provision of a variety of services in areas of waste management, pollution abatement, protection of biodiversity and landscape, and public health services.

- **Future and Progress:** Governments play a key role in supporting research and development activities. They are key drivers in promotion and adoption of innovation to ensure future preparedness and to achieve progress.

The following function classification breakdown presents a current state public service classification adopted by this Guidebook as a baseline of future government services presented in later sections. The following classification is adopted from and links to the Classification of the Functions of Government (COFOG) used by the Organization for Economic Co-operation and Development (OECD). There is a variation in how governments can be organized, however, they essentially aim to deliver the same public services to fulfill their stakeholders' needs.

Function Classifications

Function Themes	Sub-Level Functions	Detailed Services
Governance and Resilience	General public services	Executive and legislative
		Financial and fiscal affairs
		External affairs
		Foreign economic aid
		General services, public debt transactions
		Different levels of government
	Defense	Military
		Civil
		Foreign defense aid
	Public order & safety	Police
		Fire protection
		Law courts
Environment and Health	Environmental protection	Waste management
		Water waste management
		Pollution, abatement
		Protection of biodiversity and landscape
		Agriculture, forestry, fishing and hunting
		Food security and methods of agriculture
	Health	Medical products, appliances and equipment
		Outpatient services; hospital services
		Public health
Future and Progress	Education	Pre-k to 12th Grade
		Post-secondary/ university
		Other education

Function Themes	Sub-Level Functions	Detailed Services
Future and Progress	Research & innovation development	R&D on scientific discovery
		R&D on breakthrough fundamental technologies
		R&D on next generation policy
		R&D on other areas
		Innovation development & adoption
Economy and Society	Economic affairs	General economic affairs
		Commercial and labor affairs
		Agriculture, forestry, fishing and hunting
		Fuel and energy
		Mining, manufacturing and construction
		Communication
		Other industries
	Housing & mobility	Housing development
		Community development
		Water supply
		Street lighting
		Transport
	Recreation & culture	Recreation, sports, culture
		Broadcasting and publishing
	Religion	Religious and other community services
	Social protection & welfare	Sickness and disability, old age, survivors, family and children
		Unemployment
		Housing
		Social protection and social exclusion

Current Performance Indicators

Good governance is defined as the product of nation-states performing "effectively and well" on behalf of their citizens and residents.[8]

How governments are rated and evaluated today can be a complex question given a variety of dimensions of good governance. Most governments use a different set of metrics to evaluate their performance, often linked to its type of governance model. However, a variety of existing global benchmark indexes, by recognized international bodies, give us a strong view on current evaluation criteria.

For this Guidebook, we have mapped current structure of government function and services as presented earlier with a variety of governance performance benchmark indicators covered by five major global indexes. The following table summarizes the general areas evaluated by these indexes: Worldwide Governance Indicators (WGI) released by the **World Bank**; Social Progress Indicator (SPI) released by the nonprofit **Social Progress Imperative**; the E-Government Development Index (EGDI) released by the **United Nations**; the Global Innovation Index (GII) released by **INSEAD, Cornell University and the UN World Intellectual Property Organization**; and the **World Democratic Forum**'s (previously known as the Forum for a New World Governance) World Governance Index.

8 Ashrafun Laila, Mohammad and Joya, and Jasim Uddin, "Development through Good Government: Lessons for Developing Countries." *Asian Affairs* 1, no. 3 (2007): p. 15.

Select Current Performance Indicators

Function Themes	Indicators	Benchmark Values*	Source
Governance & Resilience	Control of corruption estimate (-2.5 to 2.5)	2.29	Worldwide Governance Indicators
	Voice and accountability estimate (-2.5 to 2.5)	1.70	Worldwide Governance Indicators
	Displaced persons per 100,000 Inhabitants	0	World Governance Index
	Judicial system effectiveness (0=high; 100=low)	0	World Governance Index
Economy & Society	Unemployment rate	1.2	World Governance Index
	Regulatory quality (Private Sector) estimate (-2.5 to 2.5)	2.26	Worldwide Governance Indicators
	Availability of affordable housing (% satisfied)	88.02	Social Progress Index
	Access to electricity (% of pop.)	100	Social Progress Index
	Access to piped water (% of pop.)	100	Social Progress Index
	Internet users (per 100 inhabitants)	98.16	E-Gov't Development Index
	Mobile subscribers (per 100 inhabitants)	218.43	E-Gov't Development Index
	Happiness	67.24	World Governance Index
	Quality of life (0=low; 100=high)	85	World Governance Index
Environment & Health	Waste water treatment (% of wastewater)	99.27	Social Progress Index
	Greenhouse gas emissions (CO_2 equivalents per GDP)	116.29	Social Progress Index
	Child mortality rate (deaths/1,000 live births)	2	Social Progress Index
	Biodiversity and habitat (0=low; 100=high protection)	100	Social Progress Index
Future & Progress	Number of scientific and technical journal articles (per billion PPP$ GDP)	71.1	Global Innovation Index
	Adult literacy rate (% of pop. aged 15+)	99	Social Progress Index
	Government expenditure on education (% of GDP)	9.6	Global Innovation Index
	Researchers, full-time equivalence (FTE) (per million population)	8,255.4	Global Innovation Index
	Total domestic intramural expenditure on R&D during a given period as a % of GDP	4.3	Global Innovation Index

* Benchmark values here are of the top-ranking values per Indicator

2.3
Current Stakeholder Engagement

Stakeholder engagement is at the heart of good governance. Governments are becoming increasingly aware that good governance can only be achieved through increased engagement with stakeholders, particularly citizens.

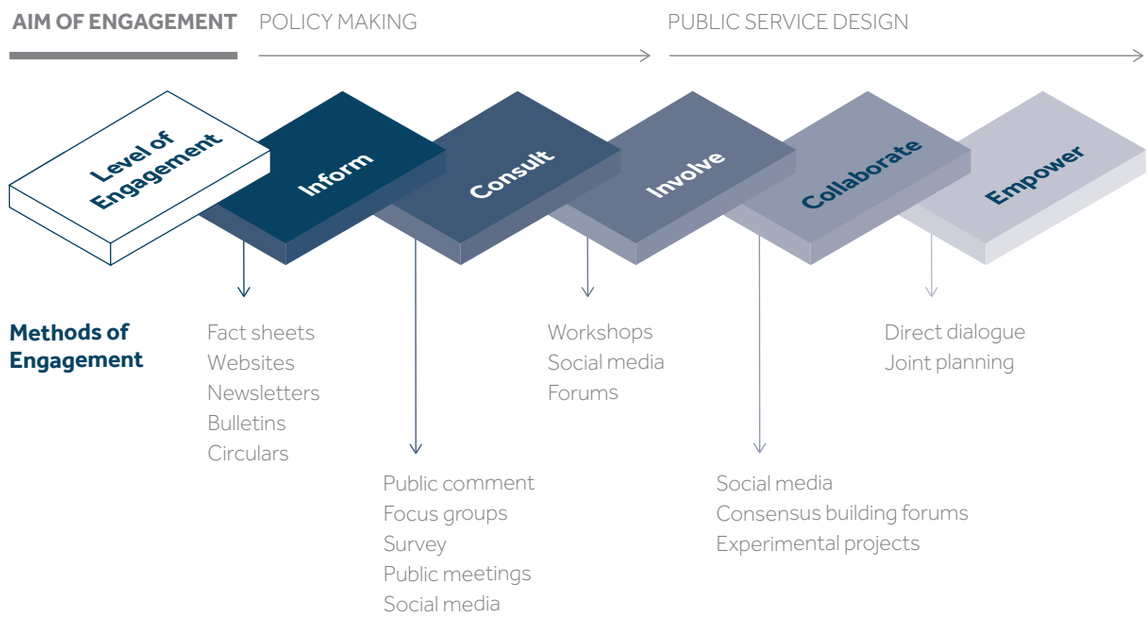
The main purpose behind citizen engagement is the development of policies and the design of services that fulfill their needs. The purpose, levels of stakeholder engagement and methods used at each level of the engagement process are outlined in Figure 19.

"A successful government will help citizens deal with change — similar to the way that many projects today incorporate 'change management' functions. There may be social change management initiatives driven by governments."

Brenda Cooper
Science Fiction Author, Futurist
Chief Information Officer, City of Kirkland, USA

Current Stakeholder Engagement Framework

Figure 19 STAKEHOLDER ENGAGEMENT FRAMEWORK MODEL



According to the International Association for Public Participation, there are five levels of stakeholder engagement; informing, consulting, involving, collaborating and empowering stakeholders.[9] Once stakeholders are identified within the context of the policy making or public service area, the choice of engagement level depends on the level of influence over and interest in the policy making or public service area. This is contingent on a number of elements, such as the nature of the policy or service, the stakeholders' level of involvement and ability to affect the outcomes.[10]

Informing stakeholders is a minimal level of engagement; it is used mainly for stakeholders who have low influence as well as low interest in the policy making/public service area. The objective of this level of engagement is mainly providing them with complete and accurate information to assist them in getting a clear understanding of government policies and services. Methods of engagement used at this level include dissemination of information through websites, fact sheets, newsletters, etc.

Consulting stakeholders can be considered the first level of active engagement; it aims to get their feedback on policy/service alternatives and outcomes. Consulting stakeholders is mainly used for stakeholders with low influence but high level of interest in the policy/service area. It can be highly beneficial in the agenda setting and policy

9 Brenton Holmes, "Citizens' Engagement in Policymaking and the Design of Public Services." *Parliament of Australia*. January 10, 2014.

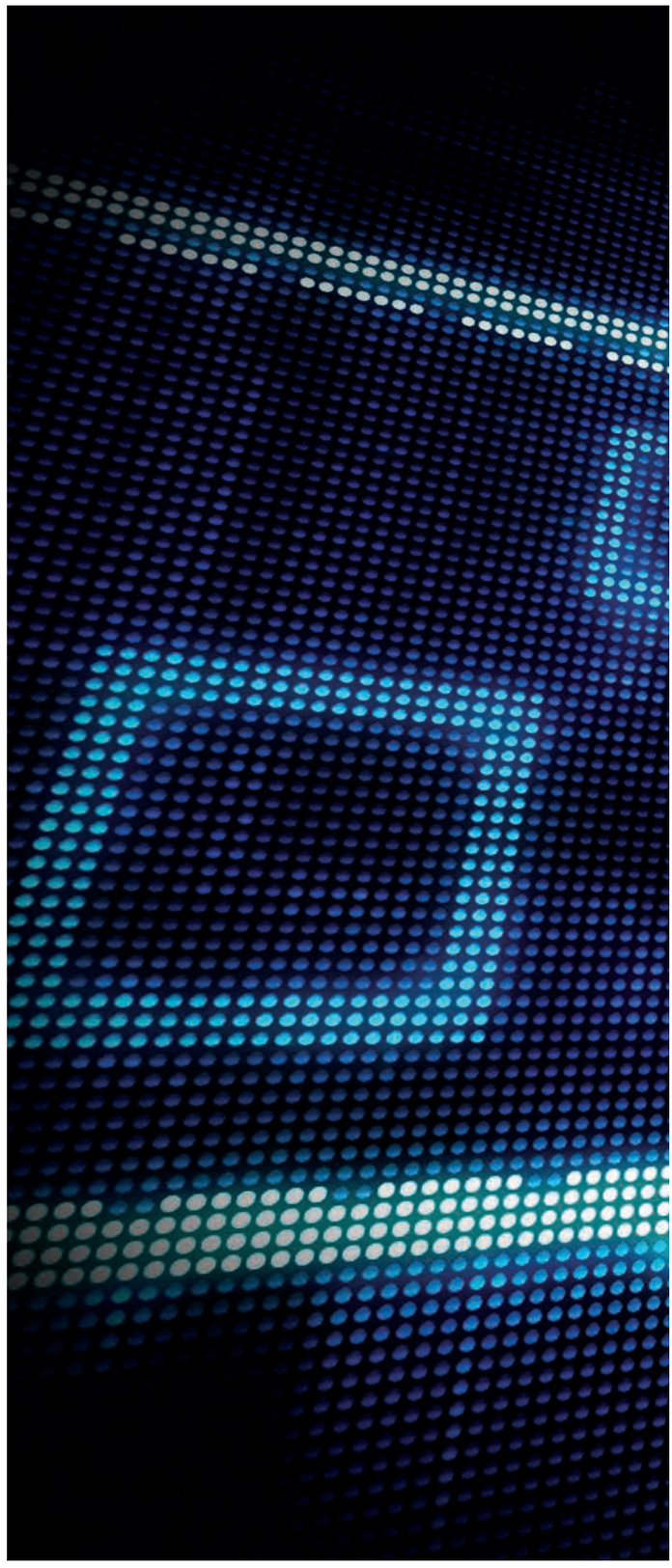
10 Melbourne Department of Education and Early Childhood Development, *Stakeholder Engagement Framework*. October 2011. 10 Natalie Helbig et al., "Stakeholder Engagement in Policy Development: Observations and Lessons from International Experience," *Policy Practice and Digital Science* 10 (2015): 177-204.

formulations stages to define the problem that policy should address and to provide alternative ideas to resolve the problem. Methods of engagement used at this level can include already existing channels for public comments and social media (Facebook, Twitter, Instagram, blogs, etc.) in addition to specifically designed research tools such as focus groups and surveys.

Involving stakeholders aims to make sure that stakeholder needs are taken into account and that their interests will be served by the planned policies and services. Involving stakeholders is mainly used for stakeholders with high influence but low interest in the policy/service area. Social media is also used at this level of engagement, in addition to holding workshops and creating forums to get a better understanding of stakeholders' needs and preferences with respect to the proposed policies and services.

Collaborating with stakeholders involves the assimilation of their opinions, advice and suggestions in making the decision or developing the public service. Besides using social media, a number of experimental tools can be used such as creating a "stakeholder board" or a "living lab" where stakeholders can interact and come up with ideas in the policy making or public service area.

Empowering stakeholders is the highest level of engagement; it is used mainly for stakeholders who have both high influence and high interest in the policy making/public service area. At this level, the stakeholders take part in the decision making or service development process through direct dialogue or joint platforms with government bodies. This level of engagement ensures that stakeholders will accept the policy/approve of the service as they have taken part in developing it.



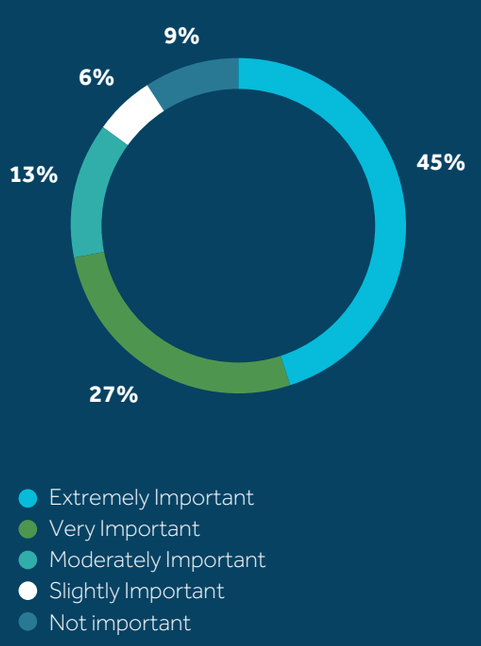
Citizen Survey Views:

The exclusive global citizens survey done for this Guidebook (see methodology section for details) provides us with valuable insights on current levels of citizen engagement with government and their satisfaction:

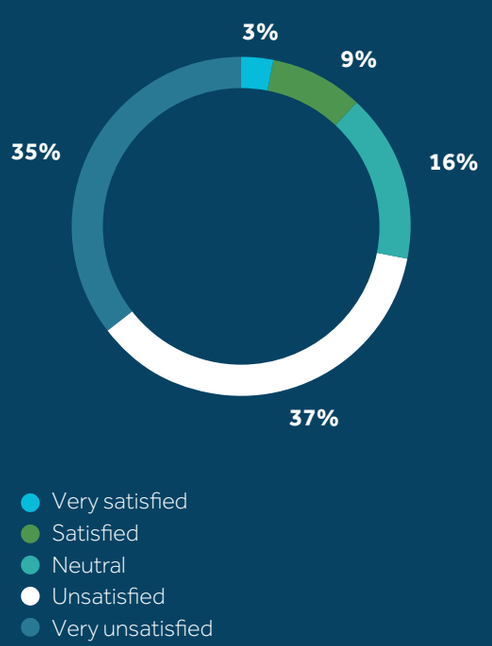
Importance of Citizen Engagement and Satisfaction:

- **Significantly important for governments to engage with citizens:** 45% responded government engagement in major decision-making as "extremely important," with 27% of them rating it as "very important." Only 9% of the respondents rated it as not important. In terms of regional variations, 25% of Latin America and the Caribbean and 17% of MENA respondents rated government engagement as not important.
- **High dissatisfaction with current levels of engagement:** 72% of respondents were dissatisfied with governments' efforts to engage, while only 13% of the respondents were satisfied and the rest were neutral.

Q: How important is it for your government to engage with citizens in major decision-making (e.g. budgeting, major policies, etc.)?



Q: How satisfied are you with your government's efforts to engage with you in decision-making?

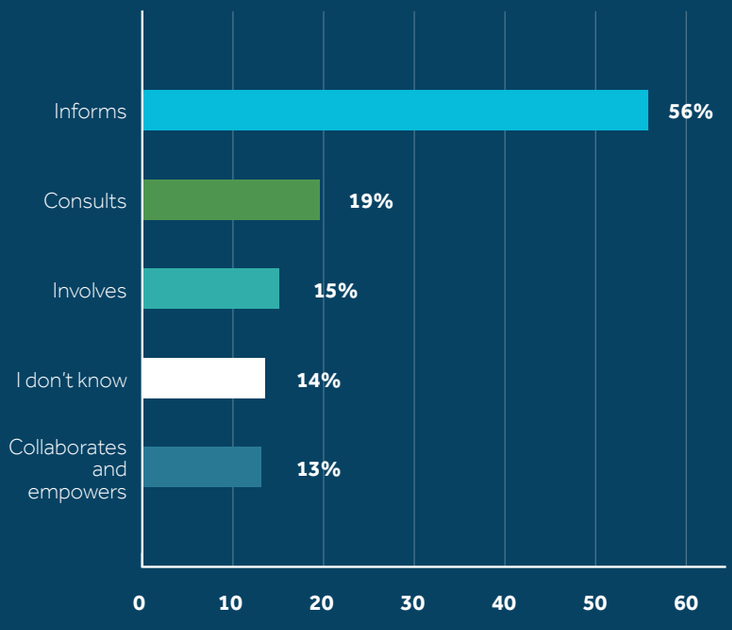


The region with the highest level of satisfaction was Asia Pacific (21%).

Level of Citizen Engagement:

- **Level of engagement today mostly at "Inform" level:** 56% of the respondents cited government only "informing" them of policies, while 20% mentioned being "consulted" by government in policy development. As for higher level of engagement, 16% mentioned being "involved" in the decision-making process while 14% cited "collaborating" in the final decision making. Compared to the other regions in the survey, Asia Pacific had the highest level of engagement at all levels.

Q: How does your government engage with you today in decision-making?



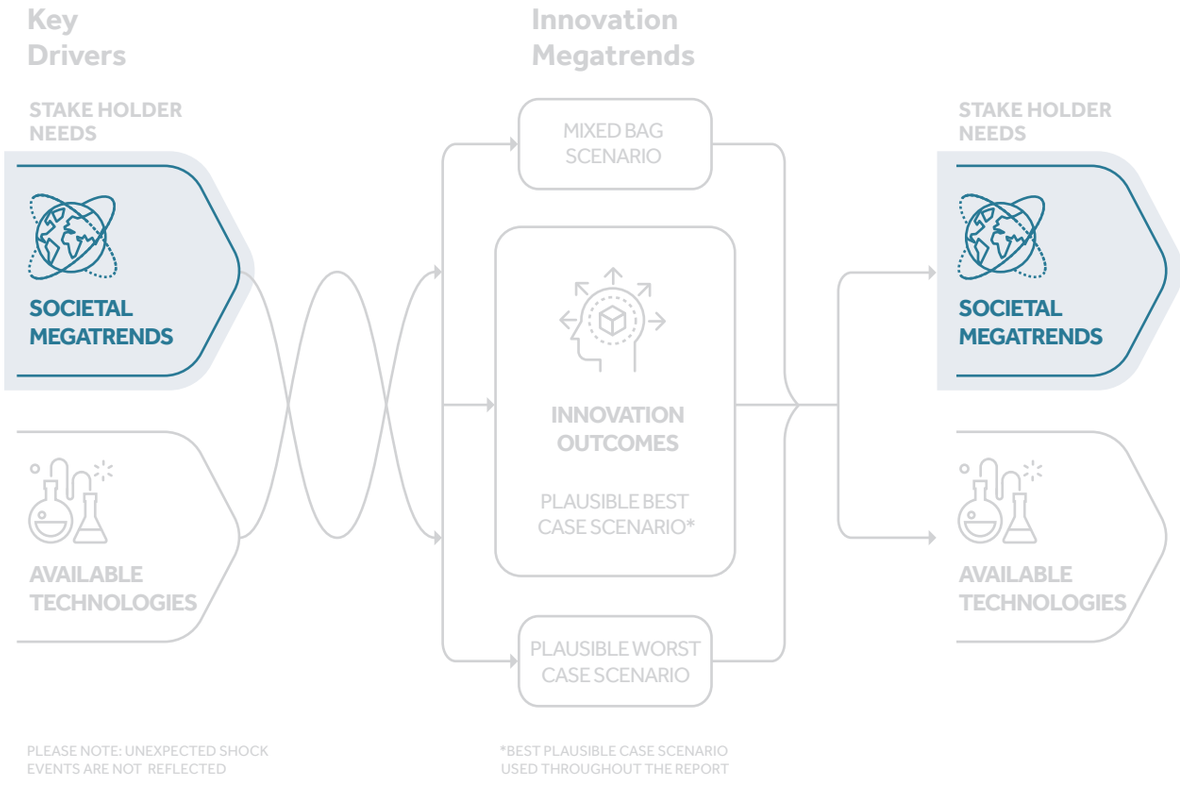
Innovation: Key Drivers

Projecting future innovations that will impact government services through the next 50 years is indeed very challenging. However, as per the guidebook's approach and model, evaluating the best-case projections of two key drivers — societal megatrend developments and technology megatrend developments — provides key inputs for determining interaction-based innovation outcomes. Presented here are best-case megatrend societal and technological drivers that form the basis for future innovation projections.

3.1
Societal Megatrends

What are the societal forces driving global shifts? These forces drive the demand to reorganize and redesign society, businesses, institutions, and therefore, governments. The following is a breakdown of the top societal megatrends driving disruptive change.

Part of Future Innovation Megatrends Model



Societal Megatrends through 2071 at a Glance

Climate Change & Resource Scarcity	Direct Effects of Climate Change		
	Inadequacy of Sustainable Practices		
	Resource Scarcity: Energy, Food & Water		
	Ecological Risks		
Demographic Shifts	Increasing World Population		
	Urbanization & Megapoli	Urbanization & Floating Megapoli	Urbanization & Strato-Megapoli
	Evolving Population Age Profile		
	Growing Middle-Class		
Political Shifts & Security	Economic Power Shift	Economic Power Shift: Tech Superpowers	
	Cities Transforming Role	Cities Significant Role	
	Smart Cities: Descriptive	Cognitive Cities: Prescriptive	Conscious Cities: Predictive
	Terrorism, Cybercrimes & Criminal AI	Terrorism, Cybercrimes & Criminal AI	
Economic Shifts	Job Shifts Due to Automation — Income Inequality	Subsidized Living Costs	Universal Basic Income
	Gig/Sharing Economy	Higher Corporate Taxation	Mixed-Profit/ Public-Private Corporations
	Connected Car/Congestion	Self-Driving Cars	Self-Flying Cars
Socio-tech Life	Connectedness & Social Media	Hyper-Connectedness	Digitization of Consciousness
	Quantified Self	Homoaugmentus 1.0: Exo-Augmentation: Wearables	Homoaugmentus 1.5: Endo-Augmentation: Implantables
	Home Automation	Conscious Home	Occupant-centric Homes
Social Shifts	Access to Healthcare	Near Elimination of Current Diseases	Emergence of New Diseases
	Virtual Companionship	Human - Machine Affinity	Robot Rights
	Access to Education	Technology as New Literacy	Augmented Education
	Virtual Recreation	Near-Space Tourism	Interplanetary Tourism

Societal Megatrends through 2071 at a Glance

Human-Machine Affinity

The growth of personal, emotional, and pseudo-emotional relationships between humans and machines.

Augmented Education

Interactive virtual and augmented education environments.

Connected Cars to Self-Flying Cars

Improvement in AI navigation technology, will continue to drive autonomous transportation as a major industry, subsequently leading to the emergence of self-flying cars.

Climate Change & Resource Scarcity

By 2071, **with a likely 2°C temperature rise,** most areas of Bangkok, Mumbai, Shanghai, Miami, Manhattan and Central London will be submerged.

Job Shifts & Universal Basic Income

1 in 2 current jobs will be replaced with automation by 2071, yet around 30% new jobs will be created. However, a big net shortfall for jobs is expected, therefore training on new skills, and universal basic income are a key policy area.

Gig/Sharing Economy to Mixed-Profit Corporations

The growth of gig/sharing economy will have nominal effect on traditional job losses. Profit-share partnerships between governments and industry would be a key avenue to address job losses.

Smart to Conscious Home

The number of industrial robots sold in the next 10 years will jump 300%. By 2071 robots will outperform humans in most tasks and will take on billions of jobs.

* Based on a global citizen survey conducted exclusively for this Guidebook. See methodology section for details.

*Education, climate change, and global population growth – highest level of societal trends priority by citizens for government to address

Near Elimination of Diseases

By the 2030-40s, most diseases could go away as nanobots and bio implants become smarter than current medical technology.

Increasing World Population

8.6 billion by 2030, 9.8 billion by 2050, and 10.6 billion by 2071 Africa's largest continent — 28% of global ppn. ; Median age from 29.6, to 40 in 2071.

Urbanization & Megapoli

Rise of Megapoli — city clusters with populations exceeding 25 million.

Smart to Sentient Cities

Human-centric municipal governance AI.

Human Augmentation

The use of technological wearables and implantables as well as genetic modifications to enhance human functions.

Terrorism to Criminal AI

Weaponized artificial intelligence entities designed.

Digitization of Consciousness

The emergence of AI systems that can be embedded with a copy of a human mind and replicate the identity of the original.

- CLIMATE CHANGE & RESOURCE SCARCITY
- DEMOGRAPHIC SHIFTS
- POLITICAL SHIFTS & SECURITY
- ECONOMIC SHIFTS
- SOCIO-TECH LIFE
- SOCIAL SHIFTS

Societal Megatrends through 2071 in Detail

Climate Change & Resource Scarcity

1. Direct Effects of Climate Change

Earth is experiencing dangerous climate changes. Signatories of the Paris Agreement in 2016 ambitiously set targets to not exceed a global temperature rise of 2°C, and to pursue efforts to limit the increase to 1.5°C[1] . (Many think 1.5°C is ambitious)

- Best ideal case: 1.5°C
- Best plausible case: 2°C (Disastrous or semi-disastrous)
- Mixed bag: 2.5-3°C (Disastrous)
- Worst plausible case: 4°C (Catastrophic)

An average global rise in temperature of up to 6°C is possible. At 6°C, warm waters kill off marine life, the Earth becomes uninhabitable, and the only surviving species are fungi. Even at 4°C, sea levels would rise by 50m (164ft) and 500 billion tons of carbon would be released into the atmosphere (primarily due to the release of CO2 trapped underneath the ice layers).[2] Most of the immediate consequences will be experienced by the poorest nations and coastal cities first.[3]

Major implications:

- **Major cities displaced** at 2°C best plausible case: It is estimated that most of Manhattan and Central London will be submerged[4]. Most areas of Bangkok, Mumbai, Shanghai would be claimed by the sea, and half of humanity would migrate to higher ground. (If not mitigated, this could be reached by 2050-2071.)

- **Rising sea levels** could displace 1.4 billion people by 2060 and 2 billion by 2100.[5] To date, five tiny Pacific islands have already disappeared due to rising sea levels.[6]

- **Extreme flooding,** especially on many coastlines, will be more common in the next few decades.[7]

- **Desertification** could displace up to 135 million people by 2045.[8]

- **Land degradation:** Could cause lower GDP up to 7%[9] and increase food prices globally by 30%.[10]

- **Oceans will contain more plastic than fish** by 2050.[11] [12]

1 The Paris Agreement, April 10, 2017.

2 "Technological Fixes for Climate Change." Futurism. January 03, 2017. Accessed September 09, 2017 .

3 "UN Report Says World Population Will Rise to 9.8 Billion by 2050." Interesting Engineering RSS. October 09, 2017. Accessed October 09, 2017.

4 "Global Warming Scenarios." Futurism. July 24, 2017. Accessed October 09, 2017.

5 Will Fox, "The First Space Elevator is Becoming Operational," Future Timeline, accessed September 10, 2017.

6 "UN Report Says World Population Will Rise to 9.8 Billion by 2050." Interesting Engineering RSS. October 09, 2017. Accessed October 09, 2017.

7 Jacqueline Ronson on July 7, 2017. "New Maps Reveal Cities That Will Get Flooded by Climate Change by 2050." Inverse. July 7, 2017. Accessed October 09, 2017.

8 Written by Ademola Braimoh. "How can we fight desertification?" World Economic Forum. June 24, 2015. Accessed October 09, 2017.

9 Ibid.

10 Ibid.

11 "More Plastic than Fish in the Ocean by 2050: Report Offers Blueprint for Change." World Economic Forum. January 19, 2016. Accessed October 09, 2017.

12 Wahl, T., I. D. Haigh, R. J. Nicholls, A. Arns, S. Dangendorf, J. Hinkel, and A. B. A. Slangen. "Understanding extreme sea levels for broad-scale coastal impact and adaptation analysis." Nature Communications 8 (July 07, 2017): 1-12. Accessed October 9, 2017.

2. Inadequacy of Sustainable Practices

Development and advancement of sustainable systems, processes, and technologies are key to addressing climate change and ecological risks. Even while today's commercial solar PV panel solutions can only produce ~32% output efficiency, the potential for using photovoltaics (PV) and other sustainable technologies for our energy supplies is severely under-tapped. Many coastal areas ripe for wind power-plants are not being utilized due to cost-prohibitive economics of setting unsubsidized windfarms. With a growing global population and the current trajectory of the adoption and development of green technologies, the adherence to the Paris Accord and other UNFCCC agreements, reasonable projections do not confidently assert that disastrous outcomes will be averted.

Major implications:

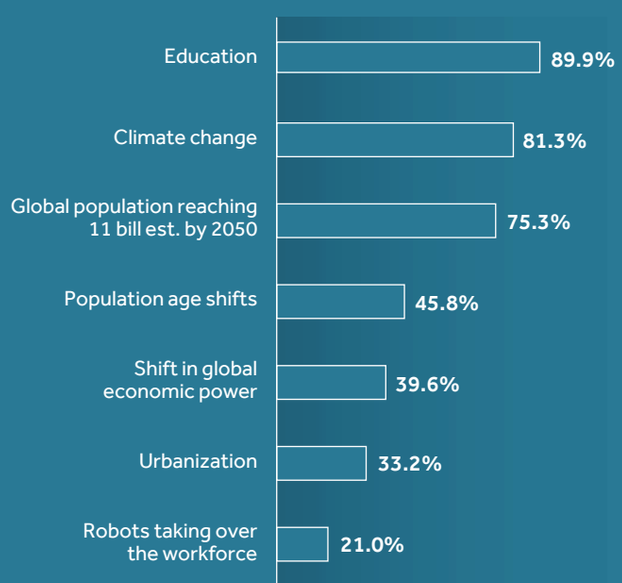
- Due to inability to outrun climate change and ecological risk implications, humanity may face a slow extinction as the damage to the planet becomes intractable and not feasibly reversible, gradually heading towards uninhabitability .
- Resource crises will leave many around the world unable to survive.

3. Resource Scarcity: Food, Energy, Water

With an increased world population, mostly in cities, and an increasing global middle class with evolving dietary preferences and diversifying tastes, there will be an ever-increasing demand for food/meat, water, and energy. The United Nations has set ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture as the second of its 17 Sustainable Development Goals for the year 2030.

Citizen Survey Views

What long-term socio-demographic changes do you feel governments should be preparing for the most ('High-priority' selected)?



- **Education, climate change, and global population growth — the highest level of priority:** This was consistent across all geographic regions.
- **Robots taking over the workforce — medium priority:** Only 21% of respondents considered "robots taking over the workforce" a high priority for governments. Regionally, there is a slightly higher concern in Europe (29%) while it is lower at 16% each in Asia-Pacific and North America.

Major implications:

- By 2030 there is expected to be a 50% increase in demand for energy, 40% for water, and 35% for food.

- By 2050 there is expected to be a 75% increase in global energy needs; 75% increase in demand for meat products.

4. Ecological Risks

Climate change factors have severe and detrimental effects on many local and global ecological systems. From the eradication of polar species and ecosystems due to melting ice-caps, to the disruption of avian migration patterns due to changes in air currents — the effects of climate change on the Earth's ecology are significant and indelible. The cyclical impact of these activities in turn affects food supplies, air quality, and water supplies.

Major implications:

- Wildlife is being killed off at roughly 100 times the rate which could be considered normal. Even humans are at-risk of facing extinction.[13]

Demographic Shifts

1. Increasing World Population

Global population is expected to continue to grow to 8.6 billion by 2030, 9.8 billion by 2050, and 10.6 billion by 2071. With around 83 million people being added to the world's population annually — equivalent to the entire population of Germany — this upward trend is expected to continue well into the future, even as fertility levels decline.

Major implications:

- By 2050, China and India will remain the two most populous countries, while Nigeria will overtake the United States to become the third-most populous country in the world.

- African nations are expected to double in population by 2050, and account for 49% of the global population by 2100. Five African nations will be in the top 10 most populous countries by 2100: Nigeria, Congo, Tanzania, Ethiopia, and Niger.

- In 1959, four European countries were in the top 10 most populous nations; Between 2050 and 2100 no European nation is predicted to appear in the top 10.

- There is a 1-in-4 chance that the world population will stabilize or fall before 2100.

2. Urbanization & Megapoli

Rise in urban population is expected to continue as urban centers continue to becomes centers of job creation relative to rural areas as well as the growth in overall urban population. This leads to the rise of Megapoli — cities with populations exceeding 10 million or clusters of adjacent cities with populations exceeding 25 million.

13 "The sixth mass extinction is killing off wildlife 100 times faster than 'normal'." Inhabitat Green Design Innovation Architecture Green Building. July 11, 2017. Accessed October 09, 2017.

Major implications:

- Governance, law enforcement, regulations, waste management, utilities, and civil services all become very large-scale problems for the governments with rapidly changing demographic landscape.

- Transportation, congestion, parking, physical infrastructure, and access to healthcare and job opportunities become bigger obstacles for the residents.

3. Evolving Population Age Profile

The human population is getting older. The global median age: is now 29.6, but it will rise to 36 in 2050 and 42 in 2100. The percentage of global population that is aged 60 years or older grew from 8% in 1950 to 10% in 2000 and is expected to reach 21% by the year 2050. Fertility meanwhile is falling, and the world's population is getting older dramatically. While falling fertility is primarily prevalent in Europe, it is now spreading to China and will soon reach Latin America. For the first time in history, aging could mean the planet's population will plateau in most of the world.

Major implications:

- Globally, the number of persons aged 80 or over is projected to triple by 2050; from 137 million to 425 million. By 2100, that figure is expected to increase to 909 million; nearly seven times their size today.

- **The workforce of aging nations will be constrained,** while other societies that are young and growing, will create ever larger labor forces and consumer markets. These youthful, growing populations however must be fed, housed, educated, and employed for their productive potential to be realized.

- In 2015, 50% of Africa's population was under the age of 24. Aged 60 or over are expected to rise from 5% in 2017 to around 9% in 2050, and then to nearly 20% by the end of the century.

- **Life expectancy** gap between the least developed countries and developing countries is expected to diminish significantly by 2050.

4. Growing Middle Class

Last year, the world's middle class reached a total of 3.2 billion people — almost half of the human population. With much of the middle-class growth coming from Asia, who is adding trillions of dollars to global consumption? How much of the global consumption is shifting to the East?

Of the next 1 billion entrants, it is estimated that almost 90% of them will come from Asia, with 78% coming from India and China. While in 2000, the EU and the U.S. were the major contributors to global middle-class consumption. In 2050, Asia will account for approximately 78% — with China and India accounting for 55% of the share.

Major implications:

- Globally the middle-class is projected to increase from 1.8 billion in 2009 to 3.2 billion by 2020 and 4.9 billion by 2030.

- Asia will represent 66% of the global middle-class population and 59% of middle-class consumption by 2030 — up from 28% and 23%, respectively, in 2009.

- By 2020, the Chinese middle class will have grown to account for 30% of global urban households. Additionally, China will add $1.8 trillion in new consumption due to an emerging upper-middle class, a young population that is eager to spend, and the accelerated growth of online-shopping.

Political Shifts & Security

1. Economic Power Shifts

Global economic growth is shifting. Western economic dominance is declining and emerging markets, especially China, are expanding their economic presence.

Major implications:

- As per OECD projections, by 2050, EU's share of global GDP will shrink. China's economy will be bigger than the U.S. economy before 2030 (it has already exceeded its purchasing power in 2016.).
- Cumulative Global GDP expected to grow by 130% from 2016 to 2050.[14]
- Six of the seven largest economies in the world are projected to be emerging economies in 2050 led by China (1st), India (2nd) and Indonesia (4th).[15]
- The U.S. could be down to third place in the global GDP rankings while the EU27's share of world GDP could fall below 10% by 2050.[16]
- Africa will grow the fastest and boast the largest continental population by 2040. Even though its total relative economic power is forecasted to surpass declining EU and U.S. economies, it will only add up to approximately 11% of the global economic power — up from 9% today.[17]

2. Smart Cities to Conscious Cities

The application of advancing data analytics, IoT, and AI technologies to the digitization of government services and resident data will drive cities to evolve from digitally servicing Smart cities to self-servicing Conscious Cities.

Major implications:

- Many civil service jobs and functions become obsolete creating the need for rethinking the role, purpose, and qualifications of government officials.
- The evolving challenges of refining and designing an autonomous yet equitable and human-centric municipal governance AI continue to challenge society and government to explore technology-human interactions at a deeper level.

3. Cities Transforming Role

As megapoli cities become commonplace, their scale will enable them to exert global influence and transform their nations' foreign affairs policies. Nation states will still be predominant as they grapple with rising waves of protectionism and populism. This trend will continue to reshape global governance institutions and its international ecosystems.

Major implications:

- Rapid growth in the number and prevalence of megapoli, along with the resources, attention, and economic and cultural influence they exude makes them centers of power that have independent global influence.
- Due to the scale at which they need to tackle — and adapt to — complex challenges, megapoli begin to exert more influence on governance,

14 "The World in 2050" PwC. April 5 2017. Accessed October 09, 2017.

15 "The World in 2050" PwC. April 5 2017. Accessed October 09, 2017.

16 "Five Megatrends and Their Implications for Global Defense & Security" PxC. Nov 24, 2016. Accessed October 24, 2017.

17 "What's the future of African power in the world?" World Economic Forum. Mar 26 2015. Accessed October 09, 2017.

trade, and policy than nation-states. They also begin to shape the priorities of nations and foreign policy agendas.

4. Terrorism, Cybercrimes & Criminal AI

The nature of crime warfare and terrorism changes to adapt to more technologically dependent, critical infrastructures of modern times. Governance AIs, autonomous driving algorithms, or IoT controlled utilities and healthcare facilities become more attractive targets for criminal and terrorist agendas due to the potential scale of damage. On the other hand, IoT and AI become instrumental for better securing critical infrastructure, assets and military hardware. They also become more adept at protecting from — and proactively detecting — malicious threats.

Major implications:

- Governments need to strike a delicate balance between protecting themselves with the latest technologies and not rushing to be the earliest adopters of new technologies that have not been adequately stress-tested.

Economic Shifts

1. Job Shifts Due to Rising Automation & Income Inequality

The pervasiveness of robotics in an expanding array of business functions results in massive job losses across all sectors and industries, while significantly reducing operating costs for employers and businesses. This results in corporations aggressively growing their profit margins. This will widen income gaps as a small number of business owners and executives enjoy larger income and bonuses while most people find themselves with no income. Competition for remaining jobs will be so high that salaries could drop relative to inflation. This gap in income inhibits the growth of the middle class and creates civil unrest and mass disenfranchisement. As the challenge grows in magnitude, the need for a universal basic income will be inevitable.

Major implications:

- Many of the incentive programs and tax-breaks for large corporations will begin to disappear, as they would no longer be justified by the number of jobs those companies create.

- With lower economic activity, governments need to explore aggressive approaches for availing resources needed for a sustainable and viable universal basic income program or other alternatives.

2. Gig/Sharing Economy to Mixed-Profit Corporations

The growth in sharing economy and multi-career/gig models to adapt to the loss of traditional employment will have a nominal and temporary effect in maintaining economic stability and mobility. More substantial correction will come from subsidizing living costs and, eventually, the institution of a universal basic income. These factors will drive governments to hike-up taxes on companies based on their human-machine worker ratios and the need for educational programs for the workers they replaced, so they can find new employment. Governments will need to mandate large companies to partner with them through profit-share agreements in place of traditional taxation allowing for governments to benefit from the higher corporate profitability upside. This will be justified by the large infrastructure and regulatory support provided by governments that the companies' product and service sales rely on.

Major implications:

- Large corporations will be incentivized to move operations offshore to avoid high taxation. To curb this phenomenon, international consensus and treaties will be needed to prevent the existence of corporate tax havens.

- A comfortable universal public income combined with a lack of jobs can cause economies to be less innovative and competitive. One solution would be to have the continuation of universal income be dependent on positive contribution.

3. Connected Cars to Self-Flying Cars

Increased ecological and safety concerns (due to congestion), coupled with the improvement in AI navigation technology, will continue to drive interest in better autonomous transportation, the growth of floating cities and the rise in megapoli. This will then drive the emergence of self-flying cars.

Major implications:

- Transportation as a service replaces car ownership.
- Near elimination of government services and businesses to manage driving privileges, violations, and vehicle repairs.
- Due to the ability to spend the commute doing anything one pleases as opposed to focusing on the road, their will be a reclaiming of time lost commuting. This results in the re-imagination of the space within a car and the reimagination of urban spaces traditionally designed around human driving.

Socio-tech Life

1. Connectedness & Social Media to Digitization of Consciousness

Due to geographic distances and convenience, people will become increasingly digitally connected, at the expense of face-to-face interactions. There will be an increased ubiquity and reliability of VR environments, that will drive a need for richer VR environments and for virtual hyper connectivity between people. The growth in AI biotech, and neuroscience will eventually allow people to authorize digitized copies of their consciousness, overlaid on cognitive AI systems, for a different level of interaction.

Major implications:

- Diminished attachment to tangible experiences and interactions between people.
- Ethical and legal debates around digitized consciousness.

2. Quantified-Self to Homoaugmentus 1.5

There is a growing trend of quantified-self (using wearable devices to access real-time mobility and wellness data) that is combining with the desire to be more connected to people and services through virtual environments. This trajectory of comprehensive wearable augmentation systems as a new societal trend will pave the way towards more aggressive augmentation with implantables, which are referred to as Homoaugmentus 1.5.

Major implications:

- Drive for perpetually advanced human augmentation as a competitive differentiator.

3. Home Automation to Occupant-Centric Home

Energy consumption and safety are currently the primary drivers for the growing home-automation/ smart-home trend. As the technology becomes more responsive and adaptive, demand for more intelligent and functional home control technologies will emerge. The drive will be motivated by the desire for increased comfort and personalization, coupled with the pervasiveness of IoT technologies. A home that is conscious and can adapt to best suit the occupants with minimal configuration quickly becomes a very attractive proposition.

Major implications:

- People are less inclined to leave their homes.
- As homes become increasingly digitized and easily adaptable to their occupants and belongings, housing-as-a-service may emerge as a new industry.

Social Shifts

1. Access to Healthcare & Enablement to Emergence of New Diseases

The increased need for improved healthcare access spurs the improvement of the IoHT (Internet of Healthcare Things) and digital health innovations. This in turn informs efforts that will successfully address the concerns related to the elimination of diseases. Making it a tangible goal will identify it as a highly motivating driver for new innovations. As life becomes more convenient and technology enabled, many lifestyle diseases will emerge, pertaining to diet and lack of exercise. Environmental factors related to living in floating or stratospheric cities, and other unintended consequences of future lifestyles will also emerge. The research and efforts to eliminate these new diseases becomes a major driver in healthcare.

Major implications:

- Today's healthcare privacy regulations will not be adequate due to new scenarios around the interactions with healthcare data.
- As many of today's healthcare concerns disappear, others will emerge to replace them.

2. Virtual Companionship to Robot Rights

Companionship and assistance from AI is currently a growing demand with Apple's Siri, Amazon's Alexa, Microsoft's Cortana, and other similar products. They are helping people across multiple and varied functions, from scheduling meetings or finding the right playlist, to shopping for groceries. Eventually, the technology will reach a stage where people are developing connections and bonds with artificial consciousness, and those AI entities will become a growing need for many people. As the technology is further refined it will also become a growing driver in mental and behavioral healthcare.

Major implications:

- Impact on human-human interactions.
- Need for legislation to define acceptable rights and limitations in human-machine interactions.

3. Access to Education to Augmented Education

As more industries and business sectors become technologically-enabled their operating models will change. How they communicate with their stakeholders and deliver their services and goods, as well as the career fields that previously had a low requirement for technical aptitude, will become technology dependent. This trend results in technology literacy becoming the new global standard for basic literacy, and reading and writing alone will no longer suffice.

All disciplines in formal education will include technology education. Eventually, even top tier universities will deliver most of their classes and practical experiences through interactive virtual and augmented environments.

Major implications:

- Many of the social and professional connections that happen as a by-product of attending education institutions will not occur to the same degree.
- Regulation and accreditation of virtually delivered education in the practical and physical sciences will be a large endeavor.

4. Virtual Recreation to Start of Interplanetary Tourism

As human need for new forms of leisure and stimulation continues, all digital entertainment platforms in existence today will evolve to be delivered through virtual/augmented media. There will be an increased interest in space exploration and growth in the space tourism industry. Further desire to explore space leisure will drive an interest in interplanetary tourism.

Major implications:

- Space tourism will help fund research in terraforming technologies and processes.
- The increasing number of space tourists will provide a large enough data-set to better assess the effects of space travel on the human body.

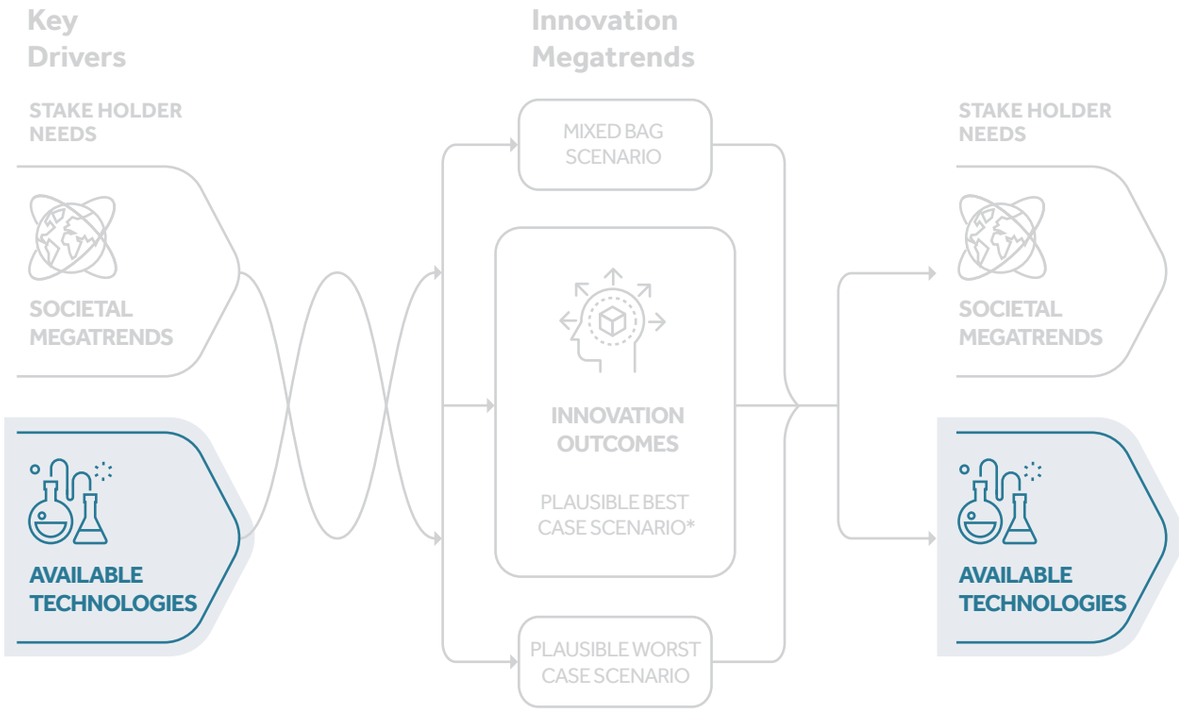
3.2
Technology Megatrends

Today we are experiencing a combinational technology explosion between digitization, machine learning, and life sciences.

All are accelerating exponentially in scale and economic impact. The true power of these technologies lies in their convergences and intersections with one another. Understanding and planning for such convergences is the key to unlocking the highest value of these technologies for society.

For governments and corporate leaders, the future of production is arriving more swiftly than many realize. This necessitates the rapid assessment, support, and adoption of these perpetually evolving technologies. The following section outlines and discusses the top available technological megatrends through 2071.

Part of Future Innovation Megatrends Model



PLEASE NOTE: UNEXPECTED SHOCK EVENTS ARE NOT REFLECTED

*BEST PLAUSIBLE CASE SCENARIO USED THROUGHOUT THE REPORT

Technology Megatrends through 2071 at a Glance

Connectivity Backbone	Internet/ IoT/ IoHT IoE Space-Net	IoE	Space-Net
	Blockchain		
	Cloud	Distributed Cloud	Secure Cloud
Computation, Decision & Automation	Big Data & HPC	Big Compute	HPC-SOC
	Spintronics		
	Quantum Computing		
	AI (Artificial Intelligence) & ML (Machine Learning)	Learning Systems	Conscious Systems
	Autonomous Navigation	Autonomous Transportation	Autonomous Aviation
	Robotics & Automation		
Power, Matter & Space	3D Printing		
	Materials & Polymers		
	Green Tech		
	Nuclear Energy		
	Space Tech		
The Body	Augmented Reality/ Virtual Reality	Augmenting Systems	Connected Human
	Genomics	Implantables	Nanotech

Technology Megatrends through 2071 at a Glance

Blockchain

Decentralized, incorruptible public ledger that records all transactions that take place on the network.

Internet of Things (IoT) to Space-Net

All devices connected by 2050-2071, and connectivity within space and Earth's internet will be a natural progression.

Artificial Intelligence (AI) & Machine Learning (ML) to Conscious Systems

Artificial intelligence (A.I.) systems perform human-like tasks, reasoning, and behavior. Estimated to boost global GDP by US$16 trillion in 2030.

Robotics & Automation

The use of automation and robotics will rapidly expand into assistive and healthcare markets of physical therapy, assistive care, spas, and personal care.

Autonomous Navigation to Autonomous Aviation

Advances in GPS, radar, lidar, computation vision, and other technologies will continue to improve the quality of currently emerging autonomous urban navigation systems. Subsequently a new era of autonomous urban aviation will emerge.

Quantum Computing

Use of quantum-mechanical states and the manipulation thereof, to store and perform operations on data.

Big Data & HPC to HPC-SOC

High Performance Computing (HPC) achieves computational power needed to analyze big data; will develop to HPC-System-On-a-Chip technology.

* Based on a global citizen survey conducted exclusively for this Guidebook. See methodology section for details.

*Renewable energy, cyber-security and hyper connectivity — Citizens highlight as highest impact technology trends to impact governments

Cloud to Secure Cloud

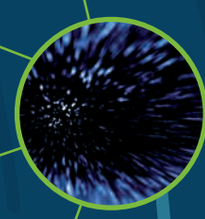
Remote, large data and application centers connected to the internet with very high bandwidth.

Greentech

Technologies include perovskite and organic solar cells nearing 100% efficiency and innovation in manufacturing techniques, making solar power widely available.

Space Tech

Photonics technology that increase bandwidth for spacecraft communication are among technologies that will dramatically reduce the cost of space access.



Materials & Polymers

New super materials including precious materials from volcanic mining, and space mining.

3D Printing

Evolving applications in healthcare, retail and construction.

Augmented Reality (AR) to Connected Humans

Augmented reality will expand to augmenting core human functions through implantables to enhanced functions or senses.

Genomics, Implantables & Nanotech in Medicine

Genetic manipulation to cure diseases, increase lifespans, smart nanomaterials, human enhancements of physical/ mental performance, machine-augmented minds.

- CONNECTIVITY BACKBONE
- COMPUTATION, DECISION & AUTOMATION
- POWER, MATTER & SPACE
- THE BODY

Technology Megatrends through 2071 in Detail

Connectivity Backbone

1. Internet of Things (IoT) to Space-Net

The Internet of Things (IoT) is a growing field of technology revolving around how any physical object can connect to the Internet and communicate with other objects or relay information to people and systems. Predictions suggest that, in the future, most everyday objects will be connected to the Internet including other things, people, processes and data.

At the intersection of the advancement of wearables and medical devices with IoT there is a growing focus around IoHT (Internet of Healthcare Things) where the devices worn by people are integrated into their healthcare and are constantly sending data to improve insights for the user and the healthcare provider alike.

In the 2050-2071 time-frame when a significant increase in space travel and exploration is anticipated, space connectivity with Earth's Internet will be a natural progression of the proliferation of Internet (Space-net).

Major implications:

- **Significant economic impact:** The potential economic impact of IoT applications in 2025 is between US$ 3.9 and $11.1 trillion, of which $1.2 to $3.7 trillion is allotted to IoT applications within the factory environment, or 'smart manufacturing'. [18]

2. Blockchain

Blockchain is a decentralized, public ledger that records all transactions that take place on the network. The result is a global record of validated information that is completely transparent, accessible, and currently unhackable, since the data is simultaneously stored in millions of computers across the planet, validating the network.[19]

Major implications:

- There is a wealth of blockchain applications for individuals (e.g. bitcoin), for businesses and for governments (first 'Blockchain Government of Dubai').[20] These applications are already being implemented and beginning to disrupt the management of processing contracts, lending, supply chains, identity management, voting among many other areas.

3. Cloud to Secure Cloud

Cloud technology is the utilization of remote, large data centers to store and aggregate data, connected to the Internet with very high bandwidths. Cloud technology is an enabler for e-commerce, subscription-based SaaS (Software as a Service) licensing solutions, and the more recent, richer IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) offerings. Cloud technology is a rapidly growing business that is expected to reach $162B by 2020.[21]

18 Written by Detlef Zühlke, Dominic Gorecky. "The internet of things will disrupt manufacturing for ever, but are you ready?" World Economic Forum. January 4, 2017. Accessed October 09, 2017.

19 Halabi, Antonio. "3 Digital Technologies that will Transform the World in the Next Decade." TechDigg. April 13, 2017. Accessed October 09, 2017.

20 "Dubai Set to Achieve Goal of Becoming First Blockchain Government by 2020." CryptoCoinsNews. July 24, 2017. Accessed October 09, 2017.

21 Columbus, Louis. "Roundup Of Cloud Computing Forecasts, 2017." Forbes. April 29, 2017. Accessed October 09, 2017.

As the data stored on the cloud becomes more critical and cyber-attacks become more of a concern, the integration of blockchain technology into the underlying framework of cloud infrastructure results in the creation of the **Secure Cloud.**

Major implications:

- **Cloud technology** will be instrumental in enabling the innovations of the future as more people and businesses reduce their dependence on physical spaces and shift their focus towards virtual, digitized environments.

- **Data collection for AI** will progressively increase with the growth of the Internet of Things whose numbers could rise from 0.8 zettabytes of data in 2009 to 50 zettabytes of data per year generated by 2020 (1 zettabyte = 1 trillion gigabytes).[22] Meanwhile more mobile phones in circulation around the world will ensure comprehensive data production (4 billion online globally and 30 billion mobile phones by 2020).[23]

- **Energy savings** will be a big benefit of cloud computing as organizations reduce their fixed investment in physical computing infrastructure, space requirements and energy consumption. A recent study forecasts that cloud computing could help large U.S. companies realize $12.3 billion in energy savings annually by 2020.[24]

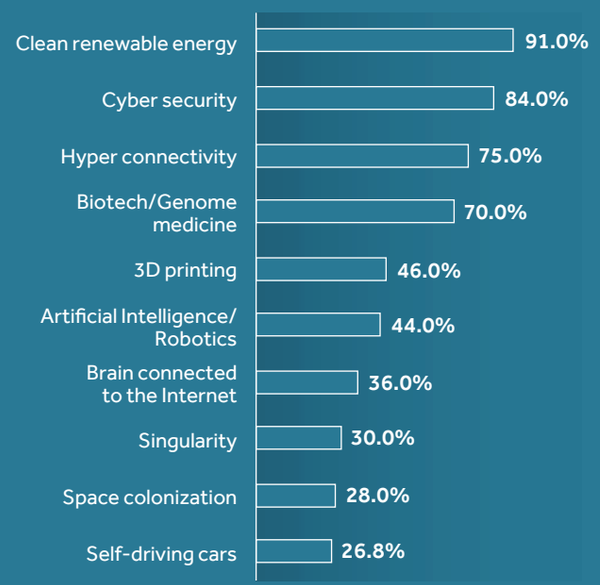
22 Rohit Talwar and Iva Lazarova, Driving Forces — *100 Trends and Developments Shaping the Path to 2025.*

23 Ibid.

24 Ibid.

Citizen Survey Views

Which developing technologies could have the most significant impact on government functions in the future? [1]



- **Renewable energy, cyber-security, hyper-connectivity and biotech** are viewed to be the most impactful — by a wide margin — by citizen respondents, with no significant geographic variations. This highlights the strong opinions and sentiments held regarding these technologies and the high expectations of their potential to shape our future.

- Singularity, while low in overall ranking, had higher interest in Europe (47% vs 30%). Similarly, Space colonization had higher interest in North America (37% vs 28%).

1 See Methodology section for survey profile.

Computation, Decision & Automation

1. Big Data & HPC to HPC-SOC

Big data refers to the extremely large and growing data sets of consumer, transaction, human behavior, scientific research, environmental interactions and information generated from everyday activities from web-connected devices and sensors (e.g. paying bills, shopping online).

High Performance Computing (HPC) refers to the products and technologies used to achieve the computational power needed to analyze big data (big data analytics). HPC solves otherwise intractable problems to uncover hidden patterns and market trends, reveal unknown associations and consumer tendencies, and other valuable information to direct scientific research, better inform businesses decisions and give governments better insights for policy making.

Further advancements in the aforementioned technologies, coupled with the productization of quantum computing technology, will eventually lead to micro-scale, High Performance Computing System-On-a-Chip technology (HPC-SOC). Micro scale HPCs in the form of tiny chips will further strengthen the capacities and capabilities to process information across the IoT ecosystem and all aspects of automation.

Major implications:

- **Advanced Scientific Simulations** are being facilitated by big data analytics. This includes simulating accelerated, complex, multivariate, environmental interactions needed to create accurate projections of future climate models
- **Healthcare** applications of big data analytical models will proliferate. Doctors can more accurately diagnose diseases based on complex correlations on very large data sets that can match symptoms with genetic, demographic, and environmental factors.

2. Spintronics

Spintronics is electronic spin-orbit technology revolutionizing smartphones, smart technology and IoT. Spintronics uses the magnetic moment resulting from the spin state of an electron as well as its charge state to store data instead of using an entire flip-flop circuit comprised of electronic transistors.

Major implications:

- Spintronics will revolutionize memory and storage for computations and data storage purposes and pave the way for logic-in memory applications.

3. Quantum Computing

Quantum computing is the use of quantum-mechanical states, and the manipulation thereof to both store and perform operations on data. These computers use atoms, not transistors, as logic units.

Quantum computers have massive potential in a digital future. Companies such as Google, Intel, and IBM (who provided public access to the first beta quantum computer in the cloud in 2016)[25] along with nations (e.g. China) are focused on making quantum computing a reality, and **producing an unhackable quantum Internet** (predicted for 2030s).

By 2020s, we should have quantum computers significantly better than super computers today, but they most likely will not be used widely by

25 Written by Oliver Cann, Head of Media Content, World Economic Forum Geneva. "These are the top 10 emerging technologies of 2017." World Economic Forum. June 26, 2017. Accessed October 09, 2017.

governments and companies until the 2030s.[26] The $15 million price tag today has a long way to drop before they can become available to consumers.

Major implications:

- By late 2040s, it is predicted that we will have advanced quantum computing, achieving wonders in medicine, finance (e.g. analyzing every financial model at once),[27] astronomy, the search for extra-terrestrial life, economics, architecture, and reconstructing the history of evolution on Earth.[28] On a governmental level, when national currencies fail, quantum blockchains could help.

4. AI & ML to Conscious Systems

Artificial intelligence (AI) refers to software systems that can perform human-like tasks, reasoning, and behavior. AI can be implemented in smart algorithms, intelligent robots, or sophisticated autonomous machines. M.L. is the application of AI to create algorithms that can teach the AI new knowledge to inform its decisions with which it was not originally programmed. Cognitive Science is the use of computational AI systems to model human learning, mental organization, and thought processes from the perspectives of psychology, linguistics, and philosophy.

The culmination of the above sciences and technologies will lead to modular learning systems that can be easily combined with most applications. Applications include virtual assistants (e.g. Siri), domestic robots, robot workers (such as lawyers, nurses, pharmacists, financial advisors, bookkeepers), virtual learning, personalized and interactive entertainment to an unprecedented level, self-driving vehicles, diagnosis and diseases, market predictions, and brain-computer interfaces (designing responsive prosthetics, and future biocompatible sensors or nanobots that interface with the neocortex).

Major implications:

- **AIs economic impact** is estimated to boost global GDP by nearly US$16 trillion by 2030 — much of the gains coming from China.[29] Forecasts suggest AI reaching, and later, surpassing human intelligence anywhere between 2030-2050. AI funded by companies such as Google, Facebook, IBM, Samsung and Alibaba, will continue to rapidly accelerate and drive technological and business model breakthroughs.

- **Dramatic impact on job shifts/ joblessness** can be anticipated due to robots and AI whose share in the workplace will increase compared to human roles in the future.

5. Autonomous Navigation to Autonomous Aviation

Advances in GPS, radar, lidar, computation vision, infrared cameras, lane guidance, wheel encoders, ultrasonic sensors, console central computers, and responsive dynamic Programmable Logic Control (PLC) systems will continue to improve the quality of currently emerging autonomous urban navigation systems.

As this technology is refined and reaches ubiquity, it will evolve to completely autonomous transportation with little-to-no engagement of a human driver from pick-up to drop-off (these

26 "When Will Quantum Computers Be Consumer Products?" Futurism. July 31, 2017. Accessed October 09, 2017.

27 Quantum Computers Will Analyze Every Financial Model at Once." Singularity Hub. September 27, 2017. Accessed October 09, 2017.

28 Things to Come: A Timeline of Future Technology [INFOGRAPHIC]." Futurism. December 21, 2016. Accessed October 09, 2017.

29 Nelson, Eshe. "AI will boost global GDP by nearly $16 trillion by 2030-with much of the gains in China." Quartz. June 27, 2017. Accessed October 09, 2017.

vehicles will pull up to pick up their passengers and park themselves after the passengers exit). These vehicles will gradually do away with a traditional driver's seat and become new social or personal spaces in transit. With increasing congestion, lower energy costs, improved energy storage technology, and additional research and refinement of autonomous transportation, a new era of autonomous **urban aviation** will emerge with self-flying cars that can safely take-off, fly, and land themselves.

Major implications:

- **Continued urbanization** will lead to changes in the definition of the Workplace. The reduction in job-to-adult ratio, the increase in crowding, and the redefinition of the commute/transportation, will result in people and governments reimagining urban spaces and urban roadways.

- **Vehicle ownership** will drop significantly as personal transportation becomes a subscription or pay-as-you-go service.

- **Sectors and departments will disappear** in industries (insurance, auto services, auto-finance, etc) and government sectors (traffic violations, motor vehicles, driver services) will begin to disappear.

6. Robotics & Automation

Robotics and automation is the use of mechatronic systems and software control systems to automate physical functions previously performed by humans or by less-sophisticated equipment that required a high-level of human operation. As this area grows, most manufacturing and blue-collar jobs are at risk of replacement by automation. The trend will continue to expand — due to the incorporation of sensors and computational vision — into areas that require minimal human interaction but a lot of physical activity. These areas will include food service, hospitality, postal services, and all repair industries from shoes to personal electronics.

In the future, the use of automation and robotics will rapidly expand into assistive and healthcare markets of physical therapy, assistive care, spas, and personal care.

Major implications:

- **Off-shore manufacturing** will not be a competitive value of economies who have benefited from it due to cheap labor.

- **A return to manufacturing** will be seen in developed economies, without the return of manufacturing jobs. Governments will need to support economies with rapidly growing unemployment and get businesses to offset education and retraining costs.

Power, Matter and Space

1. 3D Printing

3D printing is the technique that turns computer design into reality by depositing material layer by layer in a manner similar to that of an inkjet printer. 3D printing uses robotic dispensing heads that can dispense a growing variety of materials, for an increasingly growing number of applications, from consumer electronics to prosthetic limbs. Advances in materials will have a massive impact in what the user of the future can print.

Major implications:

- **The disruptive potential** of 3D printing is tremendous not only for manufacturing but also for many other industries e.g. healthcare (3D printed organs), retail (print your own products) and construction (3D printed houses and buildings).[30]

2. Materials & Polymers

Just like the manufacturing revolution was created by steel and plastic, the discovery of new super materials with wide-ranging applications promise to reshape the future. Examples include: precious materials from volcanic mining, space mining (e.g. material from space, or factories in space producing 3D printed organs), biomimetic materials (inspired by behavior of living things, leading to self-cleaning clothing, self-repairing buildings, and the elimination of plastic packaging), artificial molecules made from 'superatoms' with novel magnetic and chemical properties, and materials strong as steel but light as carbon fiber.

Major implications:

- **Infrastructure efficiencies** will be realized. These new materials will significantly reduce cost and extent longevity and durability of materials used to build skyscrapers and city-infrastructure of the future enabling strato-cities and other innovations.

3. Green Tech

Advances in renewable technology, such as solar power, wind power, ocean wave energy, and fusion power, will bring the price down, making it economical and commercially available. Technologies include perovskite and organic solar cells nearing 100% efficiency and innovation in manufacturing techniques, making solar power widely available.

Major implications:

- **Continued advances in batteries** through the 2030s could result in solutions such as: carbon-breathing batteries that suck in CO2 to generate electricity; diamond 'nuclear' batteries, that will encase radioactive waste in artificial diamonds and convert radiation into electricity; and advanced lithium-ion batteries. By mid-2040s, spacebased solar energy could become economically feasible for solar power broadcasting stations.

30 Rohit Talwar and Iva Lazarova, *Driving Forces — 100 Trends and Developments Shaping the Path to 2025.*

4. Nuclear Energy

Nuclear energy is the use of nuclear fission to split atoms of radioactive materials. The fission is an exothermic reaction which generates a massive amount of heat energy. The produced energy can be used in a multitude of ways to convert to other forms of energy such as electricity.

Major implications:

- **Nuclear power plants will proliferate in the near term,** as new materials and advancements in IoT and cybersecurity and even the potential of space-disposal of nuclear waste will make nuclear energy a safe and environmentally friendly alternative to fossil fuels. This will result in significant growth of nuclear power plants to meet growing energy demands while the efficiency and pervasiveness of green energy catches up.

- **If battery technology does not advance rapidly enough,** new artificial radioactive materials and advancements in the safety of nuclear power generation could result in the use of nuclear reactors in smaller applications. This will include powering personal autonomous aerial transports and other small applications that need massive power but cannot accommodate big enough batteries.

5. Space Tech

Photonics technology that increase bandwidth for spacecraft communication, and gyrotron microwave arrays that can beam lightweight rockets into orbit are dramatically reducing the cost of space access. In addition, geoneutrino satellites that can probe interiors of Jupiter and the sun, and low-cost jet engines reaching space without fossil fuels are all examples of the plethora of space technologies that will make space travel and exploration more economical, viable, aand lucrative in the future.

Major implications:

- **Rapid growth in space travel** can be expected given technologies aided by support and growth in many adjacent technologies. This space-travel for scientific, leisure, and commercial purposes will pave the way for long-term near-space and extraterrestrial human settlements.

The Body

1. Augmented Reality (AR/VR) to Connected Humans

Augmented reality (AR) is a live view of a physical, real-world environment whose elements are 'augmented' by computer-generated sensory input such as sound, video, text, maps, graphics or GPS data, e.g. **Pokémon Go .**[31] This is currently done via devices such as smartphones and tablets but will extend to a range of wearable and portable devices such as special purpose AR headsets, glasses, and contact lenses.[32]

Virtual reality (VR) is a computer technology that uses virtual reality headsets and other sensory feedback devices to simulate an artificial, 3D visual or other sensory environment through computer modelling and simulation.[33]

In combination with the evolution of today's wearable technology devices, emerging hearables, sensor technology, medical devices, and robotics, people will be able to don a variety of comprehensive "Augmenting Systems" that can create completely immersive, multi-sensory virtual and augmented environments. These systems can enable the user to fully experience skiing and deep-sea diving without ever leaving their home or for medical students to practice performing complex surgeries without a human subject.

Eventually, augmentation will expand to augmenting core human functions through implantables to intrinsically enhances functions or senses.

Major implications:

- Augmentation and virtualization are expected to impact and reshape many fields in the future, including business, education, healthcare and personal life. **Virtual worlds can be used for gaming, e-learning and business applications such as online conferences, promotional sites, and meeting spaces.**[34]

2. Genomics, Implantables & Nanotech in Medicine

Biotechnology is the use of biological processes for other purposes, e.g. genetic manipulation. There has been great progress in recent years of the human genome, cloning, and genetic modification of plants and animals. Nanotechnology is the engineering of systems at the molecular scale, to manufacture macroscale products with atomic precision. Industries working on nanoscale applications include energy, biotechnology, chemistry, environment, food, electronics, healthcare and space.

31 "Augmented Reality," *Wikipedia*, last modified October 7, 2017, https://en.wikipedia.org/wiki/Augmented_reality

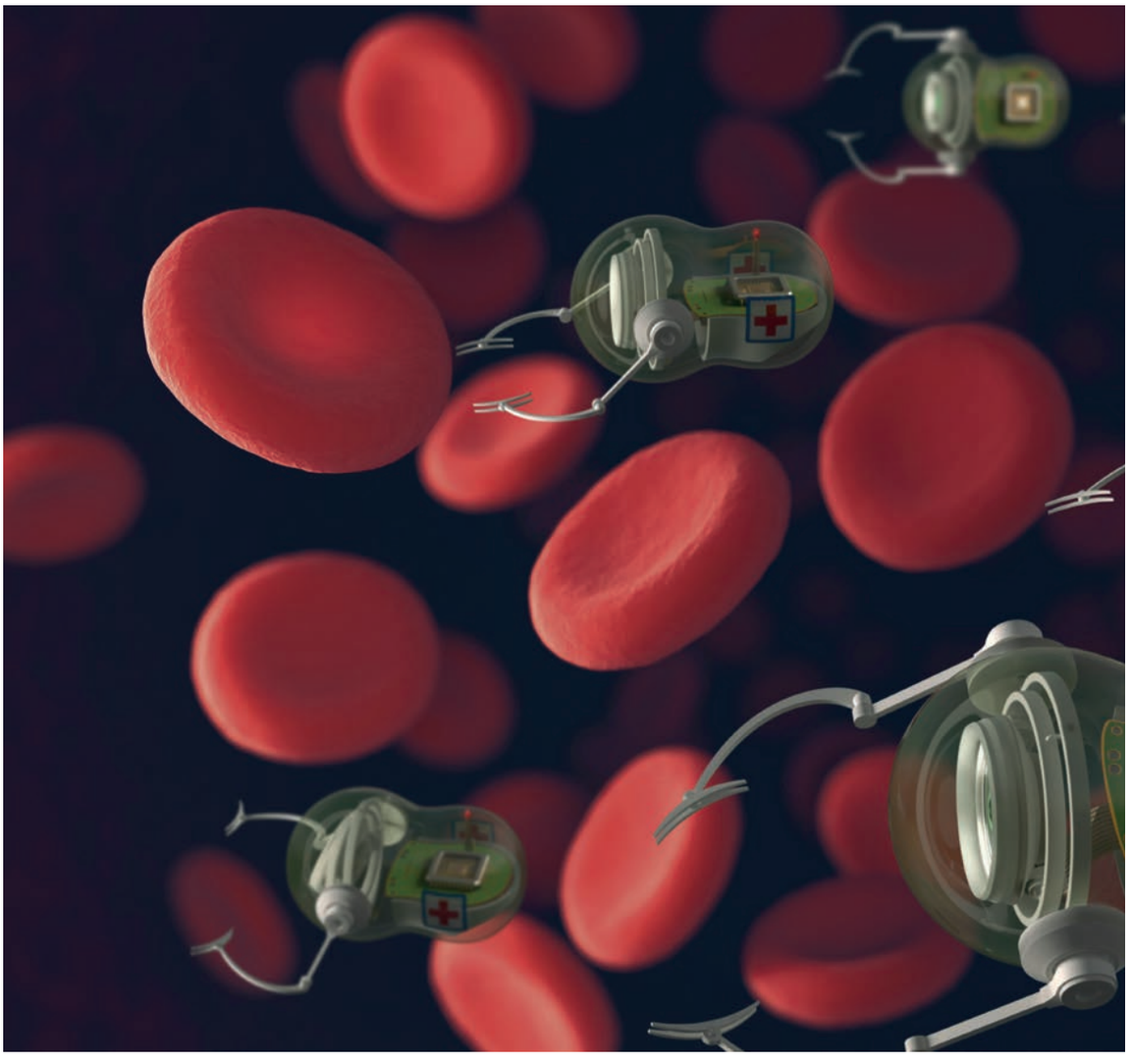
32 Rohit Talwar and Iva Lazarova, *Driving Forces — 100 Trends and Developments Shaping the Path to 2025*.

33 "Virtual Reality," *Wikipedia*, last modified October 5, 2017, https://en.wikipedia.org/wiki/Virtual_reality

34 *Driving Forces — 100 Trends and Developments Shaping the Path to 2025*. Rohit Talwar. Iva Lazarova.

Major implications:

- The few next decades offer the potential applications from converging biotechnology, genomics, genetic engineering (i.e. gene or DNA editing with unprecedented ease and accuracy), synthetic biology, genetic computing (DNA-based supercomputers smaller than a laptop), IoT, and bio-informatics to cure diseases, increase lifespan, smart nanomaterials, genetic enhancements, human enhancements of physical strengths and mental performance, machine-augmented minds, 3D printed body parts, agricultural innovations, genome vaccines (based on genetic material), new energy sources (e.g. algae), and smart pills.[35] [36]



35 *Driving Forces — 100 Trends and Developments Shaping the Path to 2025*. Rohit Talwar. Iva Lazarova.

36 http://www.geektime.com/2017/07/09/5-predictions-about-the-future-of-iot-for-medical-devices/

Innovation: Resulting Outcomes

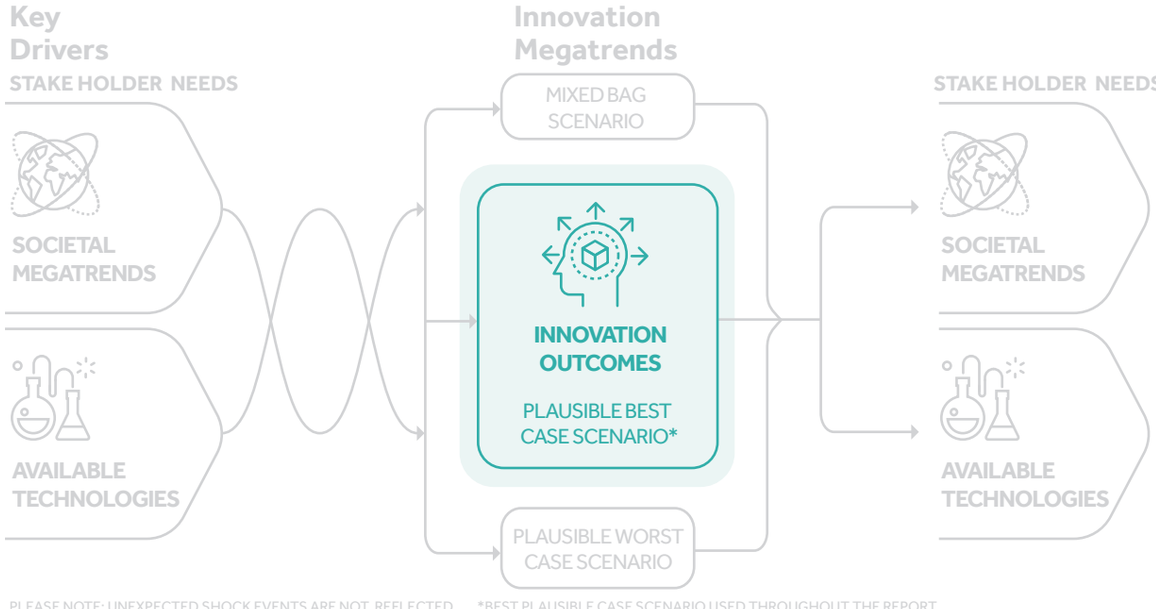
The key drivers of future innovations presented earlier interact to produce evolving innovation outcomes across the three time periods. Presented here are the top innovation outcomes that, in a — moderately optimistic — plausible scenario, will fundamentally change the needs of primary stakeholders over the next fifty years. These evolving stakeholder needs will also necessitate the evolution of governments themselves. Various alternate scenarios have been acknowledged and their resultant implications are presented as well.

4.1
Innovation Megatrends

Exponentially growing and branching technological solutions are combining in new and exciting ways to respond to the most pronounced societal drivers. In so doing, they produce new innovations that address evolving stakeholder needs.

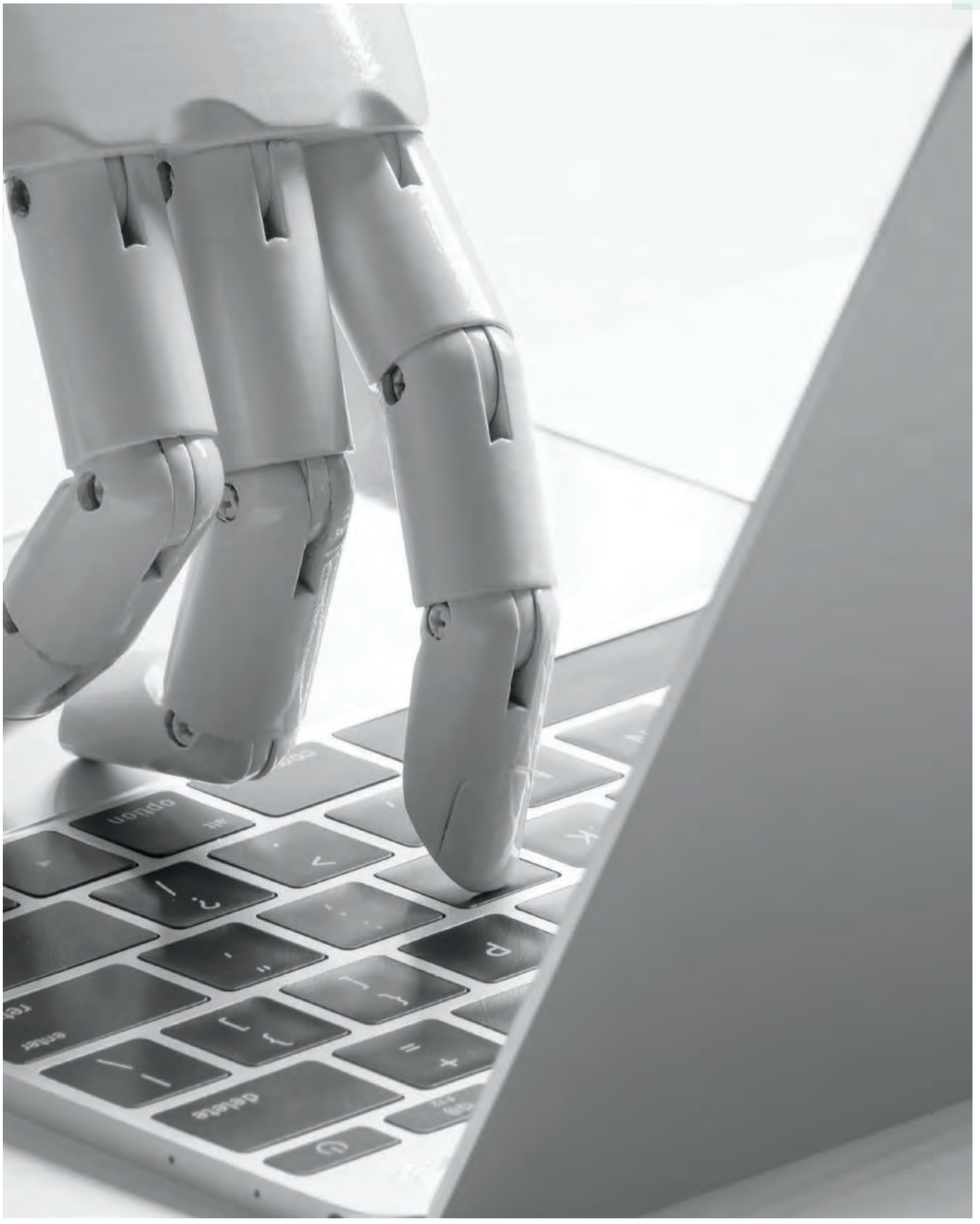
The following innovation megatrends are forecasted to impact all aspects of governance needs. This necessitates governments to function radically different by 2071, highlighting the eminent need for their continual adaptation throughout. Our focus here is to present plausible outcomes, with a focus on the plausible 'best-case' scenarios, summarizing what a 'mixed bag' and a 'plausible worst-case' alternate scenario could look like. As previously mentioned in the methodology section, our projections do not factor in the possibility of highly-destructive "shock events" described at the end of this chapter. This section features the top innovation megatrends, creating future outcomes from the present through to 2071, along with their 'adverse effects', 'new appetites' created, as well as trend-by-trend descriptions.

Part of Future Innovation Megatrends Model



PLEASE NOTE: UNEXPECTED SHOCK EVENTS ARE NOT REFLECTED *BEST PLAUSIBLE CASE SCENARIO USED THROUGHOUT THE REPORT

4



Resultant Innovation Megatrends through 2071 at a Glance

2018-2030
"DIGITAL CONNECTIVITY ERA"

2030-2050
"THE EXPLORATION ERA"

General Public Services

Smart → Conscious → Sentient Cities

IoE connected Government Services → Space Governance

Public Order & Safety

Military IoT → Curbing Terrorism & Criminal A.I.

Environmental Protection

Superefficient Solar & Other Green-Innovations

Advance Desalination → Utilizing Space Resources

Waste Transportation to Space → Preparing for Space Colonies

Health

Most Diseases Being Eliminated → Homoaugmentus 2.0

Ageing Population Productive through Robotics, Human Augmentation

4

2050-2071
"TECHNO-HUMANITARIAN ERA"

Education

The New-Normal in Education → Augmented Education

Economic Affairs

Advanced Industrial Robotics → Self-Aware Robots

VR Commerce → Art Becoming A Key Part of Commerce

Strengthened international trade through Blockchain, Secure Connectivity, and Distributed Financial System

Housing & Mobility

Conscious Homes → Vertical Strato-Cities → Floating Megapoli

Self-driving Cars → Advanced Autonomous Aerial Vehicles

Recreation & Culture

Near-Space Tourism → Inter-Planetary Tourism

Resultant Innovation Megatrends through 2071 at a Glance

General Public Services	Smart cities: Prescriptive analytics for governments.	Conscious cities: Advancements in big-data, conscious-tech, and IoE allow for more intelligent, self-regulating cities.	Sentient cities: Advancements in AI, quantum, IoE, and sentient systems create adaptive and predictive cities — reducing need for human governance.
	Internet-of-Everything for connecting government services.	People, businesses, and government are now VR-connected.	Near space governance will be an important area of government services.
Public Order & Safety	Military IoT, hardware level protection tech mitigates cybercrime.	Curbing terrorism and criminal AI through advanced digital security, device-level protection in IoE.	
Environmental protection	Mitigate climate change through efficient solar, renewables, storage (battery), IoT.	Majority energy shifts to renewables through super-efficient solar, renewables, storage and transmission.	Begin to reverse climate change through super green-tech, nanotech, and biotech regrow ecosystems.
	Advanced desalination methods and biotech drive reduction in food and water shortage.	Elimination in food and water shortage through efficient green tech; Sustainable synthetics make efficient living spaces.	Utilization of space resources and materials resolves sustainability strain on Earth.
	Waste to be transported to space given reduced cost of reusable rocket components	Early explorer/research space colonies form	
Health	Internet of Health Things (IoHT) and Homoaugmentus 1.0 Exo-Augmentation.	Most current diseases are eliminated; Homoaugmentus 1.5: Endo-Augmentation.	Nanotechnology and genomics led proactive assistance; Homoaugmentus 2.0: Bio & Neuro-Augmentation.
	Assistive AR and VR therapies for older adults.	Productive aging population through advancement in connected human augmentation, robotic exo-skeleton technologies, biotech and prosthetics.	Augmenting implantables become part of mainstream healthcare; People exist virtually.

Education	Global education accessibility through AR/VR proliferation.	New normal in education: High level of technology education as baseline; Virtual Ivy League universities emerge; AI/VR teachers.	Augmented education; Multi-sensory learning environment.
Economic affairs	Global pervasiveness of advanced industrial robotics	New Private/Public model as human employment falls; Crowdsourced governance with unemployment common	Advanced and self-aware robots become part of the fabric of economy
	VR commerce	Subscription economy	Art is a big part of economy
	Global Blockchain strengthens international trade	Adding transparency to international trade through secure connectivity and distributed financial system	
	Weaker economies strengthen through cheaper goods, connectivity.	Technology superpower nations.	End of super powers through ubiquity of advanced tech, cheaper materials, and food and agri-tech.
Housing & Mobility	Smart housing tech for more affordable buildings and more efficient micro-homes;	Conscious home	Occupant-Aware homes; Floating Megapoli.
	Viable self-driving car solutions	Aerial autonomous transport gains traction	Advanced autonomous aerial vehicles with longer range and higher safety
Recreation & Culture	Space-tourism begins	Space-tourism is a rapidly growing vertical sector of the travel industry	Inter-planetary tourism begins
	Companionship AI	Robotic relations increase with advancement in AI, quantum computing, and robotics	Advanced and self-aware robots become part of the fabric of society

Plausible Best-Case Scenario Innovation Megatrends in Detail

General Public Services

1. Smart to Sentient Cities

With the current growing trend towards smarter, digital cities, governments are beginning to be more connected to their constituents and have better insights into their services and their impact. However, by integrating siloed data sets and Departments, and creating cohesive platforms in combination with IoT and AI, governments of the future will be able to build systems that can actively prescribe solutions regarding operations and citizenry as opposed to simply giving them more detailed descriptions. The cities' AI capabilities and visibility will allow governments to become more conscious of their objectives along with their citizens' needs.

Adverse Effects:

- Societal discomfort with increasing latitude of AI in governance and decision making.

New Appetites:

- Stabilization and safety coupled with systemic "blind-spots" should increase interest in more intelligent, human-centric, municipal governance technologies and skill-sets.

2. IoE connected Government Services to Managing Space-Colonies

Much like businesses, governments will replace existing facilities and brick-and-mortar offices with VR and virtual environments. Citizens would be able to interact with government in a very safe, scalable, and convenient manner, increasing the integration between government and the governed. Departments, such as motor vehicle and drivers' services, will disappear and new departments, such as managing floating and stratospheric cities and space suburbs, will emerge.

Adverse Effects:

- Significant loss in public service jobs;
- Vertical cities may develop cultural shift, away from the rest of society, developing their own cultures.

New Appetites:

- Pressure to further virtualize places of business and civil service to reclaim livable space.

Public Order & Safety

1. Military IoT to Curbing Terrorism, Criminal AI Through Advanced Digital Security

As the defense and security industries find increasing value in safeguarding humans and hardware using IoT technology, they begin to integrate IoT into the controls, security protocols, and military uniforms of their forces. This trend may increase the potential damage of a hack — however unlikely, yet this will result in the advancement of emerging firmware-level protection technologies.

Adverse Effects:

- Early adopters of advanced Military-IoT become disproportionately influential.

New Appetites:

- Renewed interest in international military treaties.
- Global push towards demilitarization and use of smart weaponry to deter and prevent misuse or aggression.
- Need for firmware-level protection and military specifications for IoT.

Environmental Protection

1 . Mitigating Climate Change: Super-efficient Solar and Other Green-Innovations

New innovations will emerge to improve the efficiency of solar technology using advanced photo-voltaic materials and battery capacity and charge/discharge technologies. Innovations involving IoT integrations will also play a major role in identifying significantly large areas of power inefficiency and their mitigation. Nuclear energy innovations will revolve around the safety of facilities using IoT to proactively predict and mitigate risk, alongwith innovations in space technology to efficiently get rid of radioactive waste in space. At scale, if the timing is aggressive, humanity will be able to replace the use of fossil fuels with clean energy before we cross immitigable tipping points. Innovations in biotech and nano-tech will facilitate the restoration of damaged ecosystems.

Adverse Effects:

- Land used for nuclear power plants causes further displacement and disruption of local economies; destabilization of oil producing economies that have not yet diversified their revenue streams.
- Destabilization of oil producing economies that have not yet diversified their revenue streams.

New Appetites:

- Measurable progress towards sustainability creates renewed global interest in environmental matters.

2. Mitigating Resource Scarcity: Advance Desalination, Biotech, Sustainable Synthetics, and Space Resources

Advancements in bio-technology to address resource scarcity will create new sources of human consumable food with low ecological impact. Advanced innovations in materials and green technology will facilitate rapid water treatment and desalination at low cost. Genomics and biotech research will result in innovations across GMOs and hyper- efficient crop technology to feed the larger number of people, with lower need for irrigation and land resources. The space industry will create innovations allowing for the use of advanced space materials to replace the use of ecological resources.

Adverse Effects:

- Intellectual property protections of advanced biotech processes and resilient, high-yield, GMO products could result in monopolies that severely impact smaller farms and companies without the latest IP and drastically increase food costs.

New Appetites:

- Increasing interest and demand for habitable, floating and underground cities.
- Near-future value in investments towards space-exploration become clear.
- Push towards public-private partnerships to prevent IP monopolies in the food sector and introduce new laws to that effect.

3. Waste Transportation to Space to Space Colonies

Space exploration sees a boost and the economic benefits continue to fuel efforts. Garbage disposal to space becomes a viable option to reduce ecological and environmental impact as reusable shuttle components are cheaper to manufacture and cheaper fuel options emerge. Scientific and commercial space installations in near-space and interplanetary hubs pave the way for the growth of space-tourism as a growing industry. The continued advancements in space-living and controlled terraforming — tested by business, scientific, leisurely and exploits — make permanent space housing a plausible next step for mankind's expansion.

Adverse Effects:

- Concerns regarding societal and cultural disconnect between Earth and space colonies.

New Appetites:

- Increased space businesses and research pave the way for increase in space-tourism and lay the groundwork for future space colonies.
- Managing the notion of extra-terrestrial extensions of governments and governance propels an interest in exploring new governance models.

Health

1. Most Diseases Being Eliminated to Homoaugmentus 2.0

As the value for IoT in healthcare (IoHT) to the user grows and facilitates better access, convenience, comprehensiveness, and connectivity, wearables systems comprised of headsets and other clothing will become part of common attire. This will result in the effective emergence of new health solutions being defined as **Homoaugmentus** 1.0: exo-augmentation with wearable augmentation systems.

The trend of augmentation will rise and eventually include the use of implantable devices to augment organ functions outside of corrective medical purposes, leading to Homoaugmentus 1.5: endo-augmentation with implantables. Eventually, with advancements in genomics, bio-tech, and nanotech, we will see the emergence of metabolic, cellular, and genetic enhancements pre-and post birth, and for the first time, augmentation of neurological function defined as Homoaugmentus 2.0: bio-augmentation and neuro-augmentation.

Adverse Effects:

- Insurance companies disproportionately favor the augmented.
- Further class stratification based on access to latest augmenting technologies and the emergence of a prominent and influential augmento-bourgeoise class.

New Appetites:

- Interest in further exploring benefits of human augmenting systems to companies and governments.
- IoHT spurs discussions to expand definition of Personal Health Information (PHI) and update legislation to protect private health data.
- Need for governments to define new parameters for the rights and privileges of digitized consciousness becomes essential to the viability and ethical use of the technology.

2. Aging Population Productive through Robotics, Human Augmentation

Addressing the challenge of a growing aging population will be the catalyst and impetus for a lot of the augmentation and bio-tech advancements the world will see within the next 40-50 years, since they represent the largest portion of healthcare expenditure in developed nations.

VR therapies and environments will be used to assist the aging in fighting loneliness as well as mental and physical deteriorations and atrophies. Eventually, endo and exo-augmentations will allow older adults to be more productive and return to a dwindling job market. Ultimately, with advancements in AI and neuro-science, humans will be able to upload their consciousness and identities to AI entities to extend their intellectual selves indefinitely through virtual presence.

Adverse Effects:

- Influx of reenabled older adults into an already shrinking job market creates additional economic stress and unrest.
- Economic pension bubble due to older retirement age.

New Appetites:

- Seniors market becomes more technically adept and a big consumer of technology — spurrings additional investment in assistive technologies.

Education

1. New-Normal in Education to Augmented Education

Technology literacy is quickly becoming the new basic standard of passable literacy in the modern economy and digitized workforce. Formal schooling and education will rapidly evolve from the early, nascent technology adoption and integration stage it is currently in to becoming fully digitized and integrated within virtual environments. VR universities and institutions become highly accredited and recognized, and eventually, comprehensive education programs, including labs and practical work, will be delivered through students' augmentation systems.

Adverse Effects:

- Confusion and debate arise around developing reliable methods for rating and ranking the quality of virtually delivered education.

New Appetites:

- With cheaper and more accessible education more people from under-privileged backgrounds pursue higher education.
- Life-long learning becomes a growing trend.

Economic Affairs

1. Advanced Industrial Robotics and Augmented Humans to Self-Aware Robots

When will AI be better than humans at everything? The aggregate forecast of 352 experts state that it would be within 45 years. Although experts such as Ray Kurzweil and Elon Musk believe it will be 2045 and 2030-2040 respectively.[1] [2] Experts from the survey also stated that specific activities would be taken over by machines, such as translating language (2024), writing secondary school essays (2026), driving a truck (2027), working in retail (2031), writing a bestselling book (2049), and working as a surgeon (by 2053).[3]

Adverse Effects:

- Massive unemployment will result in growing profits for corporations and widening income inequality.

New Appetites:

- Global discussions around the need for higher corporate taxation and shared-profit public-corporate partnerships to offset mass living-cost subsidies.

- Increasing pressure towards Universal Basic Income as an inalienable human right, especially as job market to citizenry ratio rapidly declines.

2. VR Commerce to Art Becoming a Big Part of Commerce

As e-Commerce platforms leverage VR environments to create richer interactive shopping experiences, and traditional retail businesses replace personnel with increasingly competent AI/robotic assistants, most retail brick-and-mortar retail businesses will rapidly virtualize their outlets. Due to the significantly diminished differentiation with the new VR commerce platforms — many of those who do not make the shift quickly enough may not survive to reconsider.

People would also be able to subscribe to 3D-printing design licenses, through which they can download the latest clothing or decorative items to print at home. Eventually, the biggest human challenges of the times are resolved to a manageable scale, and robots/AI take over most jobs, enabling humanity with more luxury and freedom to explore the arts at an unprecedented scale, using all new technologies as mediums and tools to create and redefine art.

Adverse Effects:

- Growing number of people have multiple "gig" jobs with lower benefits and security and less time and energy for family.

New Appetites:

- Increased interest in online and e-commerce jobs.

- Need for new regulations and policies to govern virtualized commerce.

1 "Ray Kurzweil's Most Exciting Predictions About the Future of Humanity." Futurism. June 05, 2017. Accessed October 09, 2017.

2 The Sun. "Elon Musk says robots will beat humans at everything by 2030." New York Post. June 06, 2017. Accessed October 09, 2017.

3 "When Will AI Be Better Than Humans at Everything? 352 AI Experts Answer." Singularity Hub. September 29, 2017. Accessed October 09, 2017.

3. Strengthened International Trade through Blockchain, Secure Connectivity, and a Distributed Financial System

Digital security and lack of transparency are currently big impediments to the complete digitization and streamlining of global trade. As blockchain technology becomes more pervasive, there will be new innovations specifically targeted towards a global commerce blockchain. All nations will have secure, incorruptible records of all transactions both with, and by other countries with which they have agreements. This is to make sure that backdoor alliances don't undermine sovereign nations through secretive inequitable trade deals or dubious military alliance transactions.

New Appetites:

- As identity, personal, financial, and health information become portable and security concerns are all but eliminated, attachment to physical boundaries becomes weaker and people are more likely to live and work from any part of the world they can travel to.

4. Technology Superpowers to End of Single Superpower

As access to education, goods, and services becomes globally digitized and cheaper through virtualization, advanced 3D-printing technologies, and advancements in biotech, previously weak economies are given a great opportunity to develop and compete based on intellectual capital and how aggressively they adopt technology education and ingenuity as a national priority.

The superpowers of today's world will fall from grace due to their relatively shrinking economies and the new superpowers will be those nations who will balance an aggressive growth in technology adoption and development within a stable — and sustainably growing — economy. With the progressive growth of the influence and role of cities in international affairs, the notion of nation-state superpowers will fall by the wayside accelerated by the equitable distribution of power due to the reduction in cost of physical goods, ubiquity of technology, and universal access to health and food technologies.

Adverse Effects:

- Increased global market competitiveness slows economic growth of previously dominant nations.

- Rapid growth of African markets creates civil power struggles and intra-continental conflict over key lucrative resources as economic growth slows down.

New Appetites:

- Renewed interest in equitable and transparent international trade treaties.

Housing & Mobility

1. Conscious Homes to Floating Megapoli

Construction materials and processes continue to improve and pave the way for super-high strato-city structures and large floating cities that allow significantly greater living space. This driver also leads to the increased popularity and demand for intelligent micro-housing options that allow vastly increased functionality in smaller living spaces through smart-home technology and dynamic integration with — and in response to — wearable augmentation systems.

The cost and viability of permanent home ownership along with the advancement of occupant aware, adaptive homes, leads to the emergence of housing-as-a-service memberships. This enables people to choose to freely move between a wide option of homes without owning or renting any one specific home. Meanwhile, floating cities increase in size and influence and become megapoli.

Adverse Effects:

- Potential for health complications due to high-altitude living.
- Vertical cities may develop cultural shift from rest of society and separate identity.

New Appetites:

- Increased interest in open recreation and leisure spaces for people to disconnect and de-stimulate from the high velocity of the virtualized world.
- Desire for stronger integration between augmentation systems and smart-home.

2. Self-Driving Cars to Advanced Autonomous Aerial Vehicles

Urban congestion and the rising concern for traffic accidents along with the reduction in cost and pervasiveness of autonomous transportation leads to the mainstream adoption of advanced autonomous transportation. With the rise of stratospheric and floating megapoli, a need for faster transportation and advancements in autonomous driving systems, avionics, and nuclear and/or battery technology spurs innovations resulting in viable autonomous personal aerial transportation which continue to improve in range and safety as the adopted level grows.

Adverse Effects:

- Autonomous ground transportation hits transportation jobs and shift many ride-share drivers into other forms of sharing-economy work. Disappearance of many industries and services supporting drivers and vehicles.

New Appetites:

- Urban spaces and commute are reimagined as human-driving is no longer a factor.
- Driving becomes a savored, leisurely activity, with new experiences around the enjoyment of driving akin to cycling today.
- Car ownership is increasingly replaced with transportation- as-a-service models.

Recreation & Culture

1. Near-space tourism to Inter-planetary tourism

The emergence of orbital space tourism is already a growing trend being explored by many organizations as a revenue source in the near future. This will naturally expand to tourism in high-orbit space-stations and ultimately to nearby planets with relatively mitigable climate conditions.

New Appetites:

- Desire for long-term space resorts and ultimately semi-permanent and permanent housing accelerates research into terraforming technologies.

- The anticipated growth in space-colonies shifts focus of global governments to the nuances of managing relationships between Earth and emerging extra-terrestrial colonies.

2. Companionship AI to Robot Relations

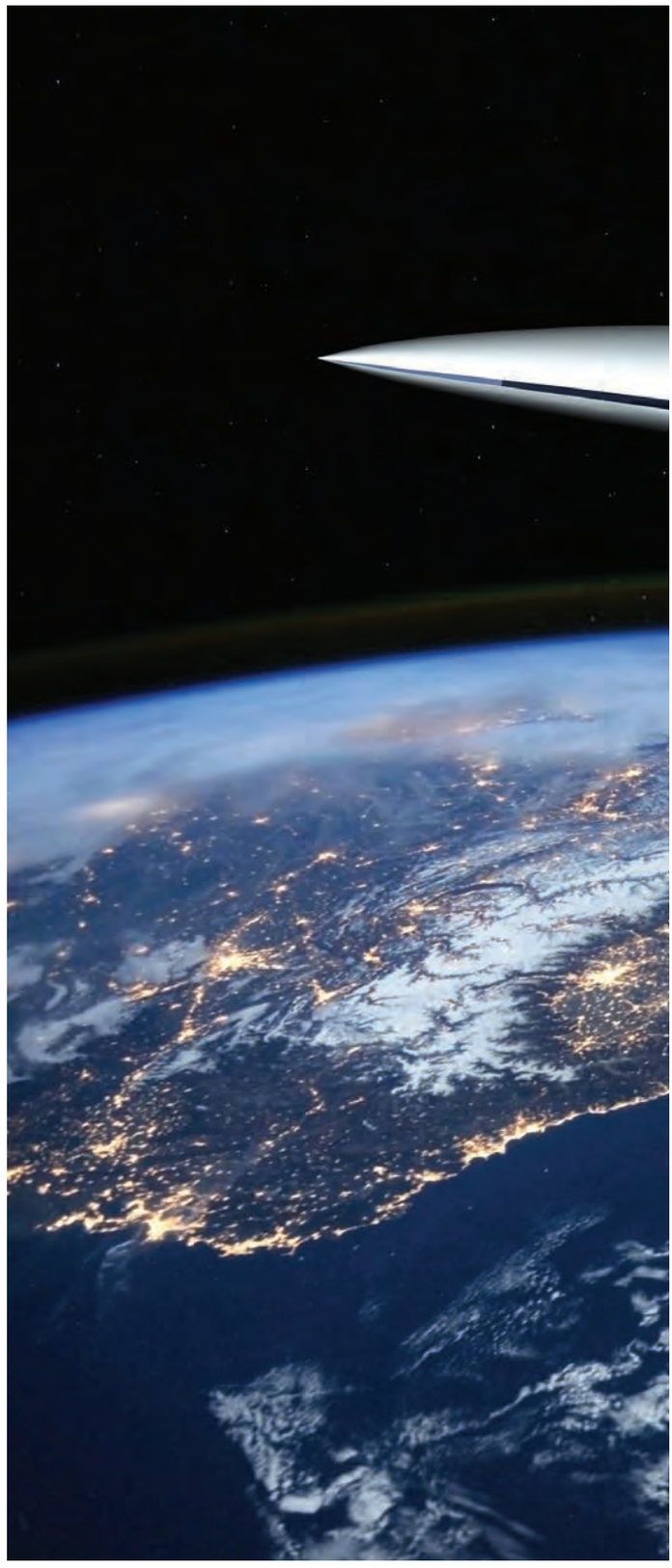
Companionship by artificial intelligence is already on the rise with education and entertainment AI. As robotics and AI continue to improve in realism and the emulation of human responses and emotions, companionship with AI enhanced robotics will begin to share attention akin to inter-human connections. Ultimately, robot relations will emerge as a societal issue as robots become considered members of society.

Adverse Effects:

- Already disrupted familial connections are weakened due to relationships with AI and robots.

New Appetites:

- Interest in AI companionship in the therapy/alleviation of mental and emotional health conditions grows.



4

4.2
The New Eras

The expected megatrends highlighted through the Guidebook carry distinct characteristics which can be categorized into new eras. These Eras are defined here as 'The New Exploration Era' for the time period between 2030 and 2050; and 'The Techno Humanitarian Era' from 2050-2071.

The New Exploration Era

"The New Exploration Era," (2030-2050) will be marked with human capacity augmentation and AI technologies, as well as space exploration, moving us from a "problem-solution" to an "opportunity-exploration" paradigm. It will be an era when humanity will have come close to resolving most of today's large-scale problems and is focused on exploring opportunities and new frontiers for human capacity growth and past- earth substantial development.

This will be a major transition from the current "Digital Connectivity Era", characterized by connectivity based innovations, led by IoE technologies to solve major challenges of the world.

The Techno-Humanitarian Era

The subsequent "Techno-Humanitarian Era," (2050-2071) is expected to be marked by a shift in innovation efforts and global priorities towards redefining and empowering a new technology-enhanced humanity. People will explore new technology media as a means for self-expression and universal access to education and healthcare will break down classist barriers. Humanity will begin to define the roles and rights of pseudo-human AI within the fabric of society, as well re-emerge out of the confines of virtual environments to connect physically with one another and with outer-space, through space exploration and an impassioned return to the arts.

4

4.3
Evolving Methods of Communication

The fundamental nature of government-citizen engagement was introduced in Chapter 1, whereby a government's level of engagement progress is through the following levels (in order of extensiveness): **inform, consult, involve, collaborate and empower.**

As the global citizen survey results highlighted, a majority (72%) want governments to engage with them in major decision making, meanwhile the current satisfaction level is very low (11% of respondents).

Based on an evaluation of innovation trends and developments in communication, we expect the following key tools of communication for governments going forward.

Key Evolving Themes

"Digital Connectivity Era" (2018-2030)

Virtual AI assistants

- Citizens can ask their virtual assistant, and later full virtual secretaries, about any city service or government bulletin, and the answer will be available. e.g. When is the next election? How much is my electricity bill this month?

Connected IoE devices

- As the world increasingly becomes hyper-connected to the internet, along with all of our items to the internet and each other (e.g. oven, alarm clock, electric meter), our electric meter will automatically inform our mobile wallet of our bill.

Big data connectivity

- Big data can increasingly be used prominently to gauge citizens' preferences and behaviors. As we gain ever-increasing sensors and information about citizens (e.g. from self-driving vehicle sensors and IoT connected devices), this method may become more prominent than surveys.

Virtual reality environments

- VR for focus groups
- VR for workshops and conferences

- VR used to test out new city services and campaigns with citizens, saving government spending
- Gaming (e.g. Minecraft) as a citizen participatory tool to envision public area developments together

Augmented reality platforms

- AR texts, chats, chatbots
- AR used for prototyping and co-creating solutions visually

"New Exploration Era" (2030-2050)

Enhanced Augmented Reality (AR)

- Enhanced AR that overlays data and augmented perception and enhanced human capability with exponential possibilities (introduced in select areas)

"Techno-Humanitarian Era" (2050-2071)

Proliferation of Enhanced Augmented Reality (AR)

- Adopted across most government functions

Augmented implants

- Information sent through brain implants. To upload a government bulletin to the brain, the citizen just needs to blink, and his/her auditory and visual nerves upload the file. The brain implant can also instantaneously search information about any city service, just by thinking about it (e.g. What time will the next bus arrive?)

Space-net

- How will governments communicate with and engage citizens once they live in space?

"Engage with your citizens — not a few times a year but in real-time. Send a message to the platforms where citizens can respond immediately (e.g. AR contact lenses) asking, 'Do you support X policy? Yes or No.'"

Peter Schwartz
Senior Vice President Strategic Planning
Salesforce

4.4
Worst-case and 'Mixed-bag' Scenarios

In addition to our primary focus on 'plausible best-case scenario', we also present here a brief assessment of the most probable 'worst-case' and 'mixed-bag' scenarios. The basis of these scenarios are as follows:

1. **Innovations are not able to address critical societal megatrends.** Innovation may not come to fruition as projected if one or more of the following conditions hold true:

    a. *Timeliness:* The innovation is introduced after the adverse effects of the trend have already caused an indelible, global, adverse impact.

    b. *Scalability:* The innovation does not address the trend rapidly enough to reverse its progress towards an irreversible tipping-point.

    c. *Adaptability:* Adverse effects created by other innovations further exacerbate the trend in a manner or rate that the addressing innovations cannot correct.

2. **Societal megatrend** projections vary dramatically from the expected plausible best-case, such as with population growth or climate change.

3. **Alternate projections** are identified based on the effects those trends are expected to have, solely as a result of the dulled impact of addressing innovations.

    a. Mixed-Bag scenarios are reasonably plausible based on majority of expert opinions.

    b. Worst-Case scenarios are not at all plausible according to some credible experts.

Alternate Scenarios: Innovation Megatrends through 2071

	2030	2050	2071
Mixed-Bag Scenario Varying Conditions Advancements in green energy and other innovations are unable to adequately address deteriorating climate change trends.	A return to nuclear energy becomes an equally larger focus as green energies.	Depletion of most fossil fuel reserves, with inadequate substitution with renewables, causes sharp increases in oil energy costs.	Temperatures increase by more than 2.5 degrees from 2016 averages causing decimation of many land ecosystems and agriculture. Icecaps melt causing decimation of marine ecosystems and fisheries.
	Governments aggressively regulate energy consumption stifling economic growth and innovation.	Rising sea-levels, displacement, desertification, and irrigation challenges make providing enough food for a growing population unsustainable.	Natural food, water, and energy are rationed. Rise of diseases due to elevated consumption of processed foods.
	Access to food and water becomes a massive problem leading to famine and drought.	Safe housing and sanitation become a growing concern for large portions of world population, leading to a sharp rise in global health epidemics.	Aggressive efforts to build sustainable, long-term space colonies as an exit-strategy for the rich.
Plausible Worst-Case Scenario Varying Conditions Advancements in green energy and other innovations are unable to adequately address deteriorating climate change trends. Growing world population and urbanization accelerated by rising sea levels not adequately mitigated by new innovations.	[All outcomes for "mixed-bag"]	[All outcomes for "mixed-bag"]	[All outcomes for "mixed-bag"]
	Innovations for affordable and more efficient housing are not developed quickly enough to address growing populations and the large numbers of people displaced.	Failure to rapidly and economically develop and scale innovations to create large floating megapoli to replace enough of the submerged lands escalates congestion and urbanization concerns.	The slow and expensive development of strato-cities along with the crowding of land and floating megapoli increases tensions in cities.
	Megapoli become chronically congested, leading to massive health concerns and rising crime.	"Aging Cities" on the outside of big megapoli are built as a means of accommodating growing aging population, while creating more room within the megapoli. This leads to increasing isolation of aging population and dissatisfaction with policy-makers.	The rich invest heavily in private space colonies ultimately leaving behind crippled economies for those less fortunate.
	Large influx of migration results in mass unrest due to increasing nationalism and racism; hindering integration and innovation.		Governments grapple with expanding and accommodating previously unpalatable measures to control population growth, such as expanding the death penalty to less egregious criminal offences, legalizing euthanasia, or incentivizing early termination of physical life replaced with a virtual existence through digitization of consciousness.
	Global healthcare crises, resulting from climate complications prevent adequate attention to addressing healthcare needs of seniors.	Inequitable distribution of limited food and resources to those who can afford them creates mass unrest.	

Shock Events

"Shock Events" are unexpected events which have a significant impact on the economy, society, and ecology despite having originated externally. These events are unpredictable and result in an abrupt shift in geopolitical and/or socioeconomic trajectories. Shock events are also not inherently positive or negative in cause, nature, or impact. The different types of shock events can be categorized as follows: economic (e.g. supply shock, demand shock, inflationary shock); political (war/invasion, terrorist attack), environment (catastrophic weather events, disease outbreaks).

For a disruptive event to be a shock event, it must meet the following criteria:

1. **Not progressive:** Shock events are not gradual in nature; they are characterized by rapid onset and rapid impact. Shock events allow very little time for governments and societies to react.

2. **Non-projectable:** Even if one can reasonably expect that a certain event can (or will) conceivably occur, it is still technically a shock event if the timing and location of occurrence are not accurately predictable or projectable without unempirical or subjective inferences.

Omissions

Shock events were deliberately not factored into the projections or recommendations of this Guidebook for the following reasons:

1. Economic shock events, while variable in impact from a short-term perspective, are generally negligible in the long-term impact.

2. Political shock events are highly volatile in causality and nature and vary widely in impact and scale so it would not be feasible to include into an analytical model. Environmental and climate shock events are matters requiring separate emergency management and contingency strategies which fall outside the scope of this Guidebook.

Future Government: The Functions

In this section, the focus is on how government functions could likely evolve through to 2071, given the earlier scenarios and underlying innovation Megatrends. We then examine how international ecosystems would need to evolve, and how government function KPIs change as necessary.

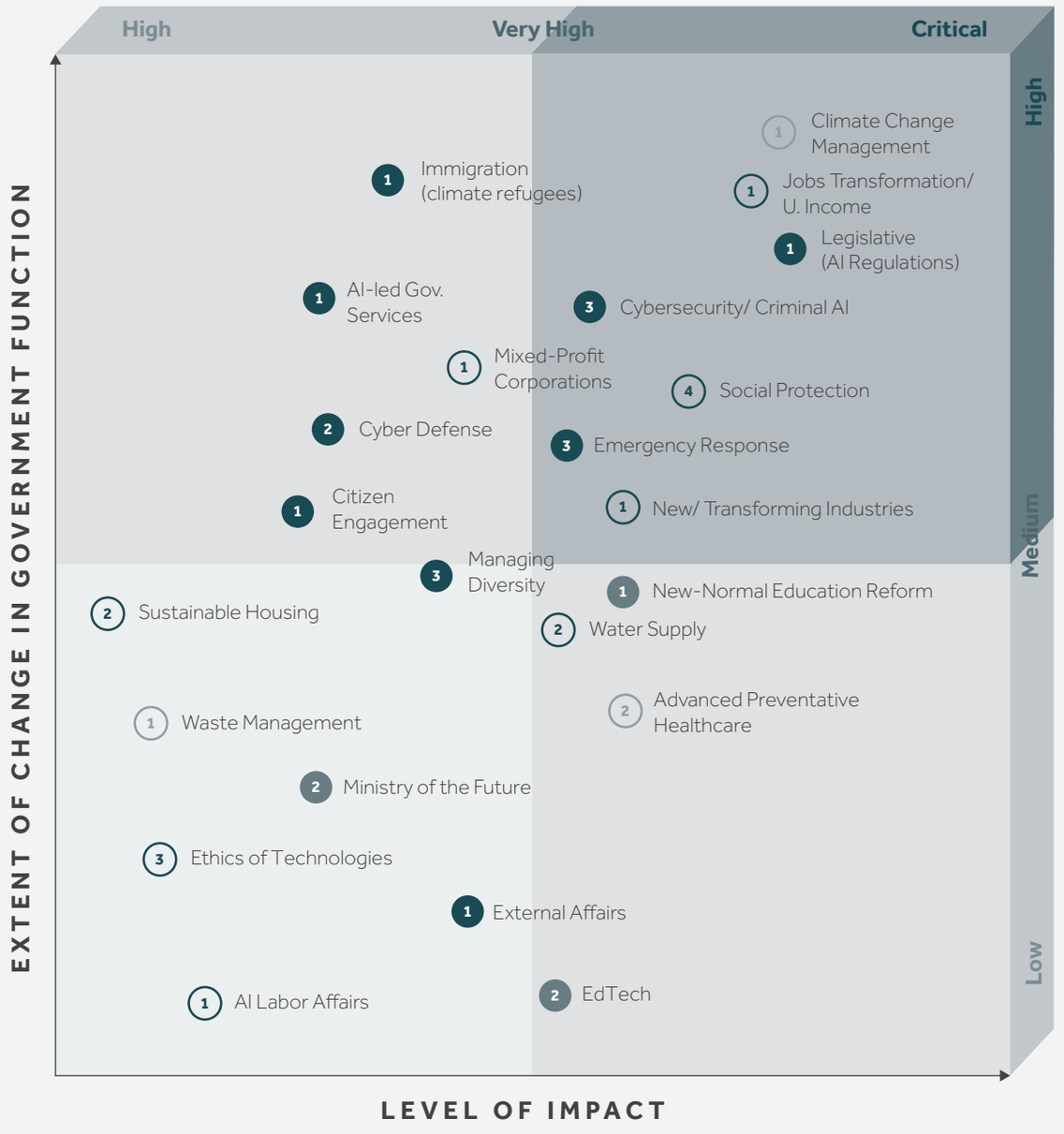
5.1
Evolution of Government Functions

The significant changes needed in government functions to adapt to the future, with the level of impact denoting the relative economic importance of each of the functions, is highlighted in the diagram in Figure 20.

Many of the high and very high-level changes are driven by the effects of top innovation trends identified — notably, drastic climate change, the need to provide increased security for citizens, job automation, technological innovation breakthroughs, and new sources of economic growth.

The government will also have to consider the impact on government jobs and job training, so as to remain effective and adaptable to the needs of stakeholders. Based on estimates, 1 in 2 current government jobs could be automated by 2071, which would be roughly 52.6 million government jobs based on the OECD. However, on the flip side, new technologies will require oversight, which will add 29.5 million government jobs within the OECD.

Figure 20 FUTURE GOVERNMENT IMPACT — 2071 VS TODAY



High:
New, dedicated departments or teams will be required for the government to address the development

Medium:
Adaptation will likely require coordination across departments and additional oversight, but less of a need for new agencies/ departments

Low:
Existing departments can be adapted to oversee and co-ordinate the new developments

Governance & Resilience
1. General Public Services
2. Defense
3. Public order & Safety

Economy & Society
1. Economic Affairs
2. Housing & Mobility
3. Cultural Values & Ethics
4. Social Protection & Welfare

Environment & Health
1. Environmental protection
2. Health

Future & Progress
1. Education
2. Research & Innovation Development

Highlighted next are select main changes required in current government functions (presented earlier in Chapter 2) to underwrite a successful future for nations and our global community. These changes are based on analysis captured across all the inputs defined earlier, with particular prioritization on innovation drivers and essential primary research feedback. Beneath each of the government function themes and services below are the selected government functions requiring change. They are listed from highest to lowest extent of change and reference the innovation outcome that will address the change.

* Related Innovations from Chapter 4 are referenced after each topic

Governance and Resilience

General Public Services

- **Immigration:** Climate refugee immigration is forecasted as a critical issue governments address, unless rising water levels and desertification are addressed by major and timely innovation breakthroughs

  * Mitigating Climate Change: Super-efficient Solar and Other Green-Innovations

- **Legislative:** Laws and industry regulations will have to be adapted to AI. This includes baseline regulations on using AI for productive and lawful purposes and managing associated health, safety, security and economic risks associated with widescale AI adoption

  * Advanced Industrial Robotics and Augmented Humans to Self-Aware Robots

- **AI-led Government services:** Advancements across AI, quantum computing, IoE, and sentient systems create adaptive and predictive cities — reducing need for human governance. However, the government will need to incorporate advanced technologies into its own operations to remain effective, and new solutions will be required for advanced cities, such as advanced disaster planning (including AI-led drone dispatch to manage fires, casualties and traffic accidents)

  * Smart, Concious to Sentient Cities

- **Citizen Engagement:** New communication tools will be leveraged, with citizens informed of policy through voice-activated AI mediums. Big data and VR will be used to interact with citizens and incorporate their input into policy decisions

  * IoE connected Government Services to Managing Space-Colonies

- **External affairs:** Adapting to new developments, Foreign affairs will need to incorporate new spheres of cooperation for the following areas: managing increased threat of cyber war; developing frameworks to oversee AI and sentient beings; and coordinating responses to increase job losses from automation and advanced cities

  * IoE connected Government Services to Managing Space-Colonies

Defense

- **Cyber Defense:** Will become a key and central risk, with far-reaching implications, necessitating its own government detailed category

  * Smart, Concious to Sentient Cities

- **Managing Diversity** will be key to maintaining order, incorporating climate change refugees, and potential migration from varying adoption of AI

  * Smart, Concious to Sentient Cities

Public Order and Safety

- **Cybersecurity/Criminal AI** will become a major focus of law enforcement to avoid drastic

  * Military IoT to Curbing Terrorism, Criminal AI Through Advanced Digital Security

- **Emergency Response** will need to evolve, using drones and robots as populations increase and cities become more complex

  * IoE connected Government Services to Managing Space-Colonies

Economy and Society

Economic Affairs

- **Mixed-Profit/Public-Private Corporations** will emerge, as governments will work closely through joint ventures and partnerships with leading corporates to create smart cities and upgrade government functions

  * Advanced Industrial Robotics and Augmented Humans to Self-Aware Robots

- **Job Transformation/Universal income** will be a key area where government will have to support an increasingly displaced workforce in transitioning to new roles. They will have to provide access to financial support and a basic income as a social safety net

  * VR Commerce to Art Becoming a Big Part of Commerce

- **New & transforming Industries** will emerge requiring government oversight, taxation and economic regulation, with AI and cryptocurrencies being current hot trends. Over time space exploration will spawn new related industries, such as energy, logistics and communication industries

  * Strengthened International Trade through Blockchain, Secure Connectivity, and a Distributed Financial System

  * Near-space tourism to Inter-planetary tourism

  * Self-Driving Cars to Advanced Autonomous Aerial Vehicles

- **AI Labor Affairs** will emerge as a critical area as robots and AI become more sophisticated, and deemed a category requiring evaluation and adoption practices and protection for human jobs

  * Advanced Industrial Robotics and Augmented Humans to Self-Aware Robots

Housing & Mobility

- **Sustainable housing development** will need to adapt to a rapidly rising population and land shortages, necessitating smart construction

  * Conscious Homes to Floating Megapoli

Cultural Values and Ethics

- **Ethics of technology** will require government regulation and guidelines, as new issues arise around the potential misapplication of technologies with far-reaching consequences. For instance, interaction between robots and humans

  * Companionship AI to Robot Relations

Social Protection & Welfare

- **Family units** will need to be protected by the state, with ongoing efforts to ensure families are not strained by the economic impact of automation and drastic changes to education

  * Advanced Industrial Robotics and Augmented Humans to Self-Aware Robots

- **Social protection** will also need to be adapted in the makeup of society to account for increased migration

  * Companionship AI to Robot Relations

Environment and Health

Environmental Protection

- **Climate change management** is a critical area for preventing a mass refugee crisis and substantial economic damage. Governments will have to create dedicated resources, supported by rigid policies, to ensure temperature rises are limited to 2ºC or below. Additional areas that existing government functions will need to incorporate include pollution abatement, which is a critical enabler of future progress in other ministries. Heavily invested international collaboration will be needed.

  * Mitigating Climate Change: Super-efficient Solar and Other Green-Innovations

- **Food security** and methods of agriculture will become critical in the resource scarcity period, and will require dedicated attention from government departments

  * Mitigating Resource Scarcity: Advance Desalination, Biotech, Sustainable Synthetics, and Space Resources

- **Waste management** in megacities will need to incorporate technologic innovation such as drones, autonomous vehicles and robots, accounting for limited space and increasing logistical challenges.

  * Waste Transportation to Space to Space Colonies

- **Water supply** management will require forward thinking policy on obtaining clean water, in particular, effective use of desalinization, and efficient distribution to households

  * Mitigating Resource Scarcity: Advance Desalination, Biotech, Sustainable Synthetics, and Space Resources

Health

- **Advanced Preventative Healthcare** will become a greater priority as medical implants and faster detection methods prevail, and as rising and aging population necessitates closer management of healthcare costs

  * Aging Population Productive through Robotics, Human Augmentation

- **Health-Tech IoHT, AI/Robotics** will be incorporated into healthcare practices and require guidelines and oversight to streamline efficiency and cost of patient care

  * Most Diseases Being Eliminated to Homoaugmentus 2.0

Future and Progress

Education

- **The New-normal education reform** will be integral as emphasis shifts from early and initial education to continuous education and adaptability

* New-Normal in Education to Augmented Education

- **EdTech** will be required to ensure that the delivery of education leverages all available digital tools, and poses less of a burden on infrastructure and logistics, especially as the population grows substantially, especially in cities

* New-Normal in Education to Augmented Education

Research & Innovation Development

- **R&D on breakthrough fundamental technologies** represent a critical enabler to future progress, and would require broad application — both in terms of adoption across the economy, and in how the government itself evolves. This necessitates dedicated government effort, and funding to incentivize broad and coordinated public-private research

* Technology Superpowers to End of Single Superpower

- **The Ministry of the Future** exists to ensure that decisions and directions are based on long-term planning and to avoid short-termism pressures of newly elected leaders

- **Education Reforms research** on the future of education, given the expected automation, is an immediate and impending area of focus for all governments to ensure the workforce is adequately prepared and agile

* New-Normal in Education to Augmented Education

5

Evolution of International Ecosystems:

Global institutions are forecasted to cede greater power and influence.[1]

For example, as automation will take jobs and put strains on social inclusion, coalitions of nonstate players will become more important in shaping policy outcomes.[2] Virtual alliances amongst sub-national entities, uniting on purpose, identity, or cultural exchange (cities conducting foreign affairs) will likely increase.

The following ten global challenges (See Figure 21), stemming from primary stakeholder needs and advancements in technological solutions, are necessitating enhanced or new forms of international ecosystems to exist.

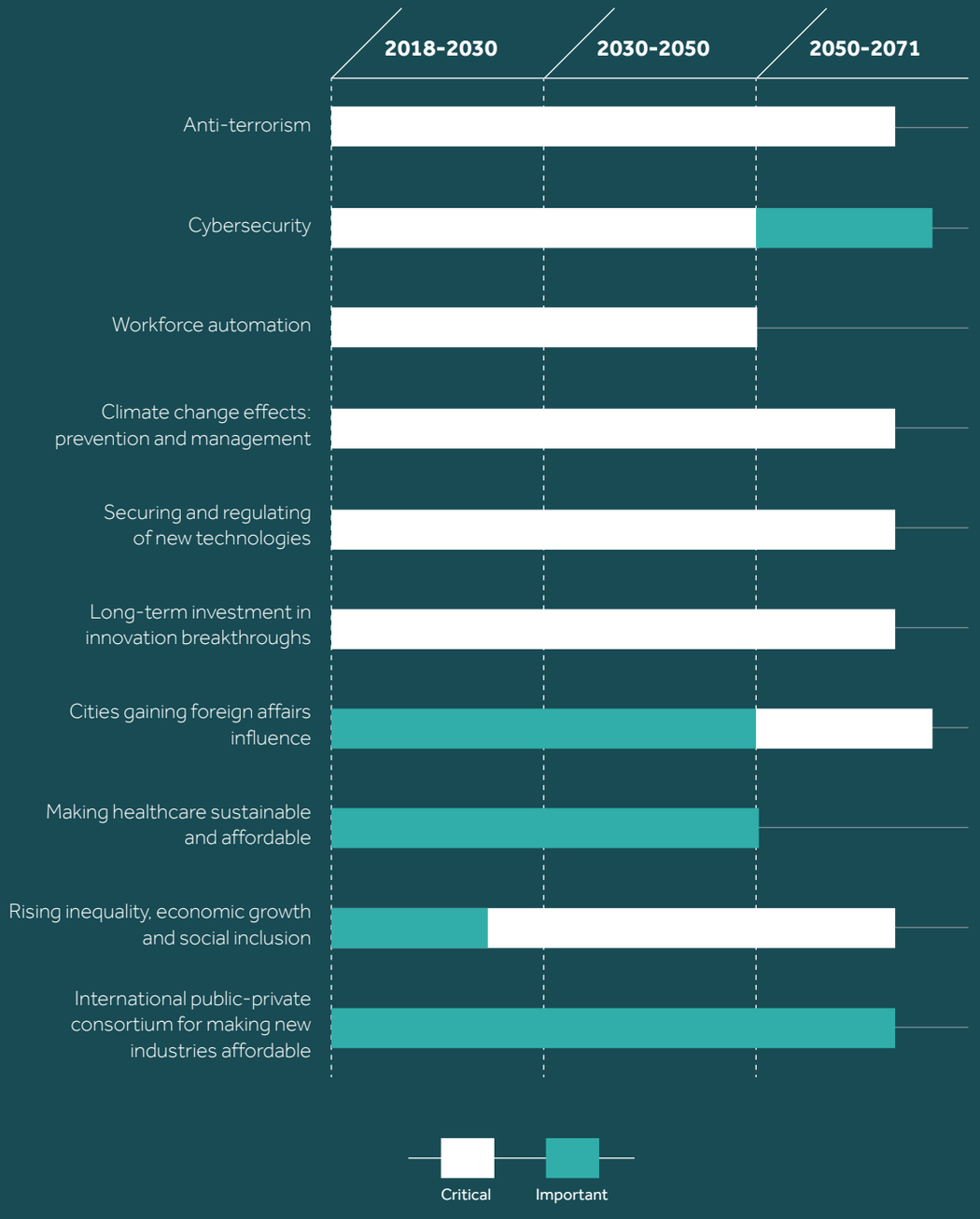
Enhanced and intensified cooperate management of anti-terrorism and cybersecurity will require collaboration through task forces and law enforcement. Climate change efforts require intensification, building on the Paris Agreement of 2016.

However, new collaborations, either through existing bodies such as the UN and ILO, or new bodies, will need to be developed. The collaborations would have broader inclusion from the business community and social organizations, with workforce automation, new technology development and regulation among the top immediate priorities.

1 *Driving Forces — 100 Trends and Developments Shaping the Path to 2025.* Rohit Talwar. Iva Lazarova

2 https://www.weforum.org/agenda/2016/11/the-global-economy-we-want-to-create-by-2030

Figure 21 MAJOR GLOBAL CHALLENGES NECESSITATING EVOLVING INTERNATIONAL ECOSYSTEMS



5.2
New Government Benchmarks

While a variety of new KPIs will emerge for governments through 2071, many of the government KPIs can be expected to remain the same, although their benchmark values would have changed. New KPIs emerging are presented here and revolve around the new key government functions introduced in the earlier section e.g. government expenditure for adult learning and retraining, and number of cyber attacks thwarted at the municipal level.

Expected Benchmark Themes

Economy/Competitiveness
Economic KPI themes in the earlier time-frames towards the future could include the percentage of the population with a universal basic income, the proportion of taxes paid by large corporations, contribution of AI to the economy, and AR/ VR penetration of the population. In the longer term, it could include KPIs such as the percentage of population with implants.

New Economic Industries
Many industries will likely be invented, where others become less important sources of economic growth, or die out. As such, broad government and economic metrics will be applied to the new industries, such as tax collection, but new, specific metrics will also need to be developed. For instance, level of AI adoption across industries in the nearer term, and GDP of new space colonies, in the longer-term.

Mobile Subscribers
This measurement will likely broaden to encompass all forms of digital platforms that emerge, such as augmented reality and VR.

Life Expectancy at 60 years
Given advances in health, the reference point will likely increase to 80 years.

School Enrollment
This will be critical from 2018-2050, but gradually will become less important. The new normal could include proportion of the population with technology proficiency, and the extent of AR/ VR, being adopted in education. Children may likely attain intelligence in ways other than attending school full-time. The years in tertiary schooling may or may not be important from 2030-2050, depending on how well tertiary institutions transform to address

"Governments should have a non-partisan Ministry of the Future, whose role is to think long-term (e.g. on climate change, future of education) and feed that information to whoever comes into power."

Anab Jain
Co-Founder & Director
Superflux

measures of continuous education, such as years elapsed since re-training. Vocational colleges and executive education or virtual short-term retraining programs may be dominant themes, as continuous education and training becomes as important.

Government Expenditure on Education

This is a priority for most governments. However, the way the expenditure will be distributed will need to change, e.g. how much is distributed to adult retraining in 2050-2071. It could be likely that this budget is allocated to learning augmentation technology usage.

Globally Ranked Universities

As the workforce increasingly becomes automated until it reaches nearly full automation, universities will have to transform their systems completely.

Researchers

The number of human researchers is likely to become less relevant, as robots and AI system based research centers provide exponential value and could become a key research KPI.

Environment

Given the criticality of climate change management related indicators such as a Sustainability Index per industry will be needed. The measures will be proactive, rather than reactive measures to reverse climate change.

Political Shifts and Security

Security related KPIs could include cyber-attacks at the municipal level, or number of AI-related crimes.

Health

Health related KPIs could include metrics such as the percentage of population with AR tools/ Implants.

Government Function Changes and Expected KPIs Through 2071

Function Themes	Sub-Level Functions	Detailed Services	KPI
Governance and Resilience	General Public Services	Immigration and displacement from climate refugees	Number of climate refugee immigrants per 100,000 inhabitants
			Displaced persons per 100,000 inhabitants
		External affairs	Level of collaboration with adequate international ecosystems to solve emerging issues (1=low; 5=high)
			Ratification of treaties and conventions on international labor rights
	Defense	Cyber defense	Cyber defense attacks by other countries thwarted (% of national total)
		Military	Conflicts (1=low; 5=high)
	Public Order and Safety	Cyber crime and/or Criminal AI	Cyber attacks at the municipal level thwarted (% of total)
			Number of security breaches from new technologies
Economy and Society	Economic Affairs	General economic affairs	GDP per capita
			GDP growth rate
		Newly invented industries (new sources of economic growth)	GDP from new sources of economic growth/newly invented industries
			Effectiveness of collecting taxes, or alternative (tax collection per capita)
		Commercial affairs	Domestic credit to private sector (% of GDP)
			Regulatory Quality (Private Sector) Estimate (~2.5 to 2.5)
		Labor affairs	Unemployment Rate : Top Human Job Category Trends; Universal Basic Income %
		Agriculture, Forestry, Fishing and Hunting	Employment to Revenue Ratio; Sustainability Index
		Fuel and energy	Employment to Revenue Ratio; Sustainability Index
		Mining, manufacturing and construction	Employment to Revenue Ratio; Sustainability Index
		Communication	Employment to Revenue Ratio; Sustainability Index

Function Themes	Sub-Level Functions	Detailed Services	KPI
Economy and Society (cont'd)	Housing and Mobility	Housing development	Availability of affordable housing (% satisfied)
			Access to electricity (% of population)
		Water supply	Access to piped water (% of population)
		Transport	Employment to Revenue Ratio; Sustainability Index
	Cultural Values and Ethics	Extremist groups	Political stability and absence of violence (Estimate)
		Peaceful coexistence of religion; pluralism	Peaceful coexistence of religions/ pluralism (1-low, 4=high)
			Degree of trust among citizens (Security)(1=high; 5=low)
	Social Protection and Welfare	Sickness and disability, old age, survivors, family and children	Pension age
			Basic income and social protections provided to climate refugees
		Unemployment	Unemployment Rate; Universal Basic Income %
		Housing	Availability of affordable housing (% satisfied)
			Availability of affordable housing to refugees (% satisfied)
		Social protection and social exclusion	Happiness
			Quality of Life (0=low; 100=high)
Environment and Health	Environmental Protection	Water waste management	Wastewater treatment (% of wastewater)
		Management against climate change effects	Management success after climate change events (e.g. natural disasters, flooding, rising sea levels)
		Pollution, abatement	Greenhouse gas emissions (CO_2 equivalents per GDP)
			Outdoor air pollution attributable deaths (deaths/100,000)
		Protection of biodiversity and landscape	Biodiversity and habitat (0=low; 100=high protection)
		Protection of agriculture, forestry, fishing and hunting	Access to affordable food
		Food security and methods of agriculture	Access to affordable food
			Undernourishment (% of population)

New Government Sub-Level Service or Detailed Category.

Function Themes	Sub-Level Functions	Detailed Services	KPI
Environment and Health (cont'd)	Health	Medical innovation breakthrough in products and services	Premature deaths from non-communicable diseases (deaths/100,000)
		Disease prevention/preventative care	Life expectancy at 60 (years.)
			Child mortality rate (deaths/1,000 live births)
		Public health	Deaths from infectious diseases (deaths/100,000)
Future and Progress	Ministry of the Future	Long term strategic investment and funding (e.g. in breakthrough fundamental technologies)	Percent of long-term funding investment in breakthrough fundamental technologies (% of GDP)
			Total domestic intramural expenditure on R&D during a given period as a % of GDP
			Domestic credit to private sector (% of GDP)
		AI human government transition and decision-making	Government decision-making with AI involvement (number of legislative cases)
		Collaboration teams (government and tech companies)	Level of collaboration between government and tech companies (1=low; 5=high)
		R&D on scientific discovery	Number of intellectual property patents per 100,000 Inhabitants
			Number of scientific and technical journal articles (per billion PPP$ GDP)
			Human and AI Researchers, full-time equivalence (FTE) (per million population)
		R&D on breakthrough fundamental technologies	Number of intellectual property patents per 100,000 inhabitants
		Innovation development and adoption	Percent of funding for long-term programs, more than 10 years in the future (% of GDP)

Function Themes	Sub-Level Functions	Detailed Services	KPI
Future and Progress (cont'd)	Education	Adult retraining and lifelong learning	Adult retraining credentials rate, at least every five years
			Government expenditure on adult learning and retraining (% of total education expenditure)
		Function solely dedicated to education reform planning and initiatives	Tracking success of education reform programs
		Access to knowledge through new technologies (e.g augmented implantables)	Access to affordable augmenting implantables (per 100,000 inhabitants)
		Pre-K to 12th Grade; University	Government expenditure on AR/VR in education (% of total budget)
			Tracking success of education reform programs
		Post-Secondary/University	Government expenditure on AR/VR in education (% of total budget)
			Tracking success of education reform programs
			Share of all tertiary graduates receiving credentials in skillsets that automation/ robots cannot perform better than humans

New Government Sub-Level Service or Detailed Category.

Future Government: The Interactions

For each government service category key government interaction themes are presented by time-period, along with the primary stakeholder needs served, and tangible examples of government interactions with citizens.

6.1
Interactions with Citizens

For presenting the evolving government interactions with its citizens in the future we are again using a plausible best-case scenario for the societal and innovation megatrends identified earlier. We reference the baseline of current government services and citizen needs/ expectations, and their intersection with innovation megatrends, to make the following projections.

2050-2071 — PLAUSIBLE BEST-CASE SCENARIO

BIRTH
Genomic health screened at birth (covered by our Government services)

Birth certificate part of global registry

EDUCATION
Augmented learning tools by government

Robot tutors subsidized

Virtual Ivy-League University (endowment)

TRANSPORT
Registration and regulation for aerial autonomous vehicles infrastructure

Space-ports usage (government managed and regulated)

LAND
Floating and Strato-cities regulation and monitoring

Land ownership part of global blockchain registry

Robot storage/housing

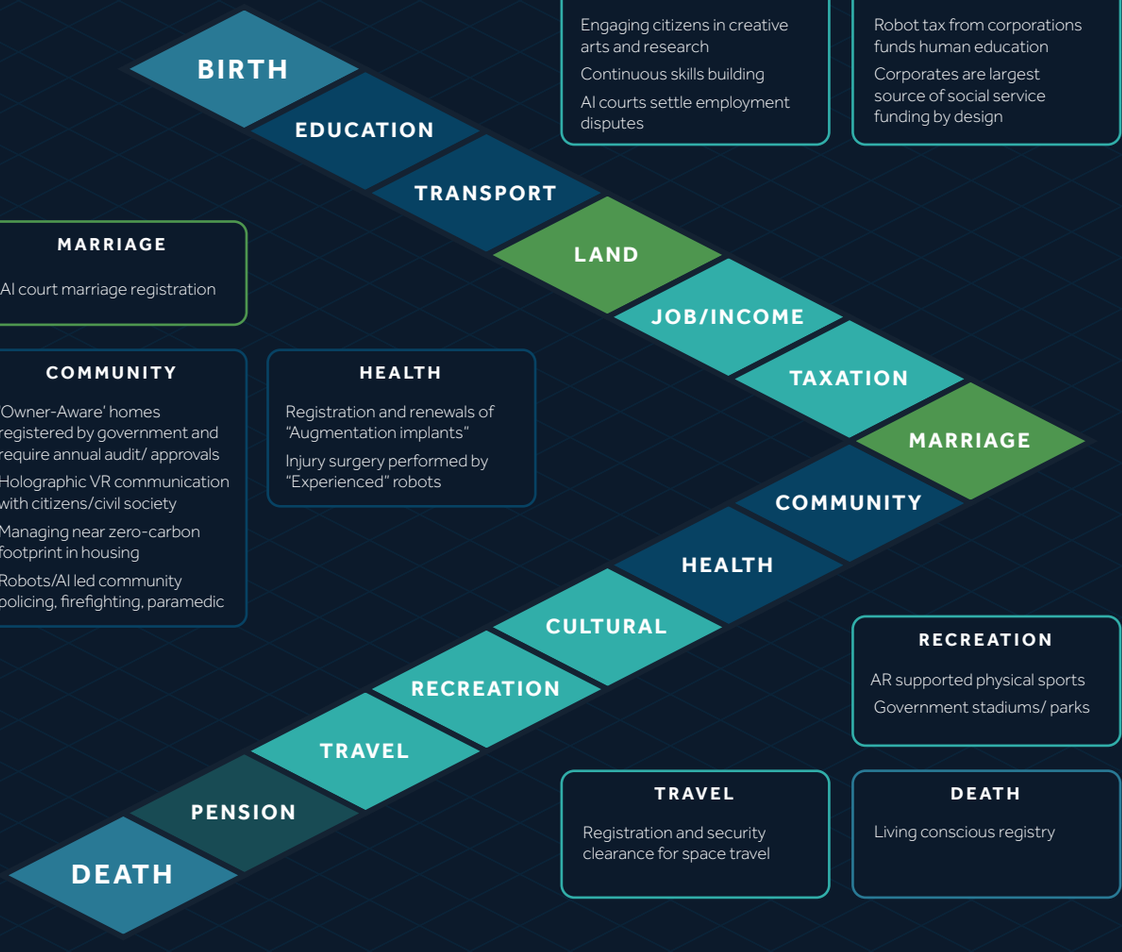
JOB/INCOME
Engaging citizens in creative arts and research

Continuous skills building

AI courts settle employment disputes

TAXATION
Robot tax from corporations funds human education

Corporates are largest source of social service funding by design



MARRIAGE
AI court marriage registration

COMMUNITY
'Owner-Aware' homes registered by government and require annual audit/ approvals

Holographic VR communication with citizens/civil society

Managing near zero-carbon footprint in housing

Robots/AI led community policing, firefighting, paramedic

HEALTH
Registration and renewals of "Augmentation implants"

Injury surgery performed by "Experienced" robots

RECREATION
AR supported physical sports

Government stadiums/ parks

TRAVEL
Registration and security clearance for space travel

DEATH
Living conscious registry

20 YEAR OLD, SINGLE
Completed vocational training on one of the 3 biggest orbital space-hubs. Works for a company that produces technology for cooling the planet.

COUPLE WITH CHILDREN
One works for a space mining company. Commutes home from space every six months to be with the family. The other is a VR platform based global teacher for early schooling.

COUPLE WITH NO CHILDREN
Jobless young couple; one of them is a military volunteer to receive special basic income. Were forced to migrate to an underwater city.

ELDERLY COUPLE
Couple aged just over 80. Volunteer workers. Middle-class.

The following three infographic fold-outs present select scenarios of how citizens could be interacting with government services across each of the three different time-periods covered in the Guidebook.

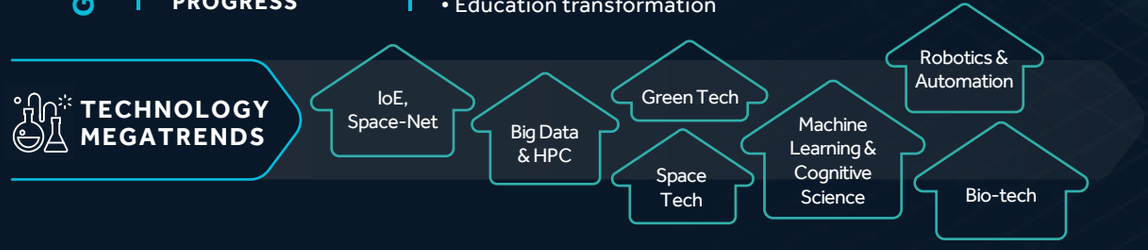
DIGITAL CONNECTIVITY ERA 2018-2030

2018-30 will see the maturity of the current "Digital Connectivity Era" characterized by connectivity based innovations led by Internet-of-Everything, Augmented Reality and Virtual Reality technologies. Expect floating farms, space mining missions, eco solar ships, assistive AR and VR therapies to be common.

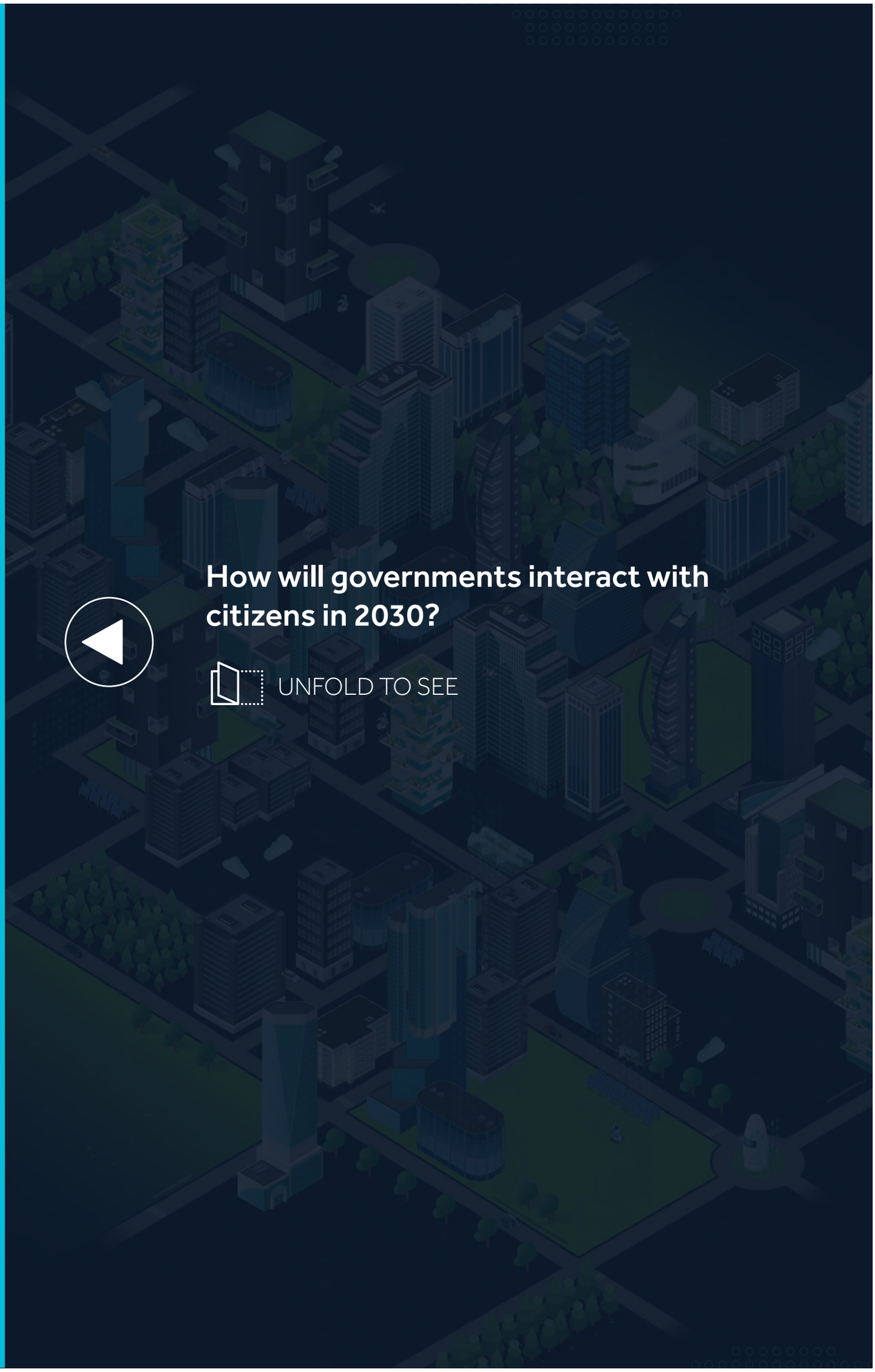
This infographic presents key innovation outcomes to impact government functions (below), and select citizen interaction scenarios (to the right) expected through 2030.

Innovation Outcomes for Government Function Themes

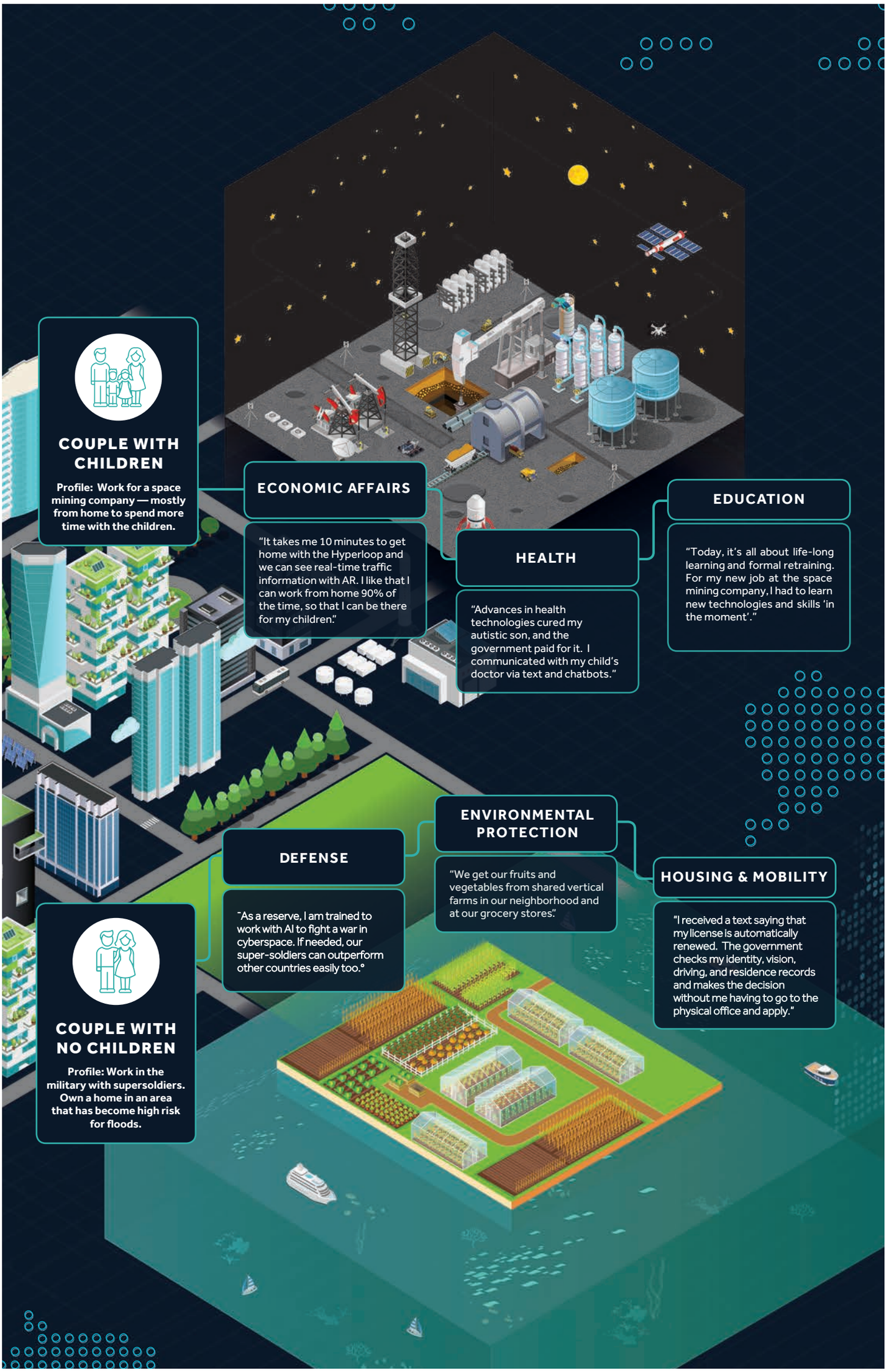
GOVERNANCE AND RESILIENCE	• Prescriptive analytics for governments • AI regulation/compliance • Climate Refugees	•Cyber-defense; Cyber-security
ECONOMY AND SOCIETY	• Gig/sharing economy • Job automation • Transformational industries (Energy, Transportation, Food, Space tech)	•Managing diversity •Social protection/Universal income
ENVIRONMENT AND HEALTH	• Climate change management	
FUTURE AND PROGRESS	• R&D on breakthrough technologies • Ministry of the Future • Education transformation	



Note: City representation based on plausible best-case scenario as per this Guidebook's analysis.
*Also assumes no "shock events" The city assumes most developed city of time period.


How will governments interact with citizens in 2030?
UNFOLD TO SEE


20 YEAR OLD SINGLE
Profile: Attends university. Likes to spend free time playing professional e-sports.
EDUCATION
"Most of my classes are through VR with human teachers and AI assistants. We took an international VR trip with our history professor yesterday. I love how personalized the lessons are! "
RECREATION & CULTURE
" I love how gaming and professional e-sports are now so immersive. The winning athletes win $1 million each! And more alternative sports are increasingly being invented, e.g. Frisbee Golf."
PUBLIC ORDER & SAFETY
"Predictive AI tools used by government services protect us from identity management fraud and cyber-crime."
ELDERLY COUPLE
Profile: Couple aged just over 60 years old. Actively engaged in co-creating societal solutions with government.
HEALTH
"My prescription bottles send me a reminder to take my pills and smart pills give my doctor an endless stream of information on how my body is performing, and reacting to the treatment."
GENERAL PUBLIC SERVICES
"Our government has increased budget allocation for improving elderly services including healthcare and social & vocational engagement."
ENVIRONMENTAL PROTECTION
"I am afraid that geo-political tensions will increase over the decreasing amount of food, water, and energy supplies for the world. As a proactivecitizen, I was part of a citizen group that co-created a solution with the government to reduce food and water waste by 90%."


COUPLE WITH CHILDREN
Profile: Work for a space mining company — mostly from home to spend more time with the children.
ECONOMIC AFFAIRS
"It takes me 10 minutes to get home with the Hyperloop and we can see real-time traffic information with AR. I like that I can work from home 90% of the time, so that I can be there for my children."
HEALTH
"Advances in health technologies cured my autistic son, and the government paid for it. I communicated with my child's doctor via text and chatbots."
EDUCATION
"Today, it's all about life-long learning and formal retraining. For my new job at the space mining company, I had to learn new technologies and skills 'in the moment'."
ENVIRONMENTAL PROTECTION
"We get our fruits and vegetables from shared vertical farms in our neighborhood and at our grocery stores."
DEFENSE
"As a reserve, I am trained to work with AI to fight a war in cyberspace. If needed, our super-soldiers can outperform other countries easily too."
HOUSING & MOBILITY
"I received a text saying that my license is automatically renewed. The government checks my identity, vision, driving, and residence records and makes the decision without me having to go to the physical office and apply."
COUPLE WITH NO CHILDREN
Profile: Work in the military with supersoldiers. Own a home in an area that has become high risk for floods.

THE NEW EXPLORATION ERA 2030-2050

The 2030-2050 time-period will be "The New Exploration Era." It will be marked by human capacity augmentation and AI technologies as well as space exploration, moving us from a "problem-solution" to an "opportunity-exploration" paradigm. Expect a near-space tourism sector, space mining, garden buildings, floating settlements and robot relationships to be common!

This infographic presents key innovation outcomes to impact government functions (below), and select citizen interaction scenarios (to the right) expected through 2050.

KEY SOCIETAL MEGATRENDS

- Climate change
- Urbanization/ Floating Megapolis
- Tech superpowers
- Cities' Significant Role
- Criminal AI
- Near elimination of current diseases

Innovation Outcomes for Government Function Themes

GOVERNANCE AND RESILIENCE
- Conscious cities (self-regulating)
- Cyber security; Criminal AI

ECONOMY AND SOCIETY
- Universal basic income
- Transformational industries (AI, Space tourism)
- Higher corporate taxes
- Social protection (automation driven job losses)
- Ethics and values

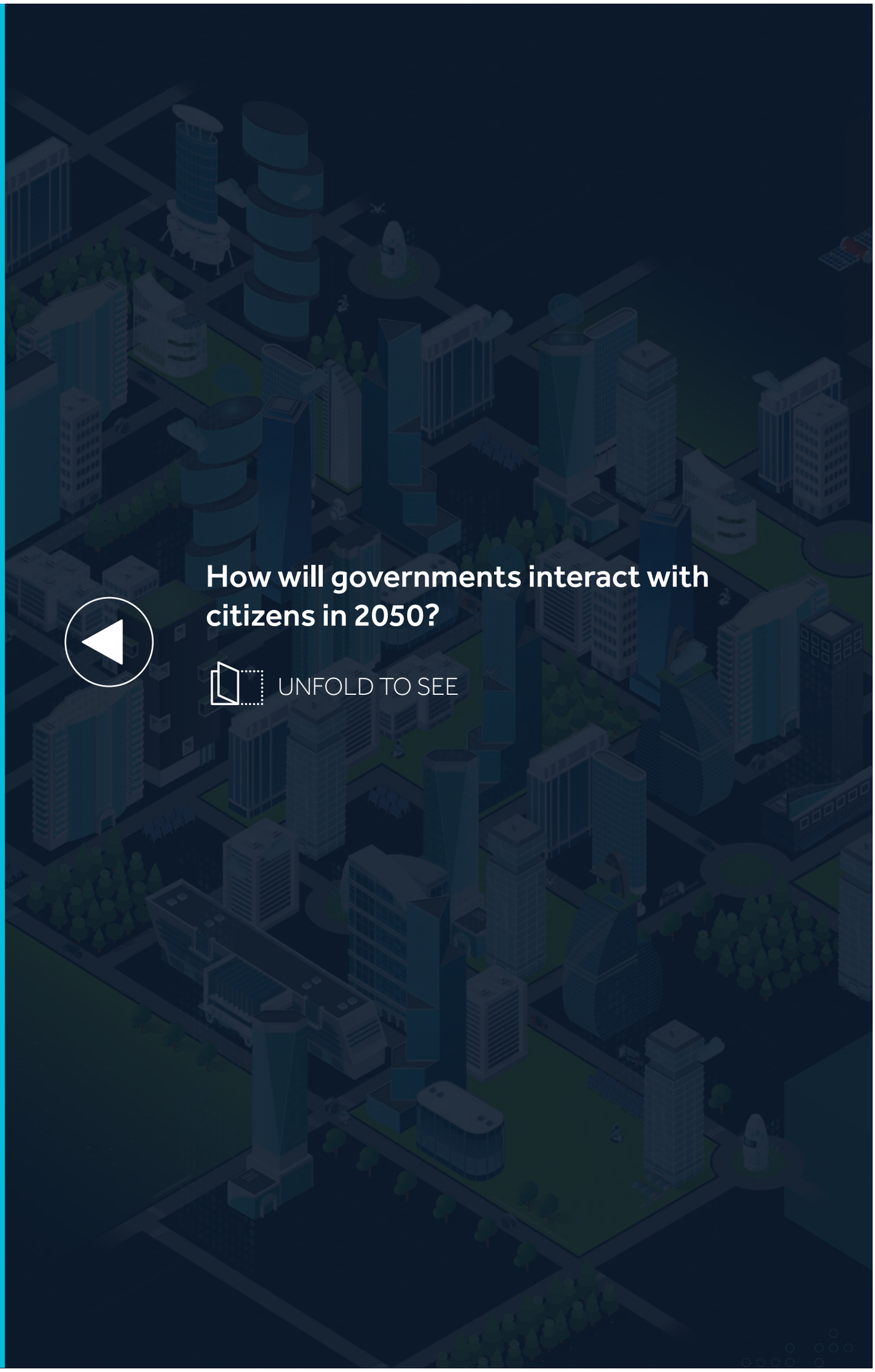
ENVIRONMENT AND HEALTH
- Majority renewables
- Climate change management

FUTURE AND PROGRESS
- R&D on breakthrough technologies
- Ministry of the Future

TECHNOLOGY MEGATRENDS

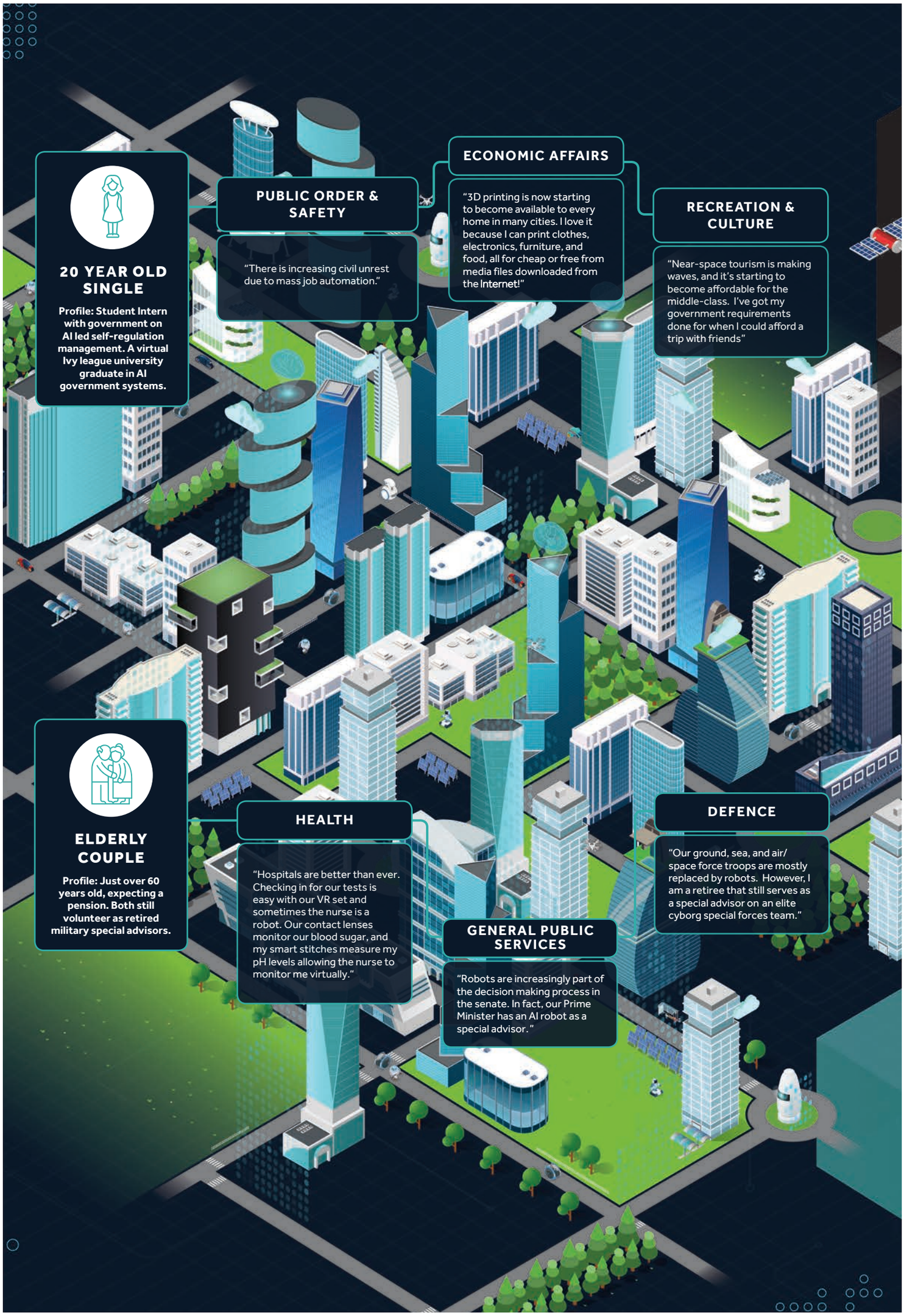
- Distributed Cloud
- Materials & Polymers
- Spintronics
- Genomics
- Quantum Computing
- Learning Systems
- Augmenting Systems

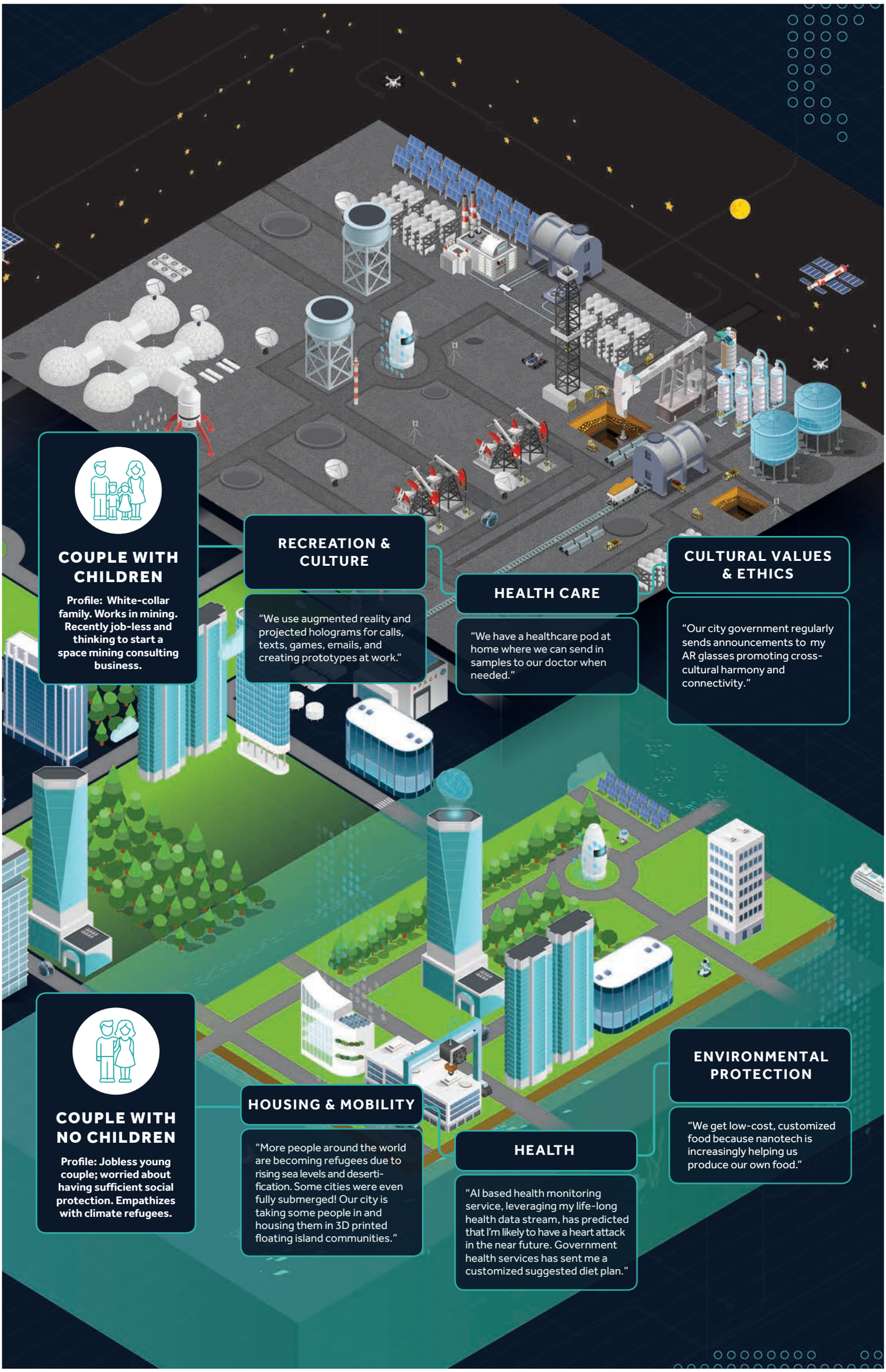
Note: City representation based on plausible best-case scenario as per this Guidebook's analysis.
*Assumes no "shock events" The city assumes most developed city of time period.



How will governments interact with citizens in 2050?

UNFOLD TO SEE


20 YEAR OLD SINGLE
Profile: Student Intern with government on AI led self-regulation management. A virtual Ivy league university graduate in AI government systems.
PUBLIC ORDER & SAFETY
"There is increasing civil unrest due to mass job automation."
ECONOMIC AFFAIRS
"3D printing is now starting to become available to every home in many cities. I love it because I can print clothes, electronics, furniture, and food, all for cheap or free from media files downloaded from the Internet!"
RECREATION & CULTURE
"Near-space tourism is making waves, and it's starting to become affordable for the middle-class. I've got my government requirements done for when I could afford a trip with friends"
ELDERLY COUPLE
Profile: Just over 60 years old, expecting a pension. Both still volunteer as retired military special advisors.
HEALTH
"Hospitals are better than ever. Checking in for our tests is easy with our VR set and sometimes the nurse is a robot. Our contact lenses monitor our blood sugar, and my smart stitches measure my pH levels allowing the nurse to monitor me virtually."
GENERAL PUBLIC SERVICES
"Robots are increasingly part of the decision making process in the senate. In fact, our Prime Minister has an AI robot as a special advisor."
DEFENCE
"Our ground, sea, and air/space force troops are mostly replaced by robots. However, I am a retiree that still serves as a special advisor on an elite cyborg special forces team."


COUPLE WITH CHILDREN
Profile: White-collar family. Works in mining. Recently job-less and thinking to start a space mining consulting business.
RECREATION & CULTURE
"We use augmented reality and projected holograms for calls, texts, games, emails, and creating prototypes at work."
HEALTH CARE
"We have a healthcare pod at home where we can send in samples to our doctor when needed."
CULTURAL VALUES & ETHICS
"Our city government regularly sends announcements to my AR glasses promoting cross-cultural harmony and connectivity."
COUPLE WITH NO CHILDREN
Profile: Jobless young couple; worried about having sufficient social protection. Empathizes with climate refugees.
HOUSING & MOBILITY
"More people around the world are becoming refugees due to rising sea levels and desertification. Some cities were even fully submerged! Our city is taking some people in and housing them in 3D printed floating island communities."
HEALTH
"AI based health monitoring service, leveraging my life-long health data stream, has predicted that I'm likely to have a heart attack in the near future. Government health services has sent me a customized suggested diet plan."
ENVIRONMENTAL PROTECTION
"We get low-cost, customized food because nanotech is increasingly helping us produce our own food."

THE TECHNO-HUMANITARIAN ERA 2050-2071

The 2050-2071 time-period is expected to be "The Techno-Humanitarian Era" marked by a shift in innovation efforts and global priorities towards redefining and empowering a new technology-enhanced humanity. Expect art to be a major sector with space hotels, and flying cars becoming commonalities. Adverse climate change effects, underwater cities, and space mining of resources will also be common.

KEY SOCIETAL MEGATRENDS

- Humanity begins to reverse climate change
- Ecological risks persist
- Tech super-powers
- Universal basic income
- Criminal AI
- Augmented Education

Innovation Outcomes for Government Function Themes

GOVERNANCE AND RESILIENCE

- Sentient cities (Artificial Intelligence driven)
- Cyber security; Criminal AI

ECONOMY AND SOCIETY

- Universal basic income
- Transformational Industries (AI, Space tech)
- AI labor relations
- Shared-profit corporations
- Social protection (family unit, tech/robot relationships)
- Ethics and values

ENVIRONMENT AND HEALTH

- Space waste management
- Climate change management

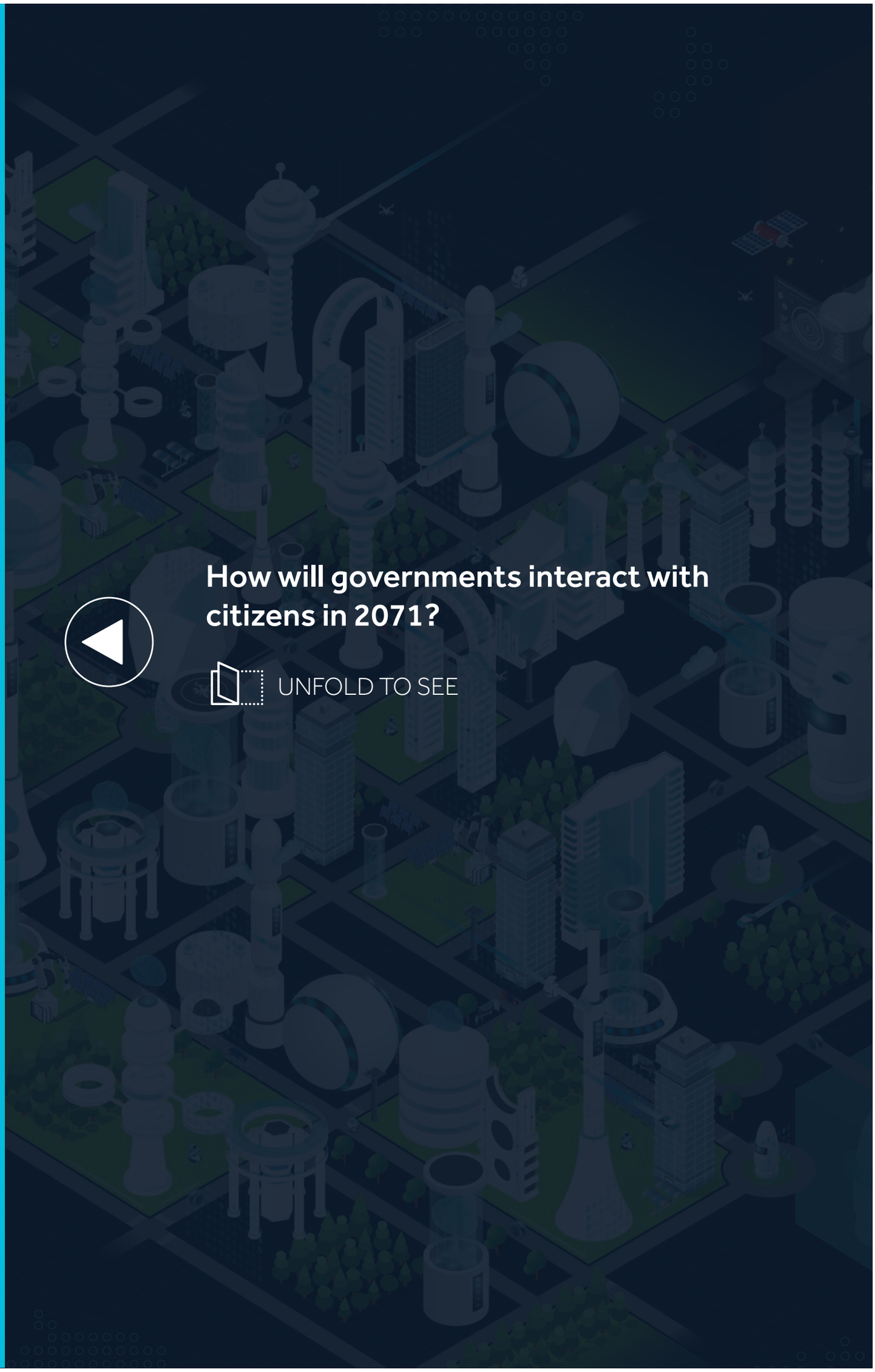
FUTURE AND PROGRESS

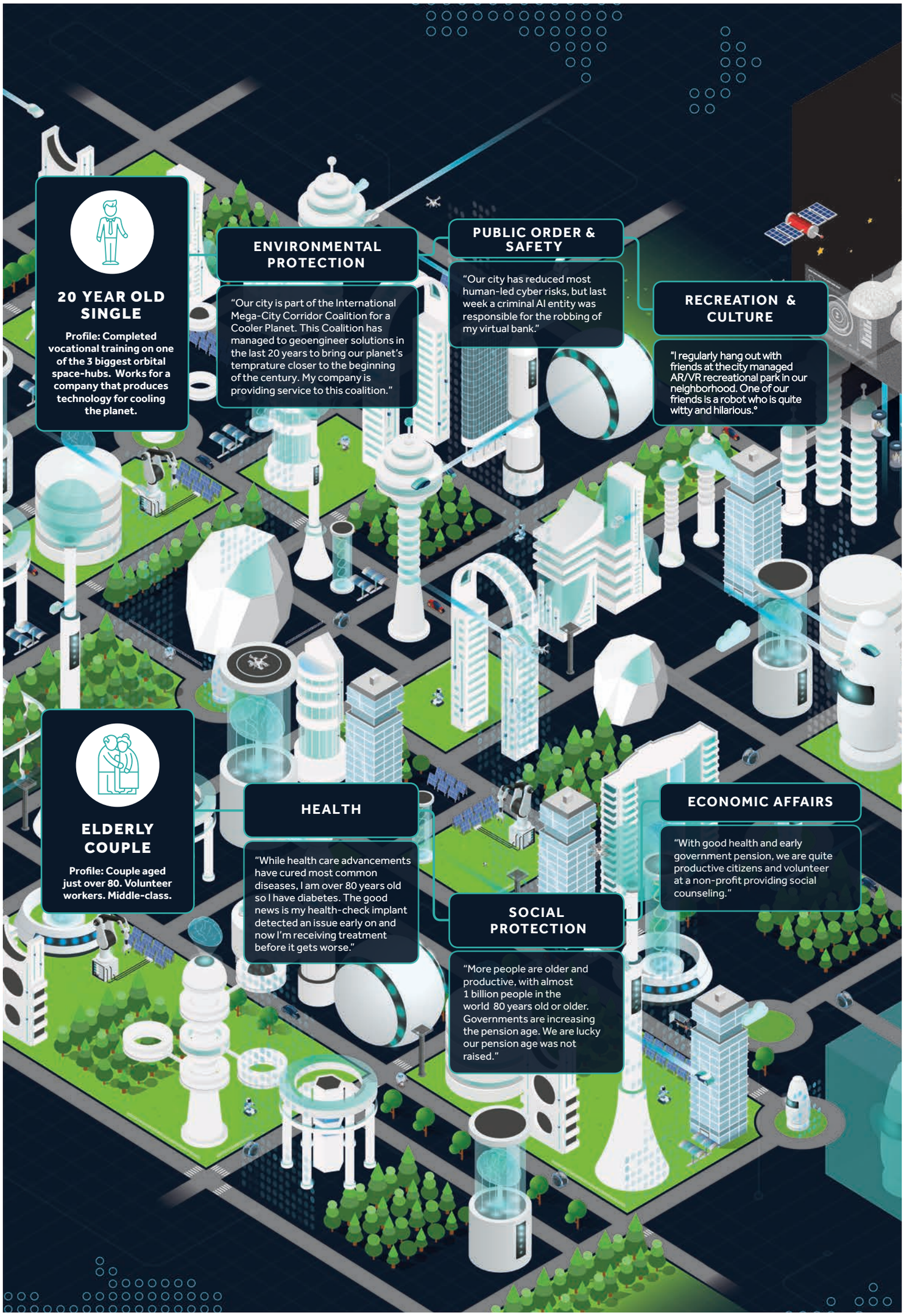
- R&D on breakthrough technologies
- Ministry of the future

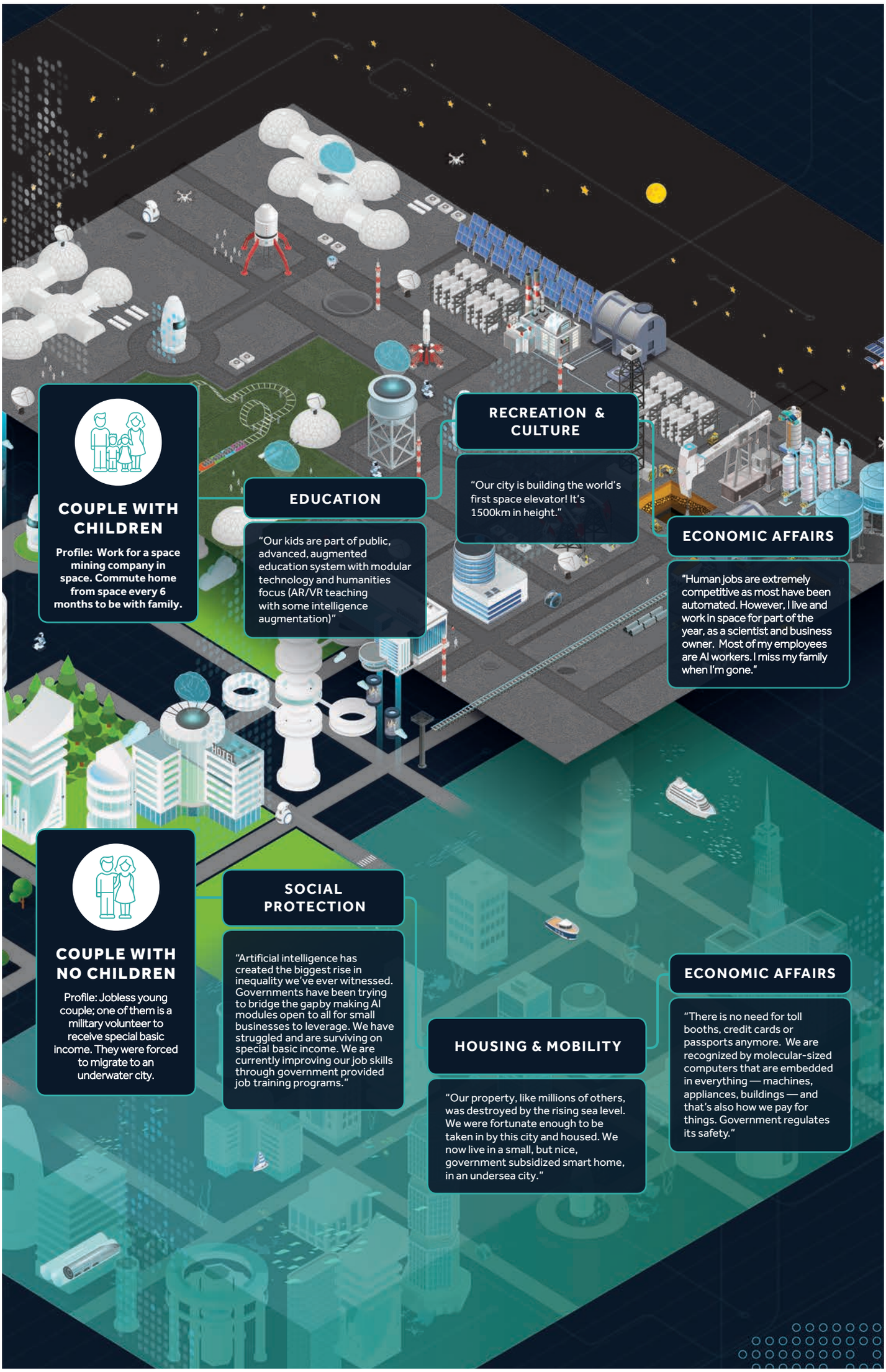
TECHNOLOGY MEGATRENDS

- Autonomous Aviation
- Concious Systems
- Space-Net
- Connected Human
- Materials & Polymers
- Nanotech in Body
- Space Tech

Note: City representation based on plausible best-case scenario as per this Guidebook's analysis.
*Assumes no "shock events" The city assumes most developed city of time period.


How will governments interact with citizens in 2071?
UNFOLD TO SEE


20 YEAR OLD SINGLE
Profile: Completed vocational training on one of the 3 biggest orbital space-hubs. Works for a company that produces technology for cooling the planet.
ENVIRONMENTAL PROTECTION
"Our city is part of the International Mega-City Corridor Coalition for a Cooler Planet. This Coalition has managed to geoengineer solutions in the last 20 years to bring our planet's temprature closer to the beginning of the century. My company is providing service to this coalition."
PUBLIC ORDER & SAFETY
"Our city has reduced most human-led cyber risks, but last week a criminal AI entity was responsible for the robbing of my virtual bank."
RECREATION & CULTURE
"I regularly hang out with friends at the city managed AR/VR recreational park in our neighborhood. One of our friends is a robot who is quite witty and hilarious."
ELDERLY COUPLE
Profile: Couple aged just over 80. Volunteer workers. Middle-class.
HEALTH
"While health care advancements have cured most common diseases, I am over 80 years old so I have diabetes. The good news is my health-check implant detected an issue early on and now I'm receiving treatment before it gets worse."
ECONOMIC AFFAIRS
"With good health and early government pension, we are quite productive citizens and volunteer at a non-profit providing social counseling."
SOCIAL PROTECTION
"More people are older and productive, with almost 1 billion people in the world 80 years old or older. Governments are increasing the pension age. We are lucky our pension age was not raised."



COUPLE WITH CHILDREN

Profile: Work for a space mining company in space. Commute home from space every 6 months to be with family.

EDUCATION

"Our kids are part of public, advanced, augmented education system with modular technology and humanities focus (AR/VR teaching with some intelligence augmentation)"

RECREATION & CULTURE

"Our city is building the world's first space elevator! It's 1500km in height."

ECONOMIC AFFAIRS

"Human jobs are extremely competitive as most have been automated. However, I live and work in space for part of the year, as a scientist and business owner. Most of my employees are AI workers. I miss my family when I'm gone."

COUPLE WITH NO CHILDREN

Profile: Jobless young couple; one of them is a military volunteer to receive special basic income. They were forced to migrate to an underwater city.

SOCIAL PROTECTION

"Artificial intelligence has created the biggest rise in inequality we've ever witnessed. Governments have been trying to bridge the gapby making AI modules open to all for small businesses to leverage. We have struggled and are surviving on special basic income. We are currently improving our job skills through government provided job training programs."

HOUSING & MOBILITY

"Our property, like millions of others, was destroyed by the rising sea level. We were fortunate enough to be taken in by this city and housed. We now live in a small, but nice, government subsidized smart home, in an undersea city."

ECONOMIC AFFAIRS

"There is no need for toll booths, credit cards or passports anymore. We are recognized by molecular-sized computers that are embedded in everything — machines, appliances, buildings — and that's also how we pay for things. Government regulates its safety."

Citizen Interactions in Detail

Governance and Resilience

General Public Services — Key Evolving Themes

2018-2030	2030-2050	2050-2071
The need for new foreign affair ecosystems gradually introduced.	The need for new foreign affairs ecosystems gradually introduced.	**The need for new foreign affair ecosystems continue to increase** due to power shifts to the East, potentially increasing influence from very wealthy businesses or private individuals, and perhaps from robot communities.
Major shifts in budget allocation, to innovation breakthroughs, climate change, social protections, and redistribution of education to adult learning.	**Major shifts in budget allocation continue.**	
	AI human governments, helping in decision-making.	
New business models to increase efficiency in government management, e.g. using blockchain to collect taxes	**Aging population will place pressure on government finances**, drawing attention away from other areas, e.g. defense and security.[1]	

1 PwC, Five Megatrends and Their Implications for Global Defense and Security.

General Public Services — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I read a tweet from our mayor today that stated that our city will secure a higher percentage of the budget to innovation, and climate change adaption. My friends and I are all for it	Our city has redistributed the education budget towards adult education — retraining people to obtain newly invented skill sets.	The city has budgeted to provide a major boost to a 'soft-landing' for anyone who loses their job fully due to automation.	Our government has steadily increased budget allocation to address elderly services, including health care and social and vocational engagement.
2030-2050	Robots are increasingly part of the decision-making process in the senate. In fact, our Prime Minister has an AI robot as a special advisor. Our mayor attended an international plastics conference to commit to global targets of removing an insurmountable amount of plastic in the ocean.	Our government is allocating more of the budget to permanent social protections for the unemployed due to automation. We were in white-collar jobs and now beneficiaries of this social protection. Formal merging of public and private sectors is helping government funding.	Our government is collaborating with other cities to discuss regulation and security of emerging brain-implant technology to be competitive. It's something we are watching out for, for ourselves and our children.	Government legislation is facilitating elderly use of augmenting implantables for the elderly
2050-2071	Bulk of city's education budget is funding augmented education and strengthening multi-sensory learning environment.	Most of us are active participants in government policy making through real-time policy input tools our Government has. We just contributed to our cities budgeting inputs.	Cities are gathering at the MegaCity Corridor Coalition for a Cooler Planet to set targets and geoengineering solutions to cool the planet further. We as a family are big supporters.	We have a robot assistant provided by government as part of the elderly care. These robots have their own robot community centers where they develop their skills and human interaction learning.

Defense — Key Evolving Themes

2018-2030

Moving towards cyberwars.

AI-human military task forces.

Increased disputes over food, or water and increased defense to protect those resources.[2]

Increased non-state attacks.

2030-2050

Cyber wars are the norm.

Military comprised of majority AI workers.

Shift in nature of armies, from conventional armies to increased extremism driven violence.

2050-2071

AI militaries, comprised of majority of AI, except for elite cyborg forces.

Increased geopolitical tensions may likely increase, due to power shifts to the East, cities gaining more influence, and robots likely gaining more influence.

2 PwC, Five Megatrends and Their Implications for Global Defense and Security.

Defense — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I finished some cyber security courses at the vocational college. There was a government program that easily helped me move over from information technology to cybersecurity and got me an internship working with the government.	As a reserve, I am trained to work with AI to fight a war in cyberspace, for our country. Also, if we need to, our super-soldiers can outperform other countries easily. International bodies are working toward practical and enforceable eliminations of nuclear, biological, and ecological weapons.	I worry about safety for our children because our country is fighting a war.	As a retired couple, we are regularly tracking growing geo-political tensions from decreasing amount of food, water, and energy supplies. We are anxious for our grandkid's future and are actively involved in input to the government on addressing these challenges.
2030-2050	It was so sad when we heard that the bioterrorism attack that wiped out 33 million people!	Our ground, sea, and air force troops are mostly replaced by robots. However, I'm part of an elite cyborg special forces team.	My city is increasingly gaining influence in the world as a Technology superpower, giving us an internationally secure place.	Extremism driven fighters seem to be more prominent than conventional armies. As a retired military person, I volunteer to advise cybersecurity personnel.
2050-2071	Global tensions are rising due to even more economic power shift to the East & space economy disagreements. African economies are also gaining economic power.		I'm involved in our governments Moon and Mars colony research program. We are planning for Mars' colonization in the next couple of decades. The Defense department is driving this initiative.	

Public Order and Safety — Key Evolving Themes

2018-2030

Emergency response increasingly leaning on more data and cutting-edge technology to do their jobs (e.g. big data, robo-cops).

Increased need for cybersecurity against cyber crimes and terrorism.

Increased security breaches for emerging technologies (e.g. IoT devices)

Increased social and civic unrest, e.g. from unemployment, financial collapse.

Emergency response for climate change effects, e.g. floods

2030-2050

Increasing AI emergency response workers.

Continued need for cybersecurity against cyber crimes and terrorism.

Increased security breaches for emerging technologies (e.g. artificial intelligence).

Increased social and civic unrest, e.g. from protectionism, negative reactions to diversity/pluralism.

Increased emergency response for climate change effects, e.g. hurricanes, extreme heat, desertification.

2050-2071

AI emergency response workers are the norm.

Increased security breaches for emerging technologies (e.g. brain implants, space elevator).

Increased emergency response for climate change effects, e.g. submersion of cities, unbearable temperatures.

Public Order and Safety — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I am concerned that predicting crime through AI analytics could profile innocent people. We started deploying better tools for identity management and online protection.	I am worried because there have been more security breaches through our IoE (Internet of Everything) connected home and work objects.	We saw the police and paramedics handle the highway accident very well yesterday. Its invaluable for them to be able to immediately draw on patient's medical history and diagnostics upon arriving at the scene.	I like that robocops and drones can help human police in our neighborhood, especially as they patrol dangerous areas. It seems like they now even work together on crime patrolling, and engage in dialogue with each other.
2030-2050	There was a riot in our city center last night. Some groups are gathering to protest against mass job automation. Things got pretty hostile.	More people have augmenting implants, but some people worry of hacking possibilities.	Computer attacks are not disappearing; rather, they are getting more complicated and expensive for our city government to manage.	There are over 10 million people living in our megacity. We stay away from dangerous areas because some are increasingly becoming a hotbed for extremism.
2050-2071	Our city has reduced most human led cyber risks by now, but last week criminal AI was blamed for robbing my virtual bank.	We were victims of a crime with a new type of weapons: a holographic jammer which disable all surveillance cameras, traffic lights, AR, and electronic parts of our body.	Our neighborhood children were visited by the robot units from the police, firefighters, and paramedic services.	

Economy and Society

Economic Affairs — Key Evolving Themes

2018-2030	2030-2050	2050-2071
Gig economy: The nature of jobs changing from 9-to-5 to temporary, freelance day tasks.	**Continued job automation,** mostly now white-collar jobs, with new jobs emerging	**Automation for most jobs** from 2018, while new jobs become prominent.
Job automation, mostly for blue-collar tasks and jobs and white-collar tasks.	**New sources of large economic growth** from newly invented industries (e.g. brain implants, fusion power).	**New sources of large economic growth** from newly invented industries (e.g. space tourism and space mining)
New sources of economic growth from newly invented industries (e.g. self-driving cars, AR platforms of communication).	**Other industries may likely become less relevant** (e.g. fuel energy)	**Other industries may likely become less relevant** (e.g. trade in finished products (clothing, etc.), trade in resource-rich raw materials, or traditional forms of education)
Need for regulating emerging technologies, e.g. blockchain	**Significant global GDP growth**	**Trade in data and intellectual property** likely to increase.
	Need for regulation of emerging technologies, e.g. health innovations	**Significant global GDP growth**

Economic Affairs — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	My pizza delivery came today from a delivery drone, and was paid directly from my mobile wallet.	I like using VR spaces for meetings and conferences, especially when it is more convenient to my schedule. VR is starting to feel 100% real. Government subsidies have really assisted its growth.	I like that it takes me 10 minutes to get home with the Hyperloop. AR provides us with real-time traffic information. I also like that I can work from home 90% of the time, so that I can be there for my children.	Government has a self-driving car service to take us to the community center. It saves us car parking, and commuting costs.
2030-2050	3D printing is now starting to become available to every home in many cities. I love it because I can print clothes, electronics, furniture, and food, all for cheap or free from media files downloaded from Internet! It's a good source of income and government regulates it to ensure quality standards	Most of us have a small, superfast personal device that runs our homes, transports us, manages our lifestyles, bank accounts, and education.	Robots have taken over all tasks in many sectors, e.g. lawyers, nurses, and pharmacists. But goods and services are cheap now making basic living either cheap or free. Having a job is more out of a passion for a higher income, than a basic need.	This year, it was announced that AI officially surpassed human intelligence. I wonder what the next 50 years will look like. The news says that robots will add tremendous growth to global GDP. Times are changing!
2050-2071	As a young person, I am excited about income from solar power satellites, the orbital electricity grid, lunar and asteroid mining, weightless manufacturing, and space tourism which is leading to an enormous growth of private sector ventures in space for our city.	I don't have a job because most of them are automated, even AI surgeons. However, there are hundreds of thousands of humans working in space communities in orbit, on the moon, and on Mars. Space-related inventions have created new industries.	There is no need for toll booths, credit cards or passports anymore. We are recognized by molecular-sized computers that are embedded in everything — machines, appliances, buildings, and artificial eyes and zoom lenses — and that's also how we pay for things.	Compared 20 years ago, we are very productive and healthy 70 year olds. Augmented implants are also enabling us to be productive part of the economy.

Housing and Mobility — Key Evolving Themes

2018-2030

Managing climate change effects on housing e.g. damaged properties or property loss, migration beginning due to rising sea levels and natural disasters.

Smart homes gradually and increasingly integrating with connected objects to the internet, making the home more seamless and automated.

2030-2050

Increased climate change effects on housing, e.g. more forced migration due to rising sea levels and natural disasters.

Changing housing market likely due to new transportation innovations, increased VR environments, and less human workers.

Urbanization pressures continue, initiating new housing solutions (e.g. large skyscrapers).

Smart homes becoming a central focus of living: increasingly integrated with connected objects to the internet, making the home more seamless and automated (e.g. virtual secretaries, domestic robots, energy bills and basic living expenses to become vastly cheaper).

2050-2071

Increased climate change effects on housing (e.g. even more mass forced migration due to rising sea levels, unlivable temperatures, and natural disasters).

Urbanization pressures continue, initiating new housing solutions (e.g. possibly large skyscrapers, city-in-a-pyramid, earth-scrapers, floating cities, undersea cities).

Smart homes increasingly integrated with connected objects to the internet, making the home more seamless and automated (e.g. holographic areas to meet with friends, self-sufficient energy, and food supplies).

Buildings could likely become vastly cheaper to build with 3D printing, super-materials, and live regeneration materials.

Housing and Mobility — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I live in a 3D printed dorm. The best way to desalinate water became available so now our city and homes don't have to worry about reduced water supply.	I was part of a citizen group that co-created a solution with the government to reduce food and water waste by 90%.	I am able to check on the baby through a smart monitor that gives me real-time information on my baby's breath, skin temperature, and body position.	Domestic robots and virtual assistants help our family with cooking, and cleaning, and taking care of us in our old age.
2030-2050	Self-cleaning and self-repairing clothes are a life saver. We love where we live. It's actually a self-repairing skyscraper that is as strong as steel and light as carbon fiber.	Ever since humans discovered a clean, safe, unlimited, and cheap energy to power our world, our electricity bills have been ultra-inexpensive.	Robot communities and housing districts are increasing. More people around the world are becoming refugees due to rising sea levels. Some cities were even fully submerged!	Biotechnology, nanotechnology, and closed-environment agriculture is now feeding the world.
2050-2071	Today, most humans live in Asia and Africa (80% of world population by 2100) and their megacities are pressured by urbanization bulges, such as adequate affordable housing for all.	We produce our own electricity, store it, consume it, and sell it back to other people or the grid.	Urbanization bulges are driving new city landscapes (earth-scrapers, floating cities, underwater cities). Virtually all homes are served by robots and are self-sustaining (in food, water, and energy).	Many people around the world lost their property and are forced to migrate due to climate change effects, such as city submersion, unbearable temperatures, and desertification.

Recreation and Culture — Key Evolving Themes

2018-2030

New communication tools: People are likely to chat, text, and communicate with friends and coworkers using a new set of technologies that could replace TV and phones (e.g. VR, AR).

Entertainment and sports is likely to become more immersive, interactive, and personal with AR VR, and gaming platforms.

2030-2050

Subscription economy: people own less and experience more.

VR environments more likely to feel 100% real by this point.

New robot communities may begin to become more common.

Robot relationships: People may have increasing friendships with robots.

2050-2071

New forms of tourism (e.g. space tourism, underwater tourism)

New recreation tools: People will begin to use multi-sensory learning environments for recreation that will need to be regulated for safety and security.

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Recreation and Culture — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I love how gaming and professional e-sports now is so immersive. I get to participate and interact on a whole new level. The winning athletes win $1 million each! And more alternative sports are increasingly being invented, e.g. Frisbee Golf.	My friends and I like to meet up in the VR café when our location or time is constrained.	I used to go to the city community center for play dates for my children, but we now sometimes use VR spaces.	I know kids these days like to gather in VR environments but we still like doing things the old-fashioned way. We enjoy meeting our friends for breakfast and coffee in person.
				Our government has gamified our city tours with AR.
2030-2050	I used AR to help me compose music and also choreograph a dance routine .		Films now are a collection of VR and Mixed Reality.	Space tourism is making waves, but for now, it's still for the rich and upper middle class.
	VR environments look 100% real now.		We use AR projections and holograms for chats, calls, texts, emails, games, and work prototypes.	Robots are writing best-selling books. I read a few already.
2050-2071	Tourist companies are just starting to take middle-income passengers to space. I went on my first tour!	Instead of meeting up with friends at cafes, my apartment has a built-in 3D hologram space where we can meet.	Our city is building the world's first space elevator! It's 1500km in length. But we have to overcome major legal and financial hurdles— requiring international agreements on safety, security and compensation in the event of an accident or terrorist incident.[3]	We don't see as much wildlife in zoos anymore (many got killed off), but we do have a holographic pet in our home.
	Connectivity and the safety of technology has increased. Augmented reality is the norm for most tasks and entertainment.	There is more emphasis placed on the arts and on experiences.		

3 Will Fox, "The First Space Elevator is Becoming Operational," Future Timeline, accessed September 10, 2017,

Cultural Values and Ethics — Key Evolving Themes

2018-2030

Religious and community services will likely experience a low level of change. We will likely see an uptake in AI automating operational tasks.

Increased extremist groups due to political or social pressures of feeling left behind.

Pockets of social and civic unrest, e.g. from negative reactions to ethnic and religious diversity/pluralism.

2030-2050

Religious and community services will likely experience a low level of change.

Peaceful coexistence of religion will be sought out.

Ethical concerns arise from technological advancements and lack of regulation.

Increased possible social and civic unrest, from negative reactions to ethnic diversity/pluralism.

2050-2071

Religious and community services will likely experience a low level of change.

Religious affiliation of people expected to be at a high 85% of worldwide population.

Peaceful coexistence of religion will be sought out.

Ethical concerns arise from technological advancements and lack of regulation.

Possible social and civic unrest from negative reactions to ethnic diversity/pluralism.

Cultural Values and Ethics — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	There was a big riot in our city today between different ethnicities.	We do not want to have children, at least not for the next 10 years. Many people in our city either have 1 child or none so far.	I experienced a work identity crisis when I lost my job, but after a spiritual quest to find myself, I've since decided to spend more time with the ones I love, and more time for giving back to society, based on my passions and values.	There was a government approved robot leading my friend's funeral today. I have mixed feelings about this! I wonder if robots will start automating some of the tasks for staff in the future.
2030-2050		Our city government sent us a real-time 'referendum' message to my AR glasses to vote 'yes' or 'no' on the legislation.	Equality is becoming even more important in our melting pot city where equal rights for all may exist.	My doctor wants to 3D print an organ to replace my liver.
2050-2071	Some people and even entire regions will remain more conservative, perhaps even deeply religious, but this will be seen as a lifestyle choice rather than as law.		Smaller households are the norm now, due to lower fertility. I think this trend will increase in the future and we will see the world's population stabilize soon.	By this point in time, the world may be more peaceful.

Social Protection and Welfare — Key Evolving Themes

2018-2030

Protections for basic income, especially for young populations, due to job automation and mass employment, until people can be retrained and switch careers, or enter the freelance economy. Most people affected will likely be blue-collar workers.

Social protections for people who lose their properties and/or are forced to migrate, due to climate change.

2030-2050

Protections for basic income from long-term mass unemployment, due to job automation of white-collar jobs.

Medical, social, and pension protections for increasingly aging populations.

Basic protections starting to reduce. We will likely see a rise in basic living becoming cheap or free, also from inexpensive goods and services automation (education, housing, health).

Social protections for a mass number of people who lose their properties and/or are forced to migrate, due to climate change.

2050-2071

Social protections is likely to increase due to the large rise in inequality from AI advancements creating haves and have nots.

Social protections for a mass number of people who lose their properties and/or are forced to migrate, due to climate change.

Social Protection and Welfare — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	Our city has budgeted to provide a major boost to a 'soft-landing' for anyone who loses their job fully due to automation. Right now, it's mostly blue-collar full jobs. Each person will get a temporary basic income and a free retraining education program	AI is now being used to help poorer communities forecast environmental hazards through predictive planning. I also get hired for daily task jobs through the government mega-freelance task database to cover my expenses.	Advances in health technologies cured my autistic son, and the government paid for it.	Advances in health technologies treated my wife's heart disease, and the government paid for it.
2030-2050	I feel bad because there is a large income inequality gap between the mega slums and middle-income families in some parts of the world. Our city is recreating our Charter/ Constitution, even to include autonomous citizens.	The government in our city continues to provide basic income 'soft landing' protections for those who lose their jobs, mainly white collar workers.	Some families from poor communities are now able to power their homes, keep businesses open, and run vital medical centers, from the breakthrough in energy. There is a possibility that international bodies will work towards an enforceable World Declaration of Human Rights.	Over 60% of people in my city are 60+ years. The government has pushed back the age of pension, and we are not happy with that.
2050-2071	Internet became a right of citizenship in our city. This is a natural step in social protections for all.	AI has created the biggest rise in inequality I've ever witnessed between the haves and have nots. The haves are the ones who control the best of AI Governments have made strides in bridging the gap by making AI modules open to all.		Almost 1 billion people in the world are 80 years old or older (in 2100) and require social protections (income and healthcare) from the government.

Environment and Health

Environmental Protection — Key Evolving Themes

2018-2030

Critical prevention phase of further climate change effects.

Reducing emissions and consumption until major innovation breakthroughs can become economically feasible.

Management of further climate change effects (e.g. increased natural disasters, increased flooding, pockets of migration from rising sea levels, providing citizens with enough water, food, and energy equitably, and at affordable prices).

Funding: Large funding investments towards major innovation breakthroughs (e.g. renewable energy). Also, grappling with how to pay for climate change prevention and effects.

2030-2050

Prevention: 100% renewable energy cities.

Management of further climate change effects (e.g. increased natural disasters, increased flooding, mass migration from rising sea levels and submersion, providing citizens with enough water, food, and energy, loss of biodiversity and habitat, saving the oceans from plastic).

Funding: Continued large funding investments towards major innovation breakthroughs and geoengineering initiatives.

The rights of others (plants, animals, the planet) could be more protected legally than they are now.

2050-2071

Funding: Continued large funding investments towards geoengineering efforts.

Management of further climate change effects (e.g. unlivable temperatures, mass migration from rising sea levels and submersion, loss of biodiversity).

Environmental Protection — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	I became a vegetarian (I like meatless burgers) to reduce food-related carbon emissions, but many other people haven't made similar commitments.	Precision farming has brought more water and food to our city, in a time of water scarcity.	Farms in the ocean cultivating algae are becoming more common in our city.	We don't use plastic packaging anymore to wrap our food because a more effective product has been invented, saving the environment and our oceans, and making plastic packaging obsolete.
	Some people are complaining that the government is raising prices to prevent further climate change disasters. I wish more people understood the severity of the situation.	We have plenty of vertical farms in our neighborhood and in our grocery stores, where we obtain fruits from.		
2030-2050	There are batteries and other products out there now that suck in CO2 emissions.	We get low-cost, customized food because nanotech is increasingly helping people to produce food on their own.	Many of us had to migrate due to desertification in our city, and global food prices shot up 30% because of the land degradation. Luckily though, food innovations helped bring the price down.	Initial geoengineering efforts are just beginning to cool the planet and repair the ozone layer.
2050-2071	Our city produces more renewable energy than it uses.	Geoengineering efforts continue to cool the planet further and repair the ozone layer.	Our government sends out robots to carry out environmental missions for humanity.	Our beaches still have more plastic than fish. There is an international alliance working to solve this problem. There are also a few civil society institutions working with the alliance.

Health — Key Evolving Themes

2018-2030

Beginning of major healthcare treatment discoveries (e.g. curing Autism, Alzheimer's).

Funding: Increased focus and funding towards major health innovation breakthroughs.

The rise of DIY healthcare, e.g. cheap diagnostics, communicating with doctors via text, chatbots.

2030-2050

Continued focus on major healthcare treatment breakthroughs becoming economically feasible (e.g. curing or preventing heart disease)

The continued rise of DIY healthcare (e.g. home healthpods, sending in samples to doctors from home).

Need for hospital transformation (e.g. rooms with screens and phones, online healthcare, self-service kiosks for blood and urine tests, AI integration for nurses and doctors).

2050-2071

People are likely to be older, but healthier.

Focus could be more likely on preventative care, and perhaps de-aging. Life-spans are increasing.

Health — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	The government provided us with easy, cheap diagnostic tools to check for diseases, e.g. Ebola, Zika. This saved me money and time. I found the entire process efficient. The nurse told me they use blockchain and AI to mine our patient records ahead of time.	Last year, I bought subsidized customized antibiotics. The ingestible micro-robots repaired my internal body injuries. Bio implants are starting to help patients reduce death from chronic diseases, e.g. heart disease.	I communicate with my child's doctor via chatbots. Bionic hands and eye chips are starting to trend among humans.	My prescription bottles send me a reminder to take my pills. Smart pills give my doctor an endless stream of information on how my body is performing, and reacting to the treatment.
2030-2050	I feel reassured my parents are safe because they have a smart walker and smart self-driving wheelchair at home. The robot nurse who bathes my elderly mother is also there for any emergencies.	We have a healthcare pod at home where we can send in samples to our doctor when needed.	I am glad that we will most likely live longer than our grandparents, thanks to advancements in healthcare. Some people are even uploading their memories and virtual selves to the internet to live forever!	Virtually no one under 80 dies of cancer anymore.
2050-2071	Health care advancements have cured many, if not most, diseases of the last half-century. However new diseases have emerged due to climate change effects as one area. Still, people are living longer and healthier lives. Healthcare services are becoming less critical than in previous generations, at least for people under 80 years old. Healthcare is now focusing more on preventative care, any new diseases or public health challenges from urbanization and worsening climate change effects.[4]			

4 https://www.weforum.org/projects/healthy-city-partnership

Education — Key Evolving Themes

2018-2030

Education reform is critical to meet the needs of newly invented industries, and freelance gig economy.

New learning tools and methods, e.g. more virtual, personalized, customized learning curricula. Global education accessibility through AR/VR proliferation.

Redistribution of education budget towards strong adult learning and lifelong learning programs.

2030-2050

Further education reform is critical to meet the needs of newly invented industries, and increasing job automation.

Continued focus on adult learning and retraining.

New-normal e.g. high level of technology education as baseline; possible virtual Ivy League universities, increasing AI virtual assistants and tutors; automating tasks of human teachers.

AI/VR teachers: Human led VR teaching assisted with AI tools will have to be integrated in the education system.

2050-2071

Augmented education: AI teaching supplemented with human VR teaching and multi-sensory learning environments will be mainstream

AI and cyborg meta-intelligence could likely become a central theme in education.

Education — Sample Interactions

Time Period	 20 year old single	 New couple, without children	 Couple with children	 Elderly couple
2018-2030	Much of my learning is done online or through VR meet-ups with our teachers and peers. I like how it's so personalized; I don't find school boring anymore! Our teacher even takes us on international VR journeys.	Things are different now. It's all about life-long learning and retraining at least every five years. Many times, I had to learn new tech and skills 'in the moment' but my boss tells me that the ability to gain knowledge is more important than the knowledge itself.	I decided it was okay for my child to have a robot-fuzzy-friend called Kizzy. Kizzy teaches her the alphabet and helps her learn how to share her toys. Kizzy's curriculum is personalized to my daughter's abilities.	N/A
2030-2050	Some people are deciding that they don't need to work as much as the last generation did (others are working more). They are fine with their income, and choose to spend more time leisurely, or learn the skills they need to follow their passions.	Retraining and gig economy programs are still in place from last generation, but as robots replace more and more jobs, this education system needs reforming.	Ordinary citizens are just starting to become cyborgs, affording brain implants, but it is still for the rich or for people in high positions.It is still expensive, but it is causing a major education gap in mega-intelligence. People say it may disrupt future educational systems.	N/A
2050-2071	More people have augmentable implants in their brain, making them more intelligent than humans. Education as we knew it in past generations needs to be totally transformed if we want it to stay relevant. Children and adults will need to be trained on how to use their brain implants. Also in this age, the 'arts' have been flourishing.			

6.2
Interactions with Businesses and Civil Society

Businesses will see a major transition to gradual job automation, changing the nature of work and hiring.

They will also become even more of a central part of the conversation solution to major global challenges, joining civil society and international bodies. Most large businesses will be "taxed" higher as their roles in human employment/jobs are reduced. They will also increasingly be expected to support long-term investments to create solutions fast enough to avert disastrous effects (e.g. climate change). Key evolving government services themes are as follows:

"Competition these days is not just between countries, but between countries and global corporations. And corporations are winning, taking over government from inside so that it no longer forms an effective check on their power relative to people."

Tim O'Reilly
Founder and CEO
O'Reilly Media
Author of the book "WTF? What's the Future and Why It's Up to Us"

Key Evolving Themes

2018-2030

Job automation, mostly of blue collar tasks and jobs, and white-collar tasks. Also, new ways of temporarily hiring people for tasks.

Long-term funding in major innovation breakthrough investments needed.

Newly invented industries as well as disruption of existing industries.

Possible compliances: e.g. climate change, robot tax.

Cybersecurity breaches.

Climate change effects, e.g. on business properties, supply chains, consumers.

2030-2050

Job automation, mostly of white-collar jobs.

Continued long-term funding in major innovation breathrough investments needed.

New sources for large economic growth: more new industries.

Cybersecurity breaches.

Increased climate change effects, e.g. on business properties, supply chains, consumers.

Businesses and civil society increasingly part of the conversation and solution to critical global challenges — ESG (Environmental, Social and Governance).

2050-2071

Most large corporations will be mixed-profit mandated by government and increasingly part of the conversation and solution to critical global challenges.

Smaller workforces, but more inexpensive goods and services.

Continued long-term funding in major innovation breathrough investments needed.

New sources for large economic growth: more new industries.

Increased climate change effects, on business properties, supply chains, consumers.

Preparation: Initial Action Plan

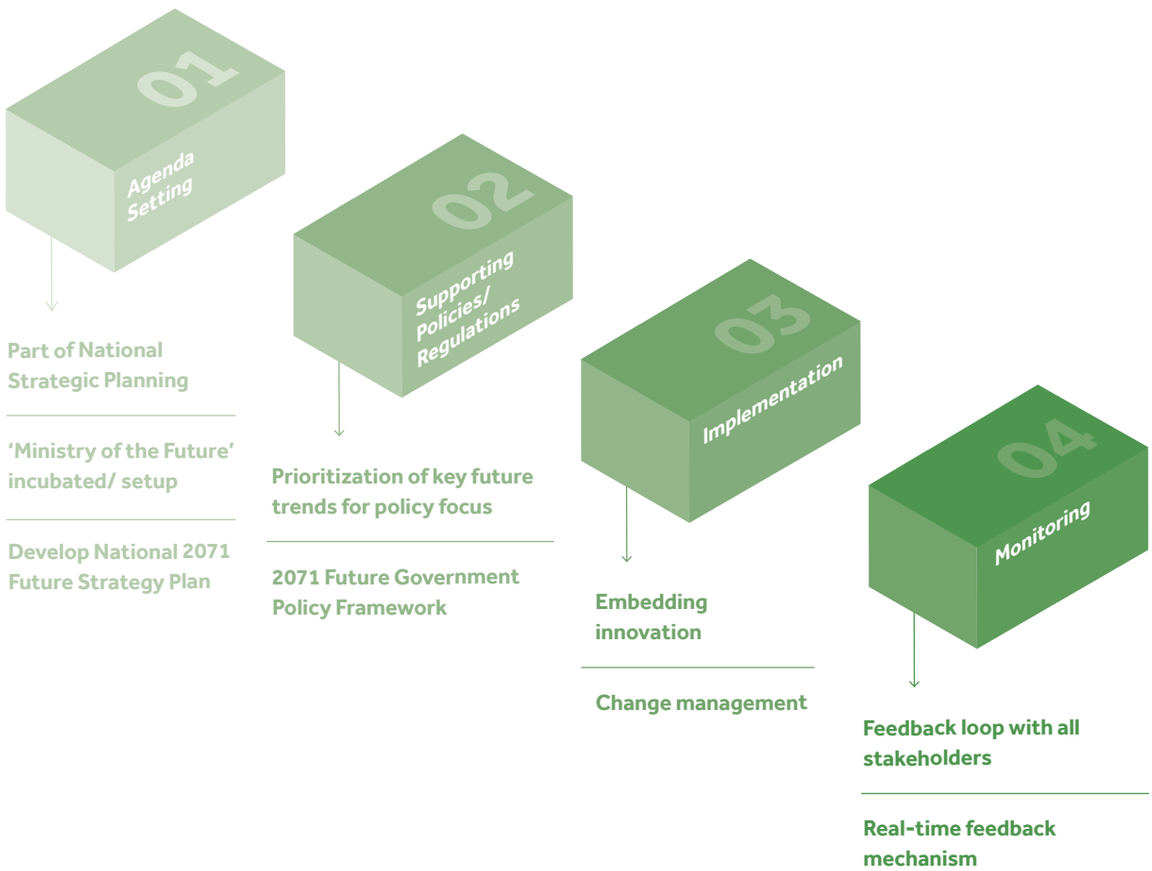
A guidebook towards the future can be envisioned by building on necessary long-term changes for each government function highlighted earlier. This section presents an overarching framework, with high-level, yet concrete initial steps for government leadership to begin with, alongside core areas of policy adjustments for prioritization. This could eventually lead to an action plan that addresses long-term drivers that sustain through national, political and leadership cycles, while serving the long-term benefits of stakeholders.

7.1
Strategic Planning

As highlighted earlier, powerful long-term future megatrends require different strategic approaches that need to start now to provide the kind of long-term solutions required.

While most governments will have a 5-10 year horizon for their national strategic plans, the acute long term needs presented in this guidebook, require key adjustments to be incorporated into the national strategic planning and implementation process. Presented here is an initial framework for future readiness that covers key areas of: agenda setting, policy prioritization, implementation, and monitoring (See Figure 22).

Figure 22 SUSTAINED FUTURE READINESS STRATEGY MODEL



"Put people to work. Build next generation infrastructure while we still can. Accelerate transition off fossil fuels. Begin climate mitigation by massive reforestation projects, white rooftops, genetic engineering to help species adapt as well as to accelerate carbon capture. Create new systems for continuous, on-demand education."

Tim O'Reilly
Founder and CEO
O'Reilly Media
Author of the book "WTF? What's the Future and Why It's Up to Us"

Agenda Setting

Governments should set a robust agenda for future-readiness, predicated on rigorous research and scenario planning.

Incorporation into National Strategic Planning

A future agenda and focus need to be prioritized within the national strategic planning process of governments, led by top government leadership. Based on the theme "Building for the Future," a detailed review of KPIs and benchmarking is required, with short-term, mid-term and long-term strategy considerations.

"Ministry of Futures and Change Management"

A non-partisan, independent body should be created, with a dedicated budget to effectively plan for the future. This body should prepare comprehensive recommendations for establishing new departments and enhancing existing ones. A key mandate for this body should be defining and executing proper change management measures, which support all government organizations and lead teams in making organizational changes to support related future strategies.

Develop a National 2071 Future Strategy Plan

Led by the assigned ministry or government department, a 50 year national future strategy plan should be developed. This should include efforts around regional and international cooperation to share resources and best-practice, such as between the OECD members and other multi-lateral bodies.

Policy Prioritization

Governments need a framework to adapt policies as needed, prioritizing the most critical changes.

Prioritize Future Policies Agenda

While this Guidebook presents general areas of future policies and their prioritization, the reality is that each country has its own unique needs and circumstances. Therefore, the responsible body should setup a task force or department that evaluates customized scenarios of the future, based on their own circumstances. They should consider short-term, medium-term and long-term scenarios, along-side core trends, and the varying needs of different stakeholders. A key starting point would be leveraging the model and scenarios spearheaded by the World Government Summit. WGS also intends to provide customizable tools — allowing individual governments to evaluate the details of various specific scenarios, based on their unique conditions, and model the resultant impact on their nation and citizenry.

Develop Supportive Policies/Regulations

Developing a comprehensive framework will be critical to ensuring readiness for all anticipated developments over the next fifty years. However, the top most trends will need to be prioritized for immediate focus, with close evaluation of automation's impact on stakeholders, climate change and the regulation and supportive development of new technologies. The 'Future Government Policy Framework' section outlines how various areas of government can deliver on priority policy areas as they prepare for the future agenda.

Implementation

Governments will need to drive the implementation of major future strategies across the internal ecosystem, as well as all stakeholders.

Embed Innovation

To ensure long-term adoption of future strategic innovations across the internal ecosystem of departments and agencies, Government led policies on incentives, regulation and oversight will need to be developed; as well as technology tools and other means of delivery and processes. Similarly, programs and incentives to encourage adoption of innovations by all stakeholders (citizens, business community and civil society) will have to be supported by Government where needed.

Drive Change Management

As highlighted earlier, governments will have to ensure that future strategic initiatives are culturally managed for effective adoption. In some countries, a behavioral shift in key areas may be needed to support adoption and effective implementation of desired strategies.

Monitoring

Ensuring adequate adaptation.

Engage Stakeholders

A strong feedback loop will be needed, inclusive of technologists, innovators, citizens, and civil society, necessitating the use of councils, focus groups, and surveys.

Leverage Technologies

Real-time feedback with stakeholders requires technologies to be leveraged fully, to ensure connectivity. As identified in this Guidebook, crowd-sourcing of stakeholder inputs in policy making is a strong interest for stakeholders, as demonstrated by the survey responses, and technologies are key enablers for efficient incorporation of stakeholder engagement.

"Create a continuous inclusive real-time local, national, and global consultative processes as well as accessible 'achievement accounts' for political leaders and public servants. Also seriously invest in a global collaborative decision-making apparatus — human and technical — based on reliable forecasting, prototyping, and testing of competitive desired futures."

Robert Jacobson , Ph.D. (UCLA)
Chairman & Strategist
Atelier Tomorrow Inc.

7.2
Future Policy Framework

Based on the overall research and analysis of the Guidebook, a variety of key innovation megatrends need to be critically addressed by many governments, through national and international policies.

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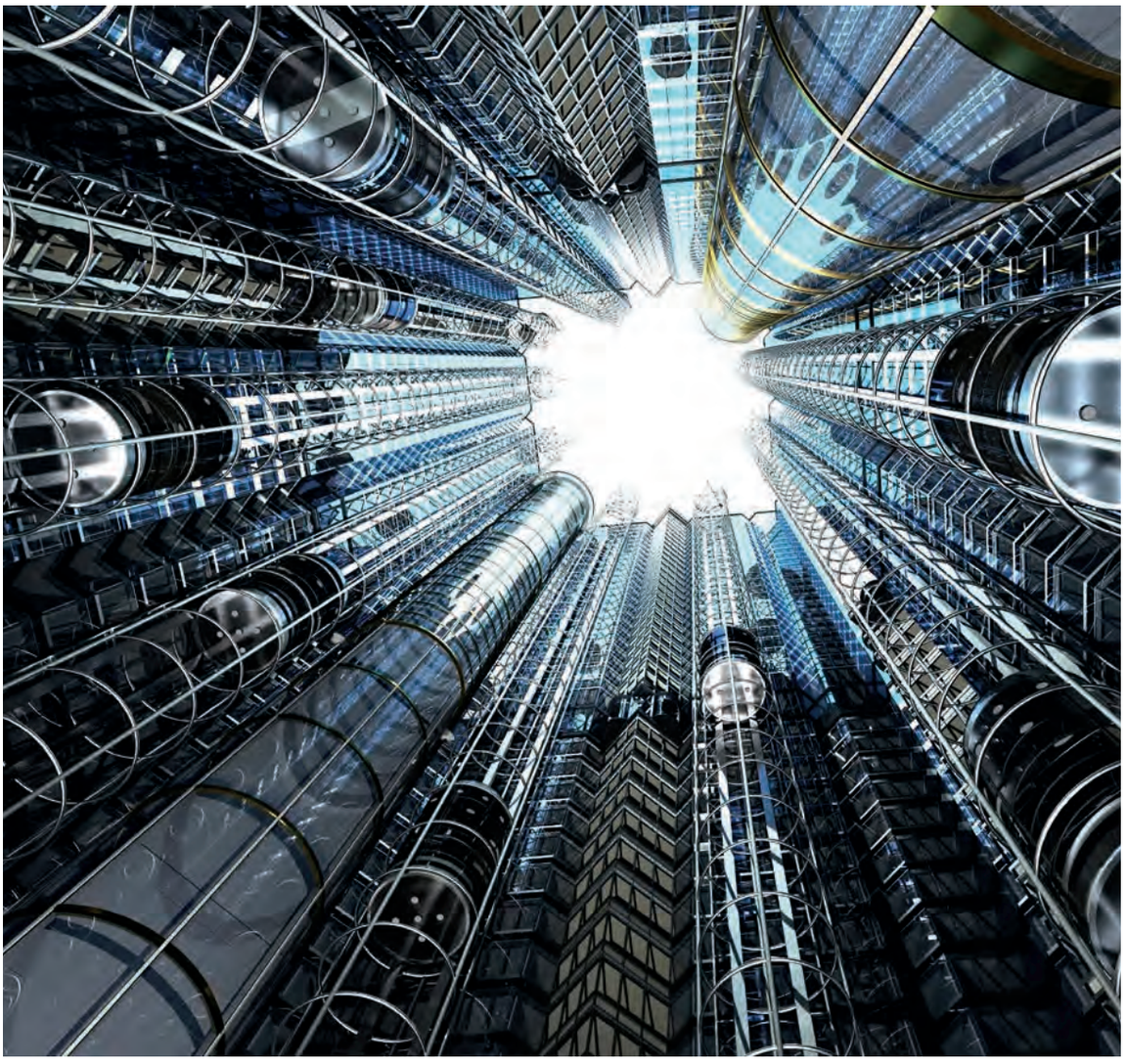

The strategic planning framework lays out how to prioritize and contextualize driving future trends for national relevance and setting up a platform to address these trends. Presented here is a recommended structure of policy development that needs to be evaluated as part of an overall Future Government Policy Framework, linked to the strategic planning highlighted earlier.

The following framework presents main government function changes for the future, as highlighted earlier (Section 5.1) that need policy level attention. Key policy areas to address include:

a. Developing a strategy as it pertains to broadening government functional capacity

b. Introducing regulations

c. Assessing the timing, and understanding of economic and resource impact, to guide prioritization

d. Development of emergency planning procedures and mechanisms

e. Assessing and managing societal impact

The framework also proposes the role governments should play in addressing the Megatrends, by defining the role as follows:

- **'Adapt'** to trends that require government to create policies and strategy to address a limitation.
- **'Support'** positive trends, for which government policies need to invest, to develop and realize the full benefits of the trend.
- **'Correct'** trends that need intervention to address the risks.

"Carbon emissions are not practically obvious to the average citizen today. They see the benefit of working on this for somebody in 2050 but don't expect to pay for it. So, it is a bit tricky. It is more of what we can do economically that is fair today to the average population as well as in 30 years' time."

Dr. David Kingham
CEO
Tokamak Energy Ltd

2071 Government Policy Framework

Function Themes	Future Trends Policy Drivers* (From section 5.1)	Key Areas to Address	Relevant Department	Government Role		
				Adapt	Support	Correct
Governance and Resilience	**Immigration (Climate Change Refugees)**	• Economic/ Resource Impact • Societal Impact • Regulation • Government Service Impact • Emergency Planning	• General Public Services	■		
	Artificial Intelligence & IoE Led Government Services	• Economic/ Resource Impact • Government Service Impact	• General Public Services		■	
	Citizen Engagement: (AR/VR/Instant Communication)	• Societal Impact • Regulation • Government Service Impact	• General Public Services		■	
	External Affairs	• Regulation (International) • Economic/ Resource Impact • Societal Impact • Government Service Impact	• General Public Services • "Ministry of Future & Change Management"	■		
	Cyber Security; Cyber Defense & Criminal AI	• Economic/ Resource Impact • Government Service Impact • Emergency Planning	• General Public Services	■		
	Managing Diversity	• Societal Impact • Government Service Impact	• General Public Services		■	
Economy and Society	**Job Transformation/ Universal Income**	• Economic/ Resource Impact • Societal Impact • Regulation • Government Service Impact	• Economic Affairs • Labor Affairs • Social Protection & Welfare	■		

Function Themes	Future Trends Policy Drivers*	Key Areas to Address	Relevant Department	Government Role		
	(From section 5.1)			Adapt	Support	Correct
Economy and Society (cont'd)	**Mixed Profit/Public-Private Corporations**	• Economic/ Resource Impact • Societal Impact • Regulation	• Economic Affairs • Environment Protection • Social Protection & Welfare			
	New & Transforming Industries: AI, Robotics; Space Industries; Green Energy; Autonomous Transportation; Sustainable Food/ Agriculture; Comm (AR/VR); DIY Healthcare	• Economic/ Resource Impact • Societal Impact • Regulation	• Economic Affairs • Labor Affairs • New/Evolving Industry Department • Environmental Protection			
	Artificial Intelligence (AI) Labor Affairs	• Economic/ Resource Impact • Societal Impact • Regulation • Government Service Impact	• Economic Affairs • Labor Affairs • "Ministry of Future & Change Management"			
	Social Protection & Cultural Values	• Economic/ Resource Impact • Societal Impact • Regulation • Emergency Planning	• Social Protection & Welfare • Labor Affairs • Public Safety			
Environment and Health	**Climate Change Management**	• Regulation • Economic/ Resource Impact • Emergency Planning • Social Impact	• Environment Protection • Social Protection & Welfare • Economic Affairs • "Ministry of Future & Change Management"			

Function Themes	Future Trends Policy Drivers*	Key Areas to Address	Relevant Department	Government Role		
	(From section 5.1)			Adapt	Support	Correct
Environment and Health (cont'd)	**Future Waste Management**	• Regulation • Economic/ Resource Impact • Emergency Planning • Social Impact	• Environment Protection • Social Protection & Welfare • Economic Affairs • "Ministry of Future & Change Management"		■	
	Resource Scarity Management (Land, Water, Food etc)	• Economic/ Resource impact • Societal Impact • Regulation • Government Service impact • Emergency Planning	• Environment Protection • Social Protection & Welfare • Economic Affairs • "Ministry of Future & Change Management"			■
	Advanced Preventative Healthcare/ Augmentation Health-Tech	• Economic/ Resource Impact • Societal Impact • Regulation	• Health Affairs • "Ministry of Future & Change Management"		■	
Future and Progress	**Education Reform & Technologies**	• Economic/ Resource impact • Societal impact • Regulation	• Education Departments • "Ministry of Future & Change Management"		■	
	Public/Private R&D on Breakthrough Technologies	• Economic/ Resource Impact • Societal Impact • Regulation • Government Service Impact • Emergency Planning	• "Ministry of Future & Change Management" • Economic Affairs • Environment Protection • Education, Health, Social Protection		■	

7.3
Concluding Overview

In conclusion, we summarize the key future policy areas that governments need to address today across the four theme categories of government functions. The Guidebook has presented these priorities as initial areas to evaluate further. Subsequent planned tools and resources will further assist governments in being more resilient as they navigate the challenges the future could bring.

Highlighting core areas by government function themes

Governance and Resilience will require active government support for AI adoption and enhanced citizen engagement to ensure an acute understanding across the board. Risk mitigation related to drastically increased immigration and new technology-enabled criminal activity will also be necessary.

- Climate change effects, as well as man-made catastrophes, will necessitate new regulations to ensure the government effectively addresses catastrophes and can handle mass migration. This includes background checks, sustainable housing and social integration
- Supporting the increasing diversity will be a critical area, addressed at several levels, starting at early education
- Technology will bring with it substantial criminal risks. Ensuring appropriate skillsets and attention in law enforcement and technology investments will enable effective detection and enforcement
- The government will need to substantially invest in its own capabilities as a priority, managing the risks associated with slow adaption by enabling a culture of change at many levels of society

Environment and Health, already a top priority for many governments, but will require an ecosystem of regulation and planning overseen by the government.

Healthcare systems, whether nationalized or private and regulated, will need to incorporate technologies to ensure the health needs of an aging population can be cost-efficiently addressed.

Economy and Society will require substantial support in the development of new industries, but also management of the employment consequences.

As new technologies and industries are explored, with governments and corporations naturally competing in trade and business, the side effects of automation on jobs must be managed. A universal basic income strategy is needed to protect society's most vulnerable members.

R&D on breakthrough technologies is an immediate area of focus near-term strategic focus by the government, and a collaboration among businesses, civil society and government. This collaboration should be supported by substantial investments and robust guidelines.

Preparing the workforce for an automated world will necessitate substantial review of the education system, with new regulations to ensure adequate preparation for the future.

Glossary

3D Hologram
A three-dimensional image or animation, created with photographic projection, that exists freely in space without the need for 3D glasses.

3D Printing
Printing objects in the third dimension by depositing material layer by layer in a manner similar to an inkjet printer.

Adverse Effects
Undesirable effects of new innovations or technologies.

Artificial Intelligence (AI)
Computer systems that are able to perform human-like tasks, reasoning, and behavior. AI can take the form of smart algorithms/software, intelligent robots, or sophisticated automated machines.

Augmentation
The process of making or becoming greater in size or amount. Human augmentation is generally used to refer to technologies that enhance human productivity or capability.

Augmented reality (AR)
A live view of a physical, real-world environment whose elements are projected by computer-generated sensory input such as sound, video, text, maps, graphics or GPS data.

Augmented education
Teaching through interactive multi-sensory virtual and augmented environments (see 'augmented reality').

Augmenting systems
Completely immersive, multi-sensory virtual and augmented environments.

Best-case scenario (Innovation outcomes)
The most probable best innovations outcome to occur in the future, forecasted from analyzing best-case scenarios from key societal and available technology drivers.

Big data and HPC/SOC
The large and growing database of consumer and transaction information generated from everyday activities. HPC (high performance computing): the products and technologies used to achieve the computational power needed to analyze big data. SOC (system-on-a-chip technology): micro-scale high performance computing.

Biotechnology
The use of biological processes for multiple purposes, e.g. genome medicine

Blockchain
A decentralized, incorruptible public ledger that records all transactions that take place on a network, making it transparent, accessible, and currently unhackable.

Civil Society
Key government stakeholders representing NGOs, community organizations, and professional associations.

Climate refugee
A human-being forced to flee their home or country, due to severe climate change inflicted damages.

Cloud computing
A place for data and applications to be stored on the internet instead of a person's own server or personal computer.

Cognitive cities (prescriptive)
Cities that become learning cities and use prescriptive analytics for governments.

Combinational technology explosion
A combination of technologies accelerating and converging at an exponential rate, e.g., machine learning and biotechnology.

Connected human
A human connected through many technology devices e.g. wearables, that create completely immersive, multi-sensory virtual and augmented environments.

Conscious cities (predictive)
Advancements in big data and the Internet of Everything that lead to more intelligent self-regulating cities, performing complex functions.

Conscious home
A home that is aware, responding to its occupants by adapting to best suit their needs, with minimal configuration. The home is more intelligent, digitized, and functional, as smart home technologies emerge.

Criminal AI
When artificial intelligence commits an offence punishable by law that was not explicitly directed by its human operator.

Desertification
When fertile land becomes desert, typically as a result of drought, deforestation, or inappropriate agriculture.

Digital/smart cities (descriptive)
A city that uses information and communication technologies to increase its operational efficiency, engagement with the public, and the quality of government services and citizen welfare.

Digitization of consciousness
AI biotechnology and neuroscience eventually allowing people to authorize digital copies of their mind to the internet.

Geoengineer
A large-scale effort to artificially modify the earth or its environment, especially to counteract global warming.

Gig/sharing economy
A labor market with short-term or freelance jobs, as opposed to permanent jobs.

Homo-augmentus 1.0 (exo-augmentation)
The increased progression of technologies on the exterior of the body used for functions, such as wearables, headsets, and hearables.

Homo-augmentus 1.5 (endo-augmentation)
The increased progression of technologies on the interior of the body used for functions, such as implantable devices to perform organ functions for medical enhancement.

Homo-augmentus 2.0 (bio & neuro-augmentation)
The aggressive progression of genomics biotech and nanotech technologies in the body or brain, used for functions such as genetic enhancements and implantables to upload a person's consciousness to the internet.

HPC
(see 'big data').

Human-machine affinity
When humans develop a strong bond or companionship with artificial consciousness.

Innovation megatrends
Innovations creating future outcomes forecasted to impact all aspects of society, resulting from societal and technological megatrend drivers.

Internet of things (IoT/IoHT/IoE)
The idea that any physical object can connect to the internet and communicate with other objects or relay information to people or systems.
IoHT — Internet of Health Things.
IoE — Internet of Everything.

Key performance indicator (KPI)
A measurable value that demonstrates how effectively an institution is achieving key objectives or reaching its targets.

Machine learning
When an artificial intelligent machine learns on its own and improves by experiences, without it necessarily being explicitly programmed.

Mixed reality
The merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real-time.

Nanotechnology
The engineering of systems at the molecular scale to manufacture macroscale products with atomic precision.

New appetites
Innovations or technologies creating a new desire or need.

Occupant-aware home
Housing-as-a-service emerges where people can choose to freely move between a wide option of homes without owning or renting any one of them.

Quantified self
Individuals having access to real-time data.

Quantum computing
The use of quantum-mechanical states, and the manipulation thereof, to both store and perform operations on data, hence outperforming supercomputers.

Self-aware robots
(see 'singularity')

Shock event
An unexpected or unpredictable event that significantly affects an economy or nation, either positively or negatively.

Smart cities
(see 'digital/smart cities')

Social listening
A large number of social media interactions captured as a 'snapshot' to determine people's sentiment on a particular topic.

SOC
(see 'big data')

Societal megatrends
Major societal forces driving global shifts to reorganize and redesign society, businesses, institutions, and therefore governments.

Space mining ('asteroid mining')
Extracting raw materials and minerals from asteroids and other minor planets, which are brought back to be used on Earth.

Sentient cities
Advancements in AI, quantum, Internet of Everything, and systems that are able to feel or perceive, will lead to cities that are adaptive and predictive, reducing the need for human governance.

Singularity
A time forecasted in the future when artificial intelligence will supersede human intelligence.

Space-net
Internet connectivity between people on Earth and in space.

Spintronics
Electronic spin-orbit technology revolutionizing smartphones, smart technology, and the Internet of Things.

Strato-megapoli
Cities, with populations exceeding 10 million or clusters of adjacent cities with populations exceeding 25 million, that are situated extremely high in the sky, or into the Earth's atmosphere.

Technological megatrends
Technological forces disrupting all disciplines, economies, and industries.

Transformational industries
Industries that will be disrupted significantly and go through the most dramatic changes due to technology.

Universal basic income (UBI)
A form of social security where citizens/residents of a country receive a regular, unconditional sum of money from the government.

Virtual reality (VR)
a computer technology that uses headsets to simulate an artificial, 3D visual or other sensory environment.

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