EVOLVING JOBS IN THE URBAN WATER SECTOR

Keynote Lecture for the Institute for Environment and Sustainability,
Lee Kuan Yew School of Public Policy
National University of Singapore

By

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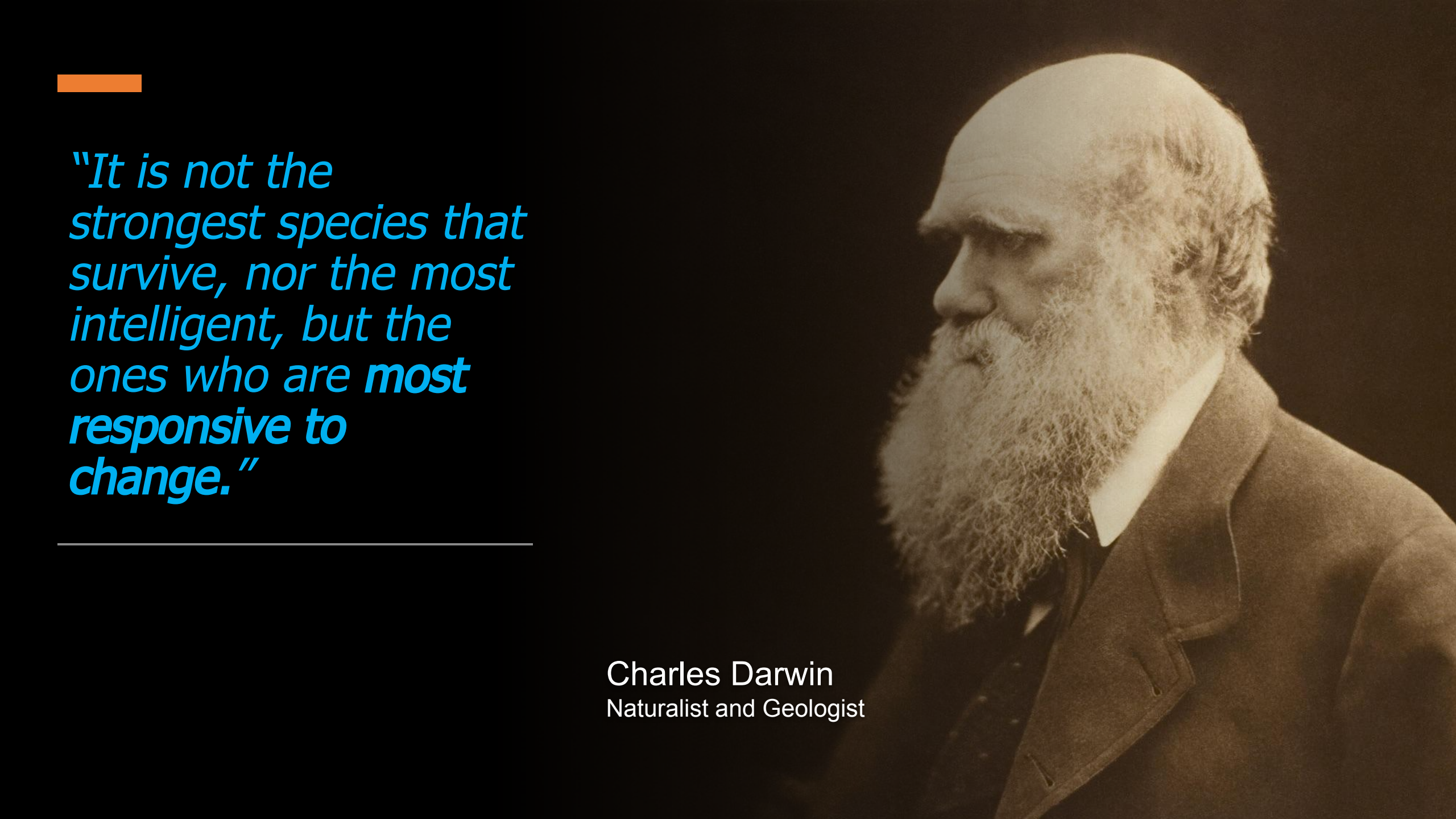
WatSan Analytics

February 23, 2024

*"It is not the strongest species that survive, nor the most intelligent, but the ones who are **most responsive to change.**"*



Charles Darwin
Naturalist and Geologist

Key Messages

- Water utilities in urban areas face significant and unique challenges with **transformational impact** on human capital.
- The workforce **must adapt** to the water utility of the future.
- Addressing the sector's workforce challenges require a **strategic approach**.
- A glimpse of the **emerging competencies** required by the water utility of the future.

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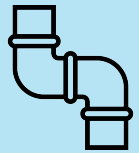
There is a HUGE difference in WSS between developed and developing countries.

		Developed Countries	Developing Countries
	**Infrastructure Development**	Has well-established water infrastructure networks	Has inadequate infrastructure
	**Investment and Funding**	Has greater financial resources and capacity to invest	Rely more heavily on external funding sources, development assistance, and PPPs
	**Service Coverage and Quality**	Has higher levels of access	Experience disparities in service coverage and quality

There is a HUGE difference in WSS between developed and developing countries.

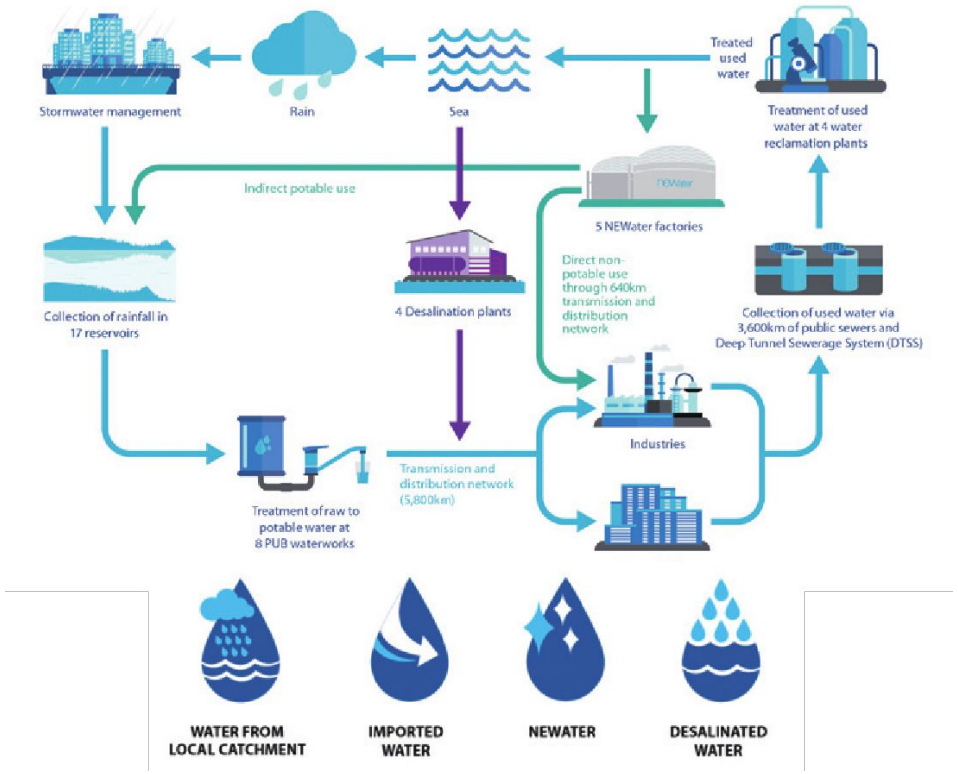
		Developed Countries	Developing Countries
	**Governance and Regulation**	Has well-established regulatory frameworks, institutional capacity, and governance structures	Has weak regulatory enforcement, fragmented governance structures, and lack of institutional capacity
	**Technology and Innovation**	Has greater access to advanced technologies and innovation	Adopt simpler, low-cost technologies suited to their context
	**Climate Resilience and Environmental Sustainability**	Has more advanced climate resilience measures and environmental sustainability practices	Has inadequate infrastructure resilience, and limited resources for environmental protection

There is a HUGE difference in WSS between developed and developing countries.

		Developed Countries	Developing Countries
	**Affordability and Equity**	Adopt metered billing systems with tariffs reflecting the cost of service	Affordability can be a significant challenge
	**Community Engagement and Participation**	Has established mechanisms for community engagement and participation in water governance	Community engagement may vary depending on local contexts

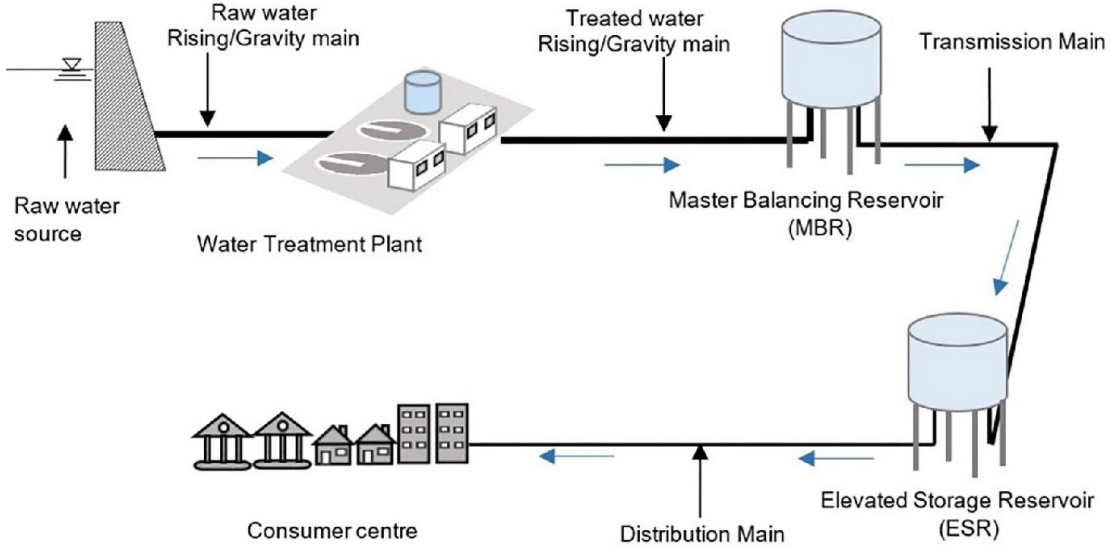
There is a HUGE difference in WSS between developed and developing countries.

- Singapore PUB: The Four National Taps contribute towards closing the water loop



Singapore PUB. 2022. Innovation in Water Singapore. Closing the Loops Toward More Sustainable Water

- WS Utility in India: Typical layout of WSS with a surface water source in India



Ghorpade, Anujkumar., et al. September 2021. Drivers for Intermittent Water Supply in India: Critical Review and Perspectives, Frontiers in Water

A tale of two utilities

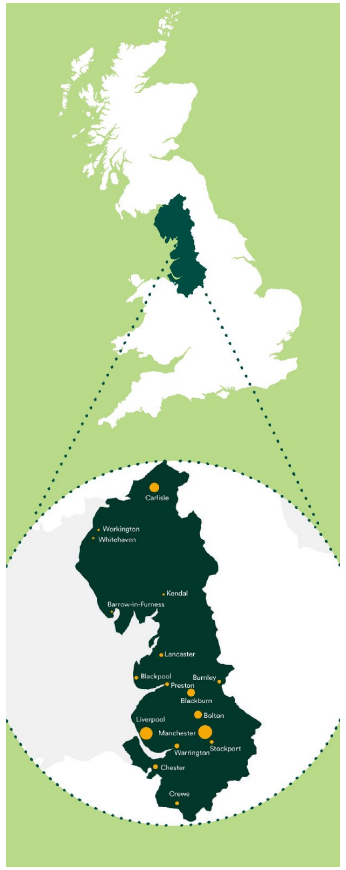
MANILA WATER

7.5	Population	7.4
~20,000	Pop Density / (sq.km)	526
1.75	Production (bld)	1.80
6,991	Length of potable water pipeline (kms)	43,000
41	Wastewater treatment facilities	584
34.7%	Sewer coverage	100%
~1,500	Employees	~5,000

Sources: Company Annual Reports

United Utilities

Water for the North West



Framework for Analysis

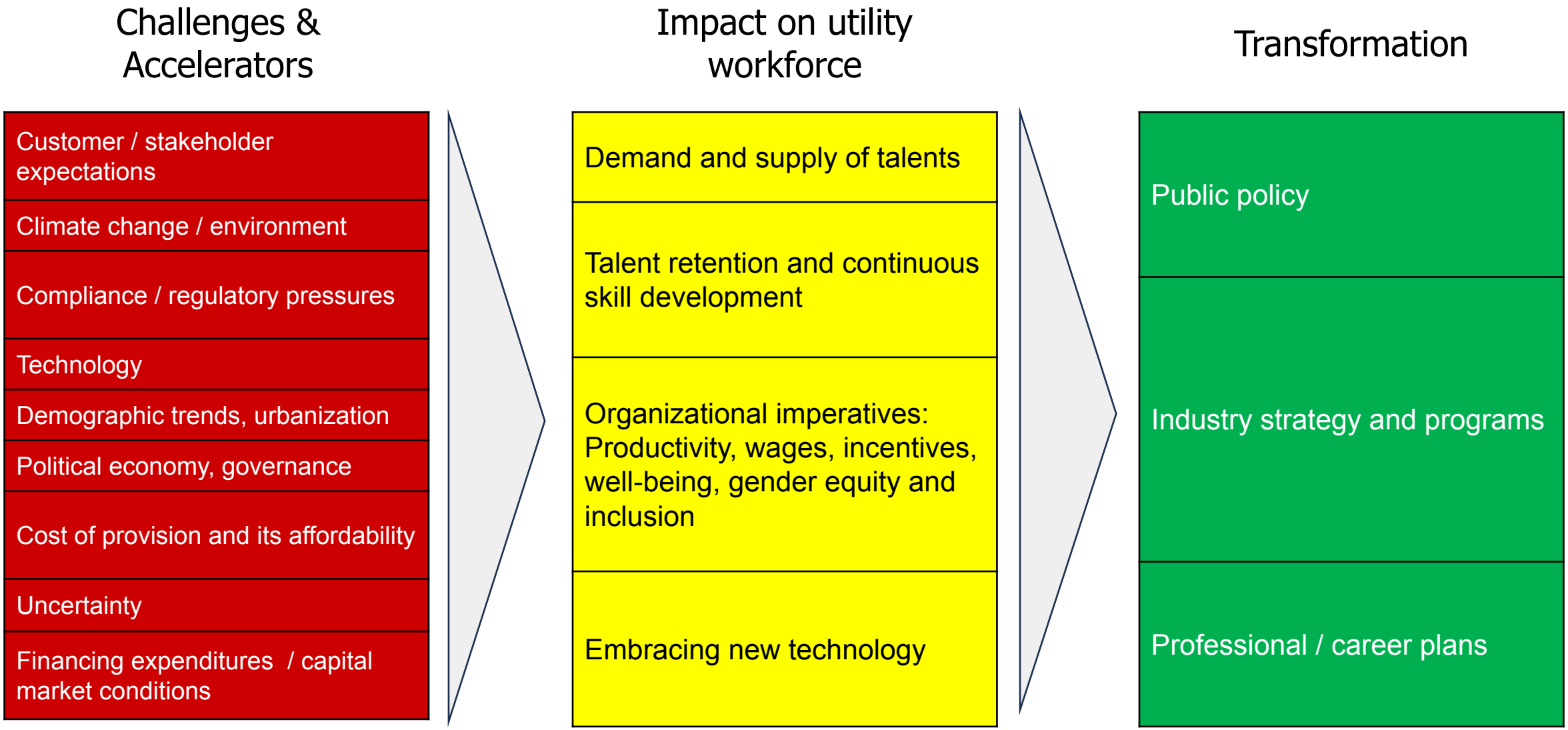



Image Credit: GMA Network
WATER &
SOCIETY


Image Credit: IRRI
WATER &
ECONOMY

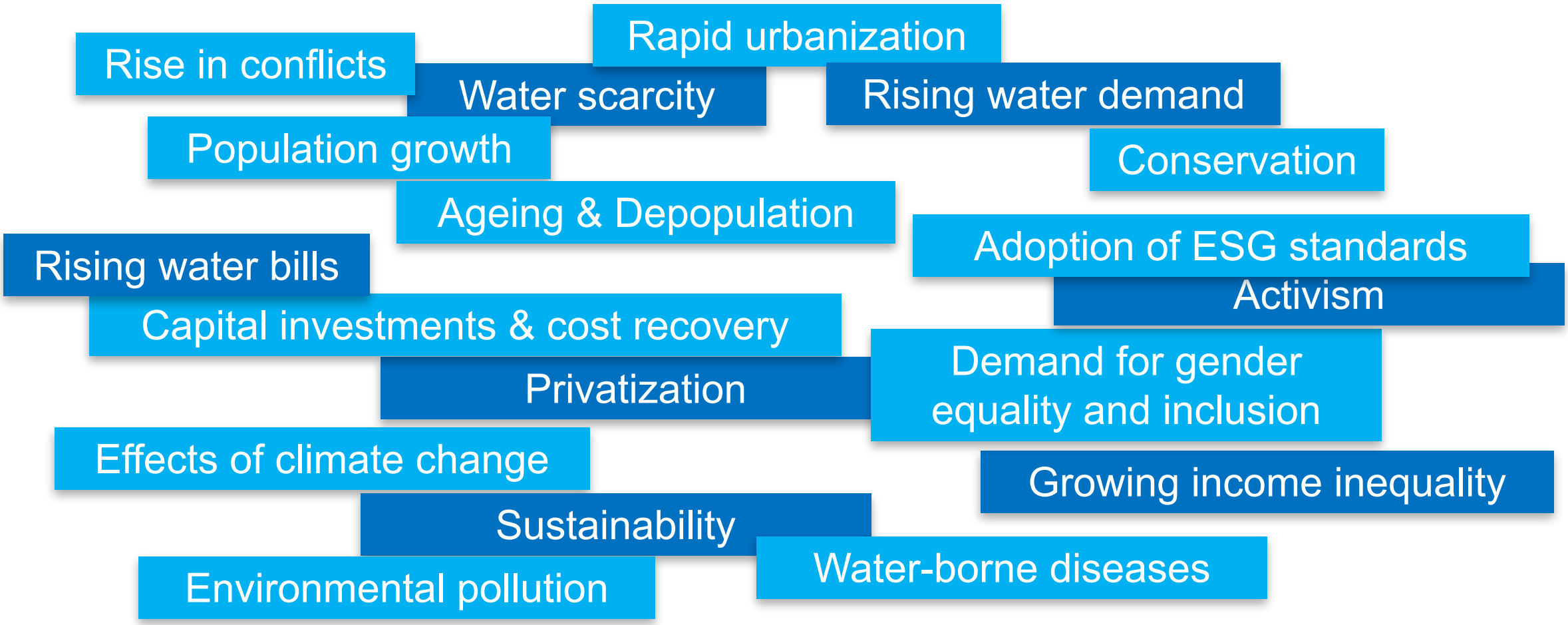

Image Credit: Manila Water
WATER &
ENVIRONMENT


Image Credit: Philippine Star


Image Credit: Rappler


Image Credit: Manila Water

Water sector is a **complex web of factors and inter-relationships…**



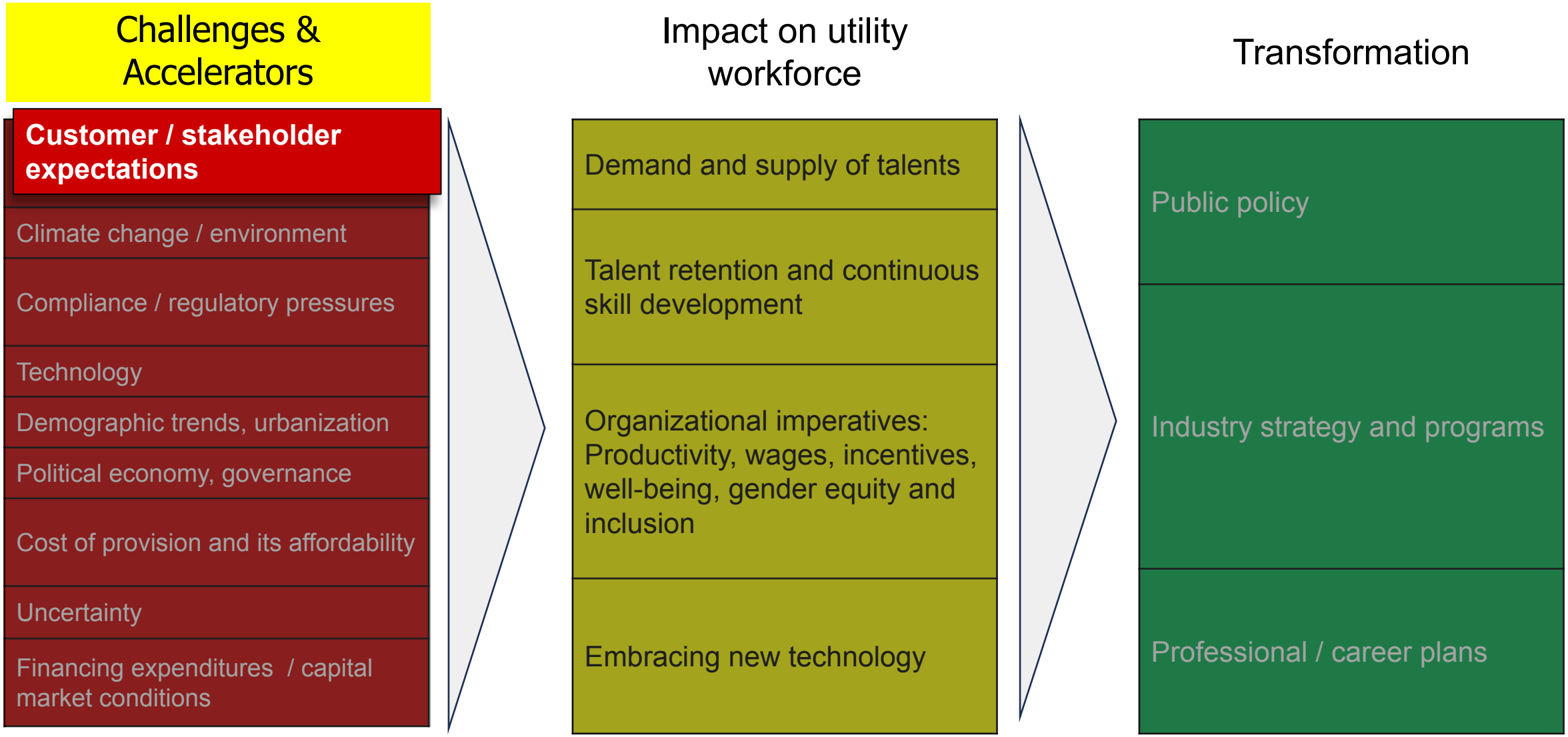
RISING POPULATION

Image Credit: Business Insider

CLIMATE CHANGE

Image Credit: Rappler

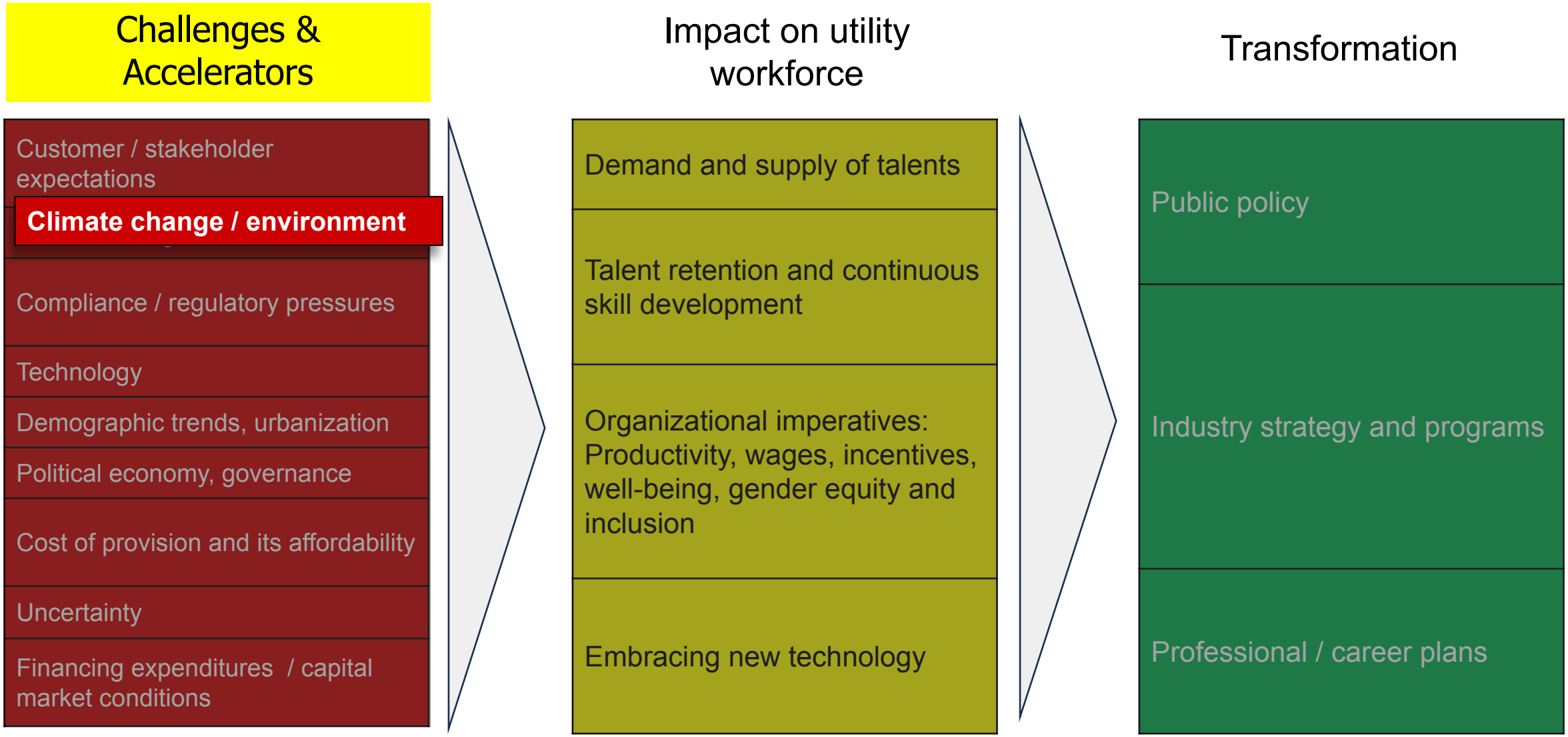
Framework for Analysis



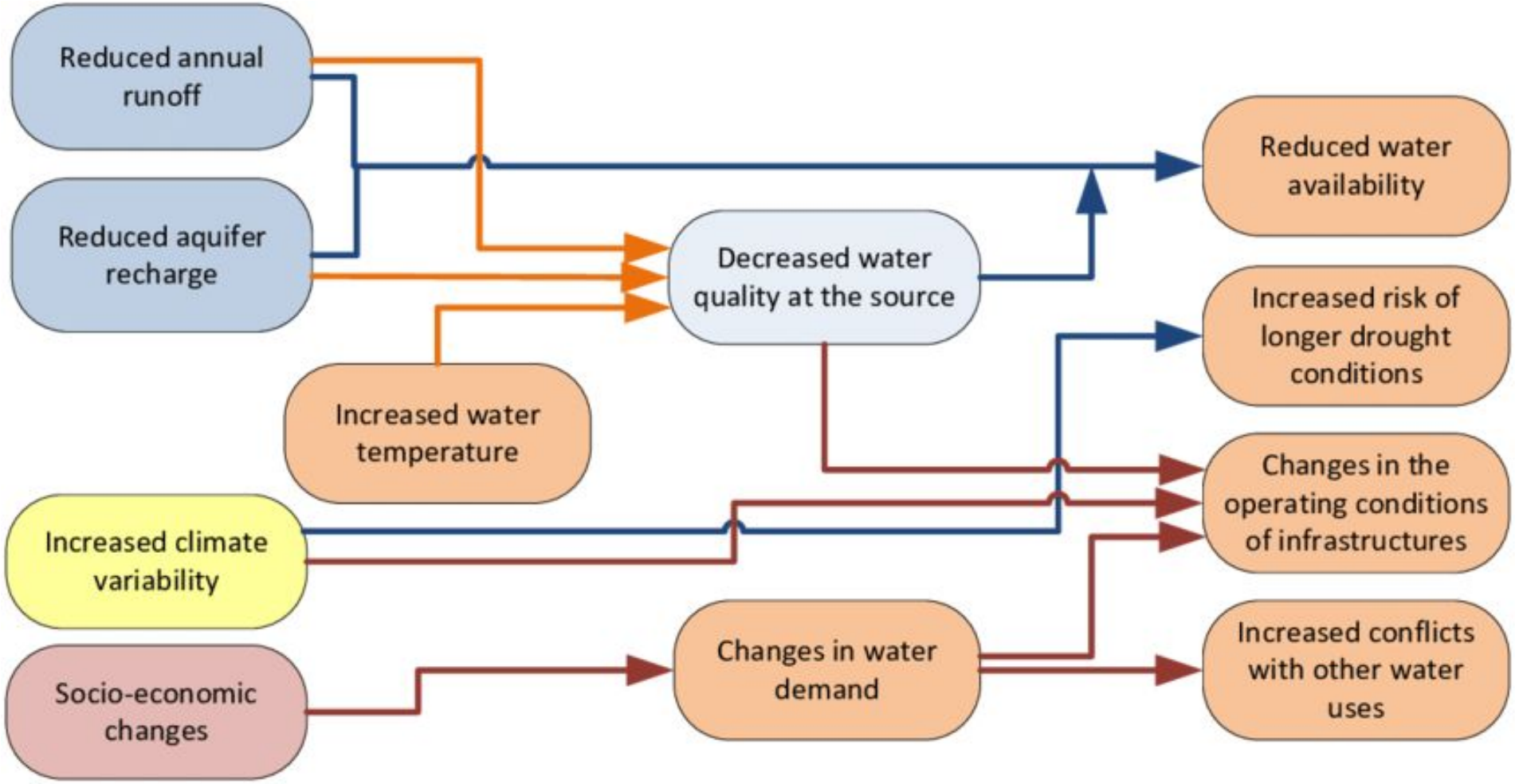
Rising customer and stakeholder expectations…

- Reliable Water Supply
- Water Quality
- Affordability
- Transparency & Communication
- Responsive Customer Service
- Environmental Sustainability
- Innovation & Technology Adoption
- Resilience and Emergency Response
- Community Engagement
- Regulatory Compliance

Framework for Analysis

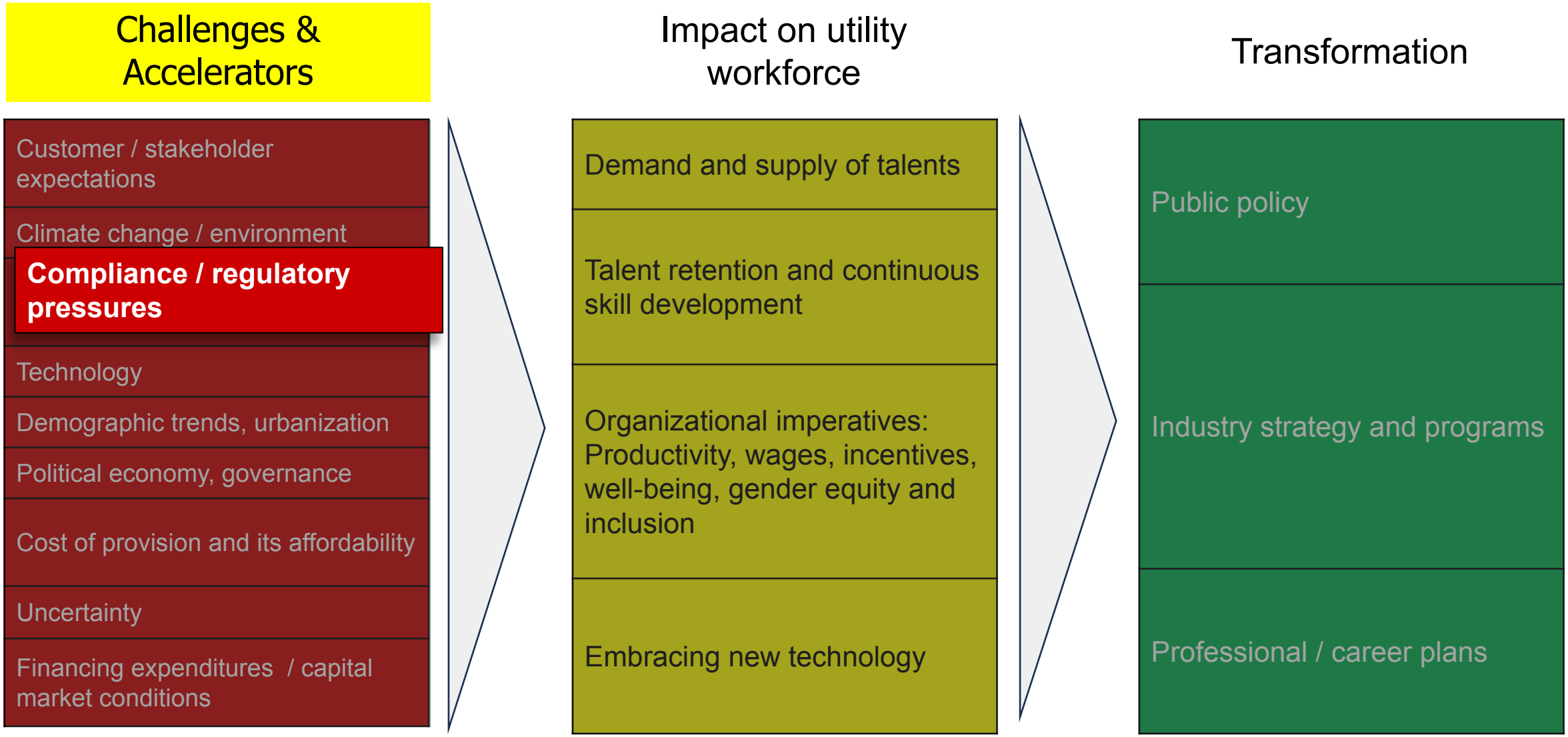


Climate change / environment

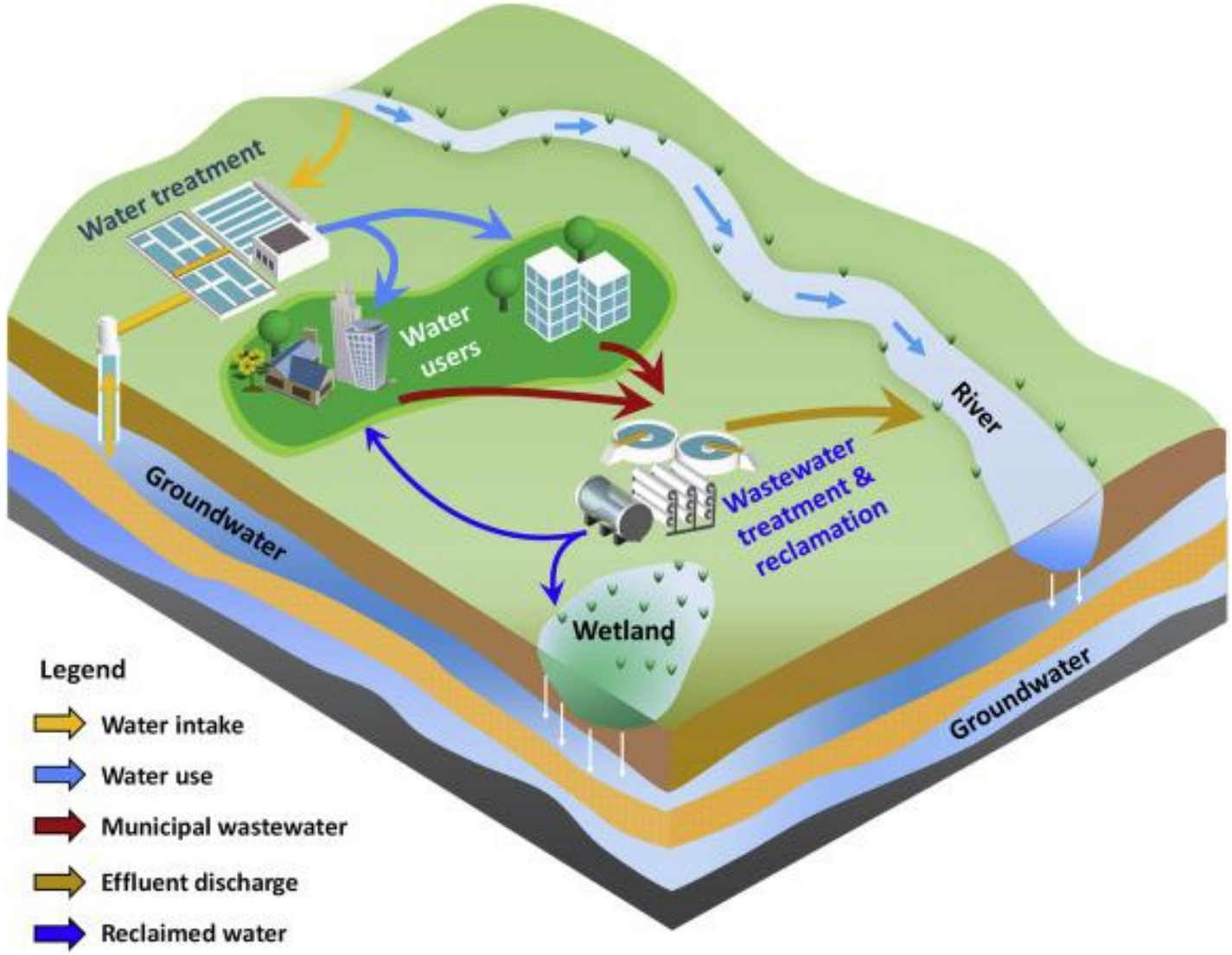


Source: Proença de Oliveira. R., et. al. 2015. Managing the urban water cycle in a changing environment. CERIS - CEHIDRO

Framework for Analysis



Compliance and regulatory pressures



Source: Water Eco-Nexus Cycle System (WaterEcoNet) as a key solution for water shortage and water environment problems in urban areas

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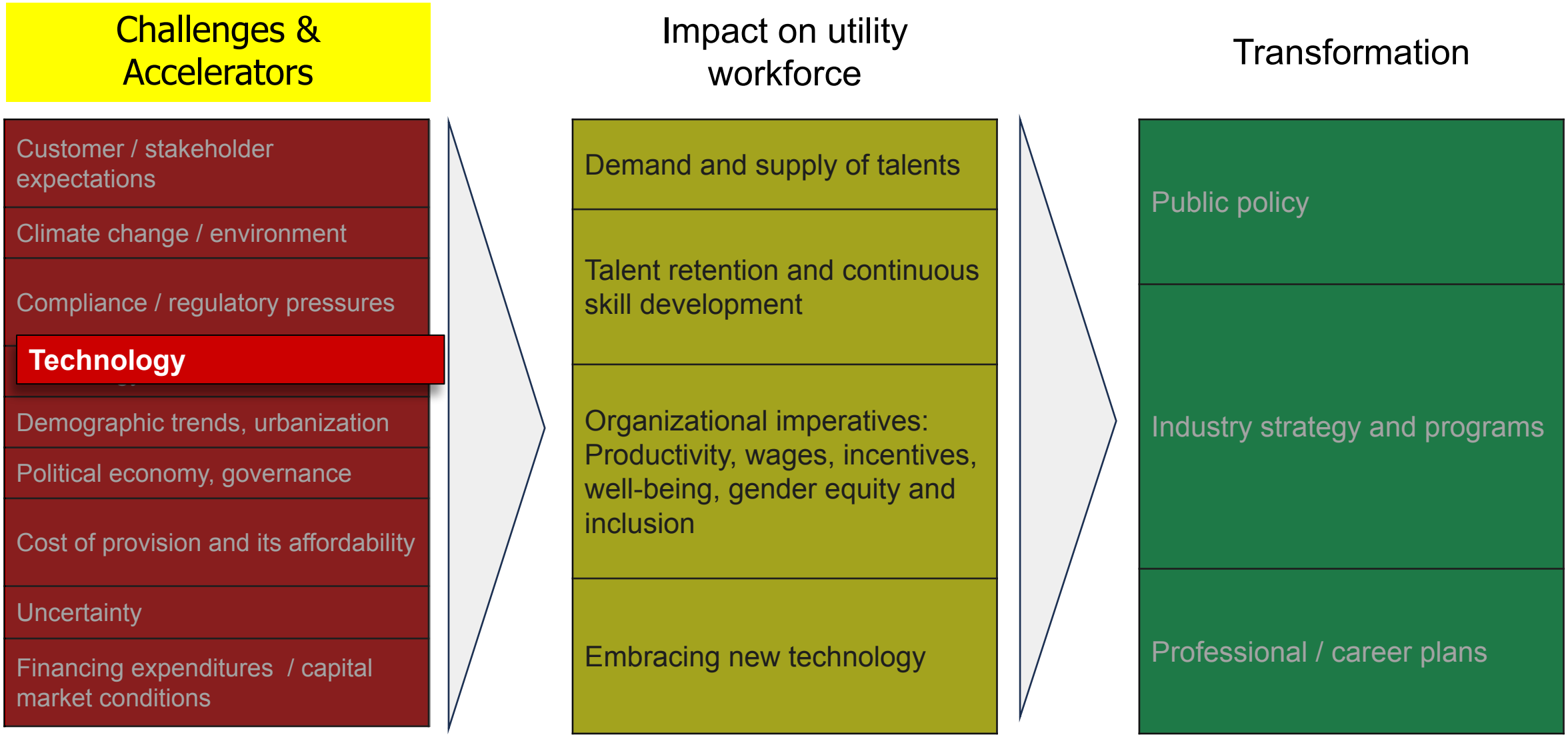
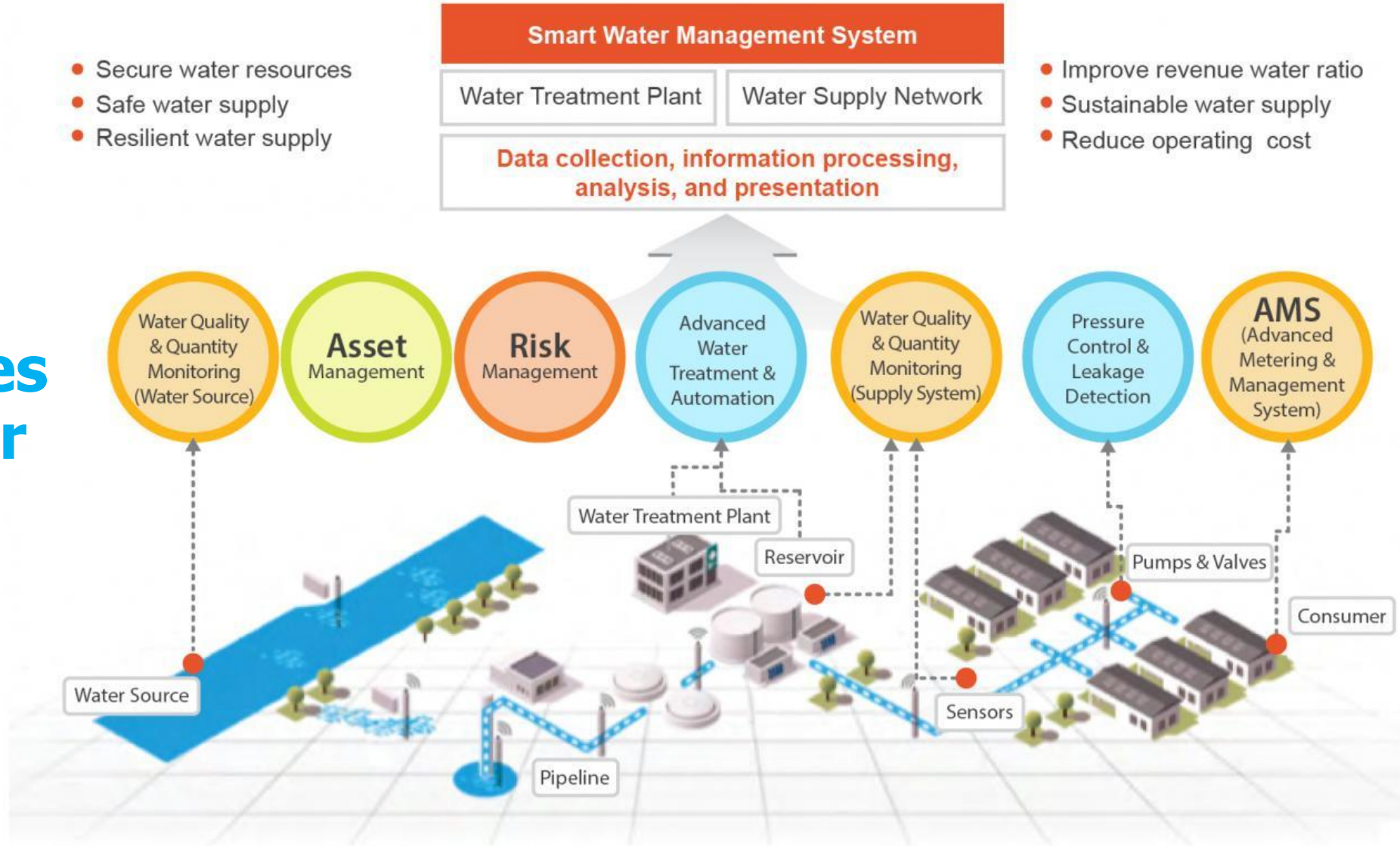


Digital Technologies in the Water System



Source: You Kwangtae, CEO, UnU Civil & Environmental Engineering, Republic of Korea cited in ADB-Development Asia

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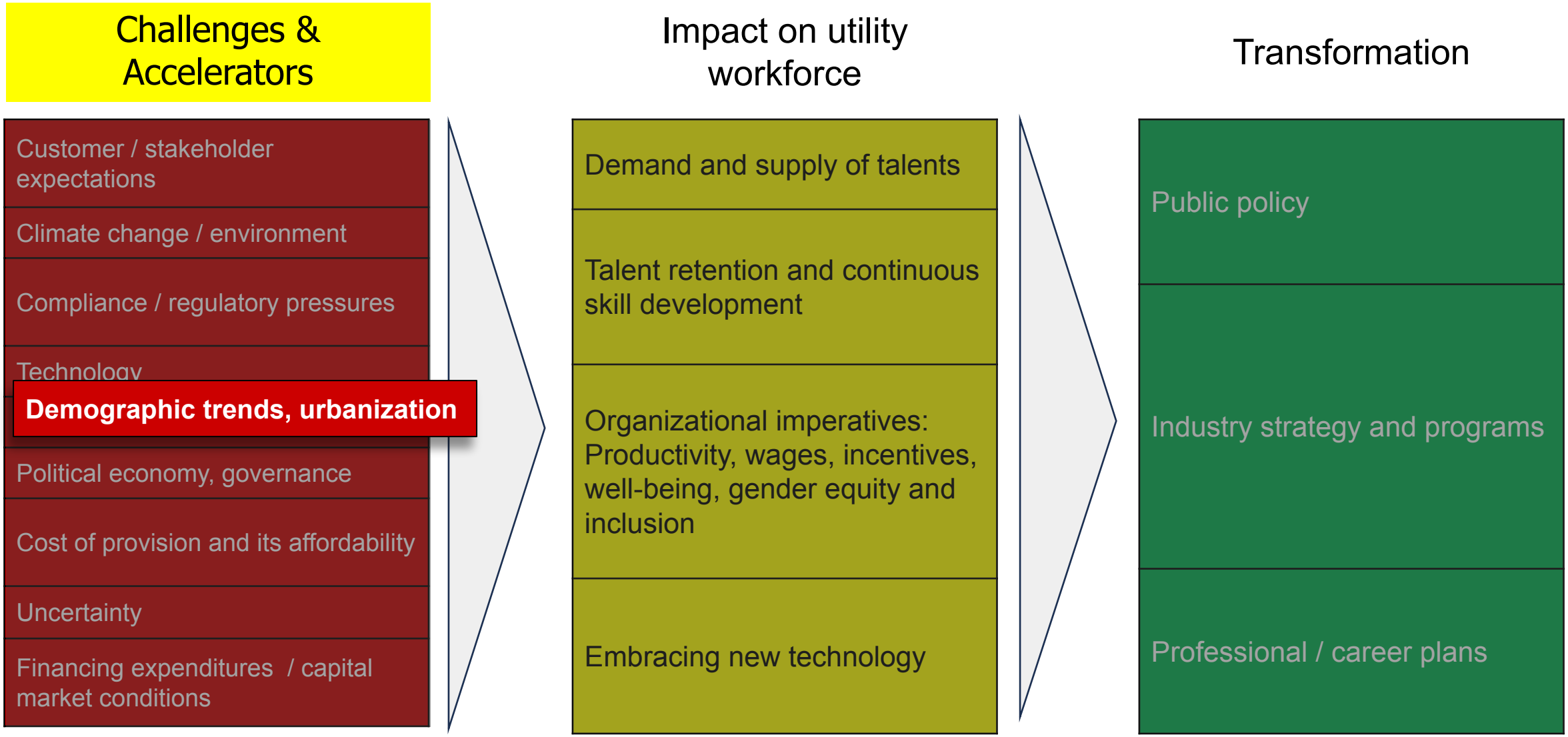
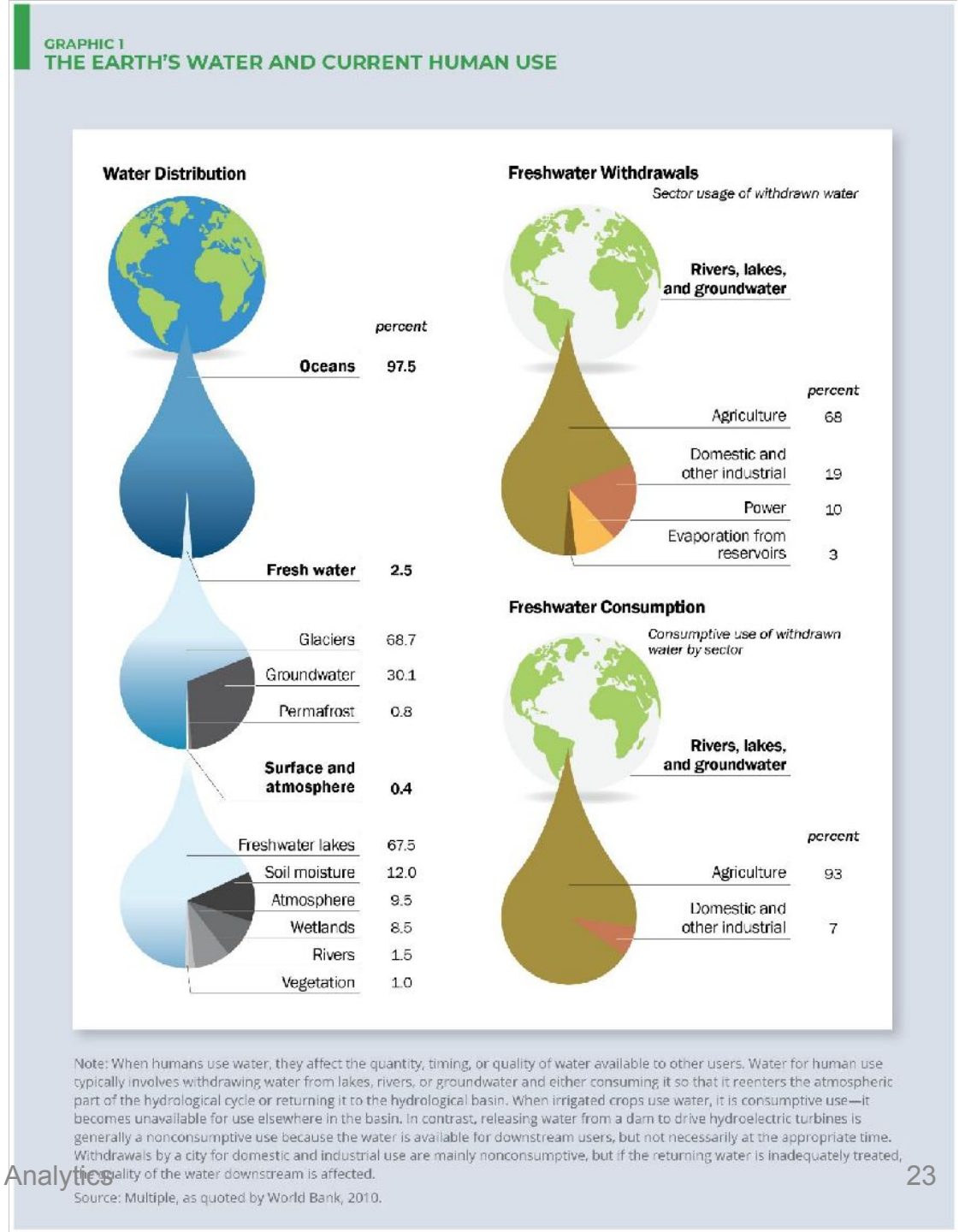


Water Insecurity Threatening Global Economic Growth, Political Stability

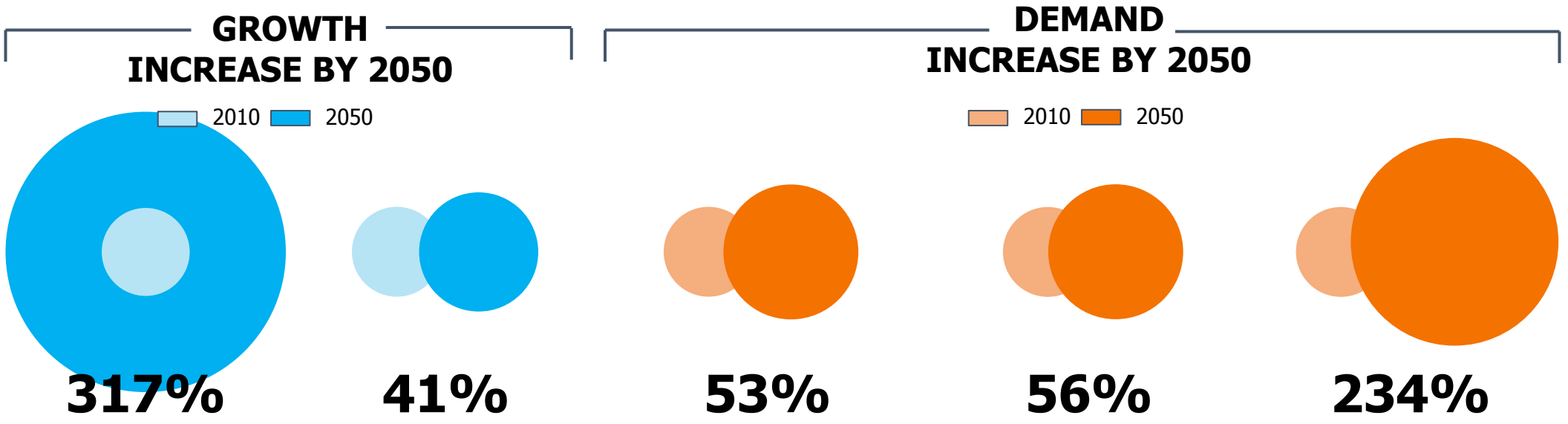
- Mismatch between supply and demand
- Weak governance enabling mismatch
- Developing countries are vulnerable but developed countries are not immune
- Broader implications of water insecurity

Source: Office of the Director of National Intelligence. April 2021. Global Trends - Water Insecurity Threatening Global Economic Growth, Political Stability



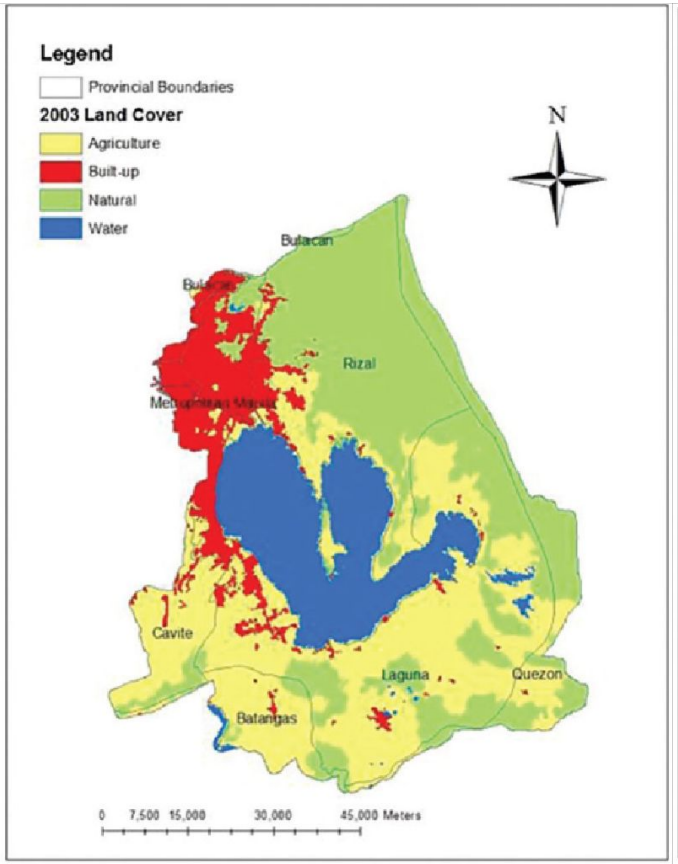
Demographic trends and its impact on water use

Projected Growth in Population and Resource Demands by 2050

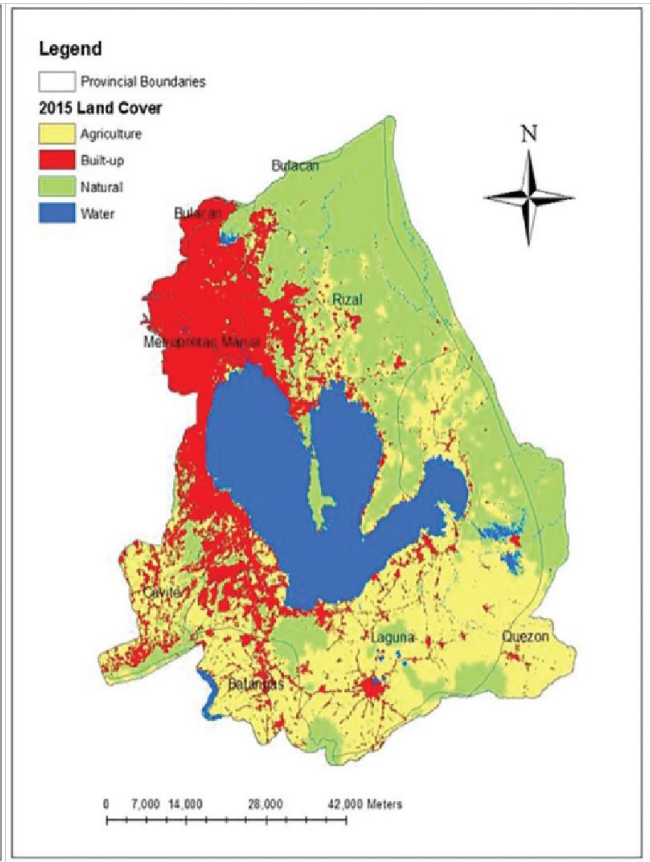


Source: The Nature Conservancy

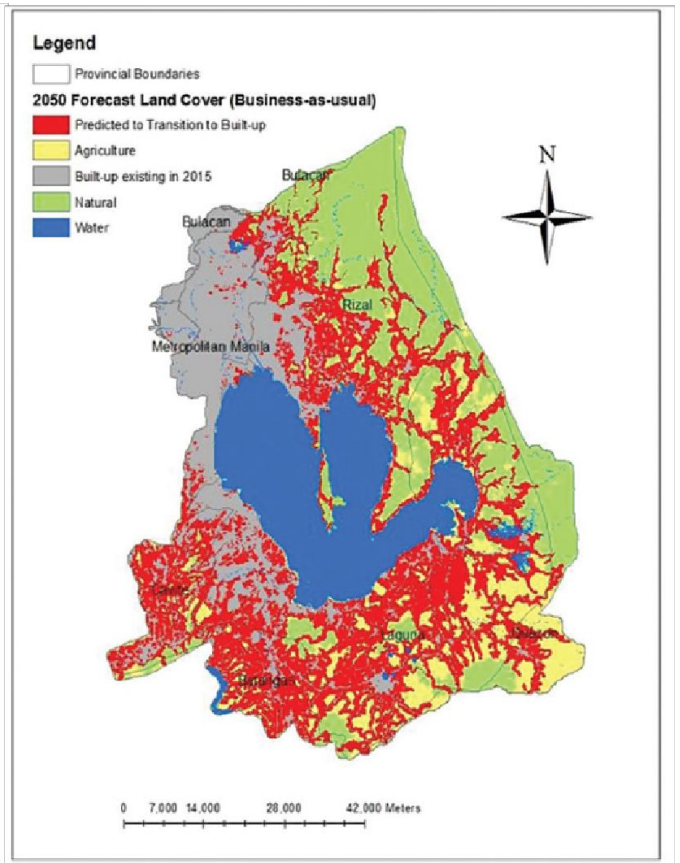
Rate of Urbanization in NCR and CALABARZON



2003 harmonized land cover map [raw (unprocessed) land cover map obtained from NAMRIA; boundaries map from LLDA].



2015 harmonized land cover map [raw (unprocessed) land cover map obtained from NAMRIA; boundaries map from LLDA].



2050 forecast for conversion to built-up land assuming "business-as-usual" conditions.

Source: Tanganco, et al. (2019). Forecast of Potential Areas of Urban Expansion in Laguna de Bay Basin and its Implications to Water Supply Security. Philippine Journal of Science. 148 (4): 715-724.

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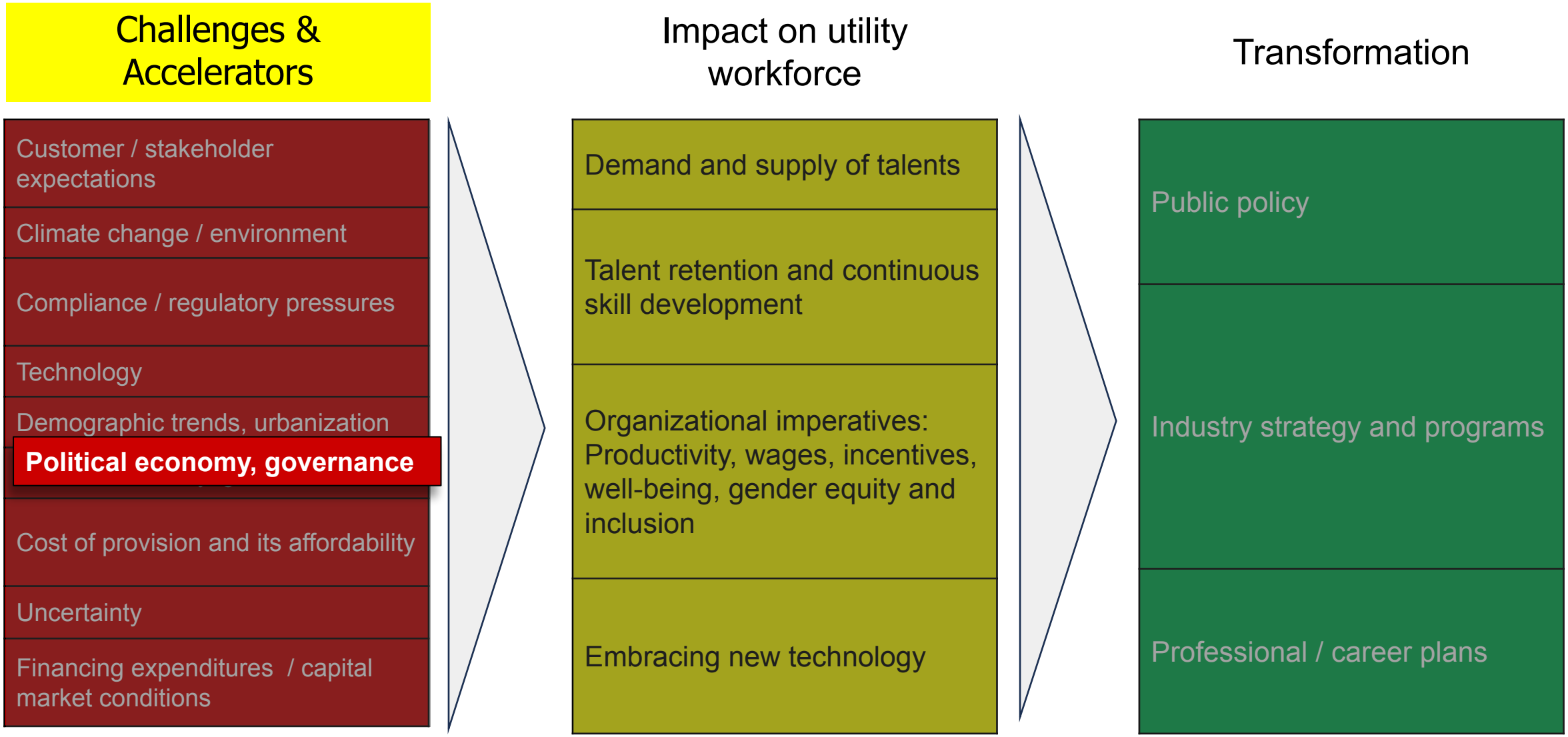
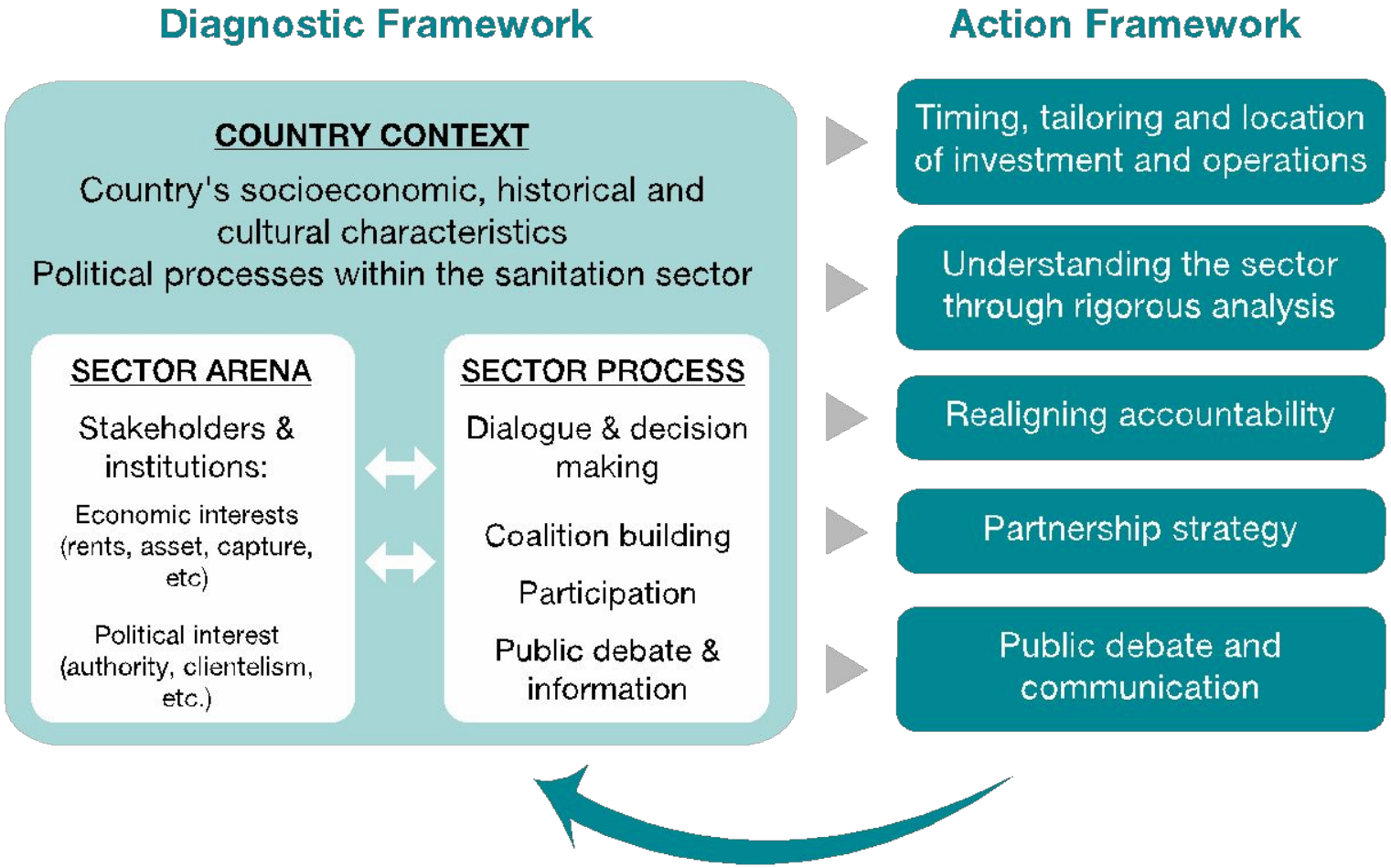


CONCEPTUAL FRAMEWORK FOR THE POLITICAL ECONOMY OF SANITATION

*The "political economy of sanitation," therefore, refers to the **social, political,** and **economic processes** and **actors** that determine the extent and nature of sanitation investment and service provision.*



Source: World Bank. 2011. The Political economy of Sanitation: How can we increase investment and improve service for the poor?

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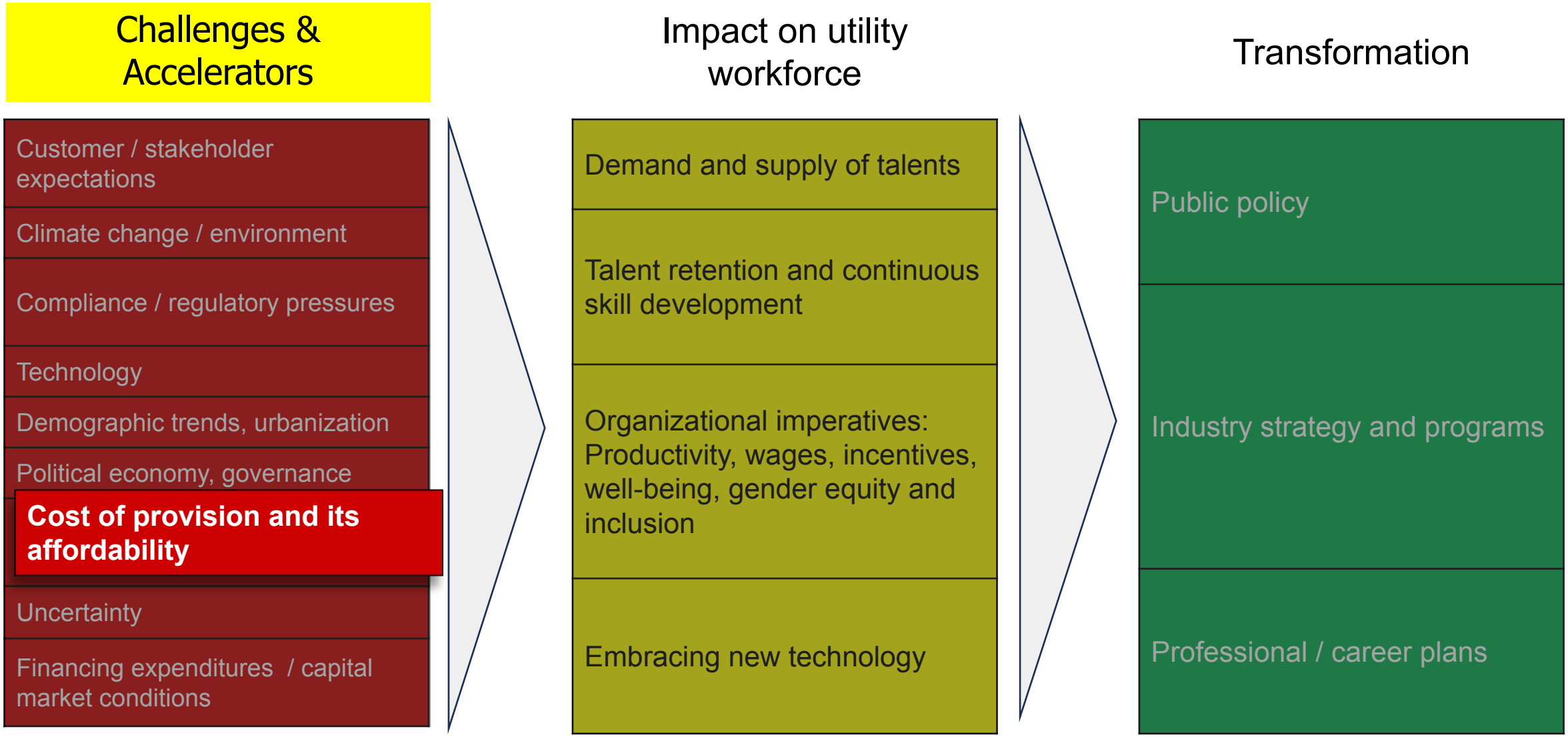
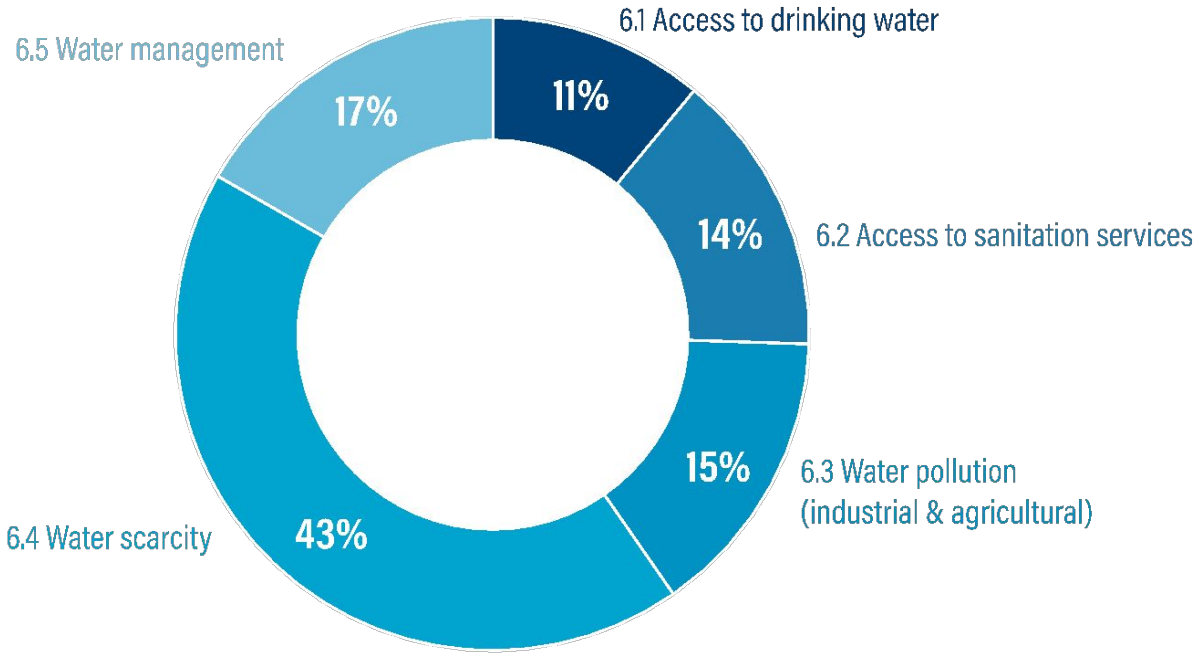


Estimated Cost to Deliver Sustainable Water Management Globally…

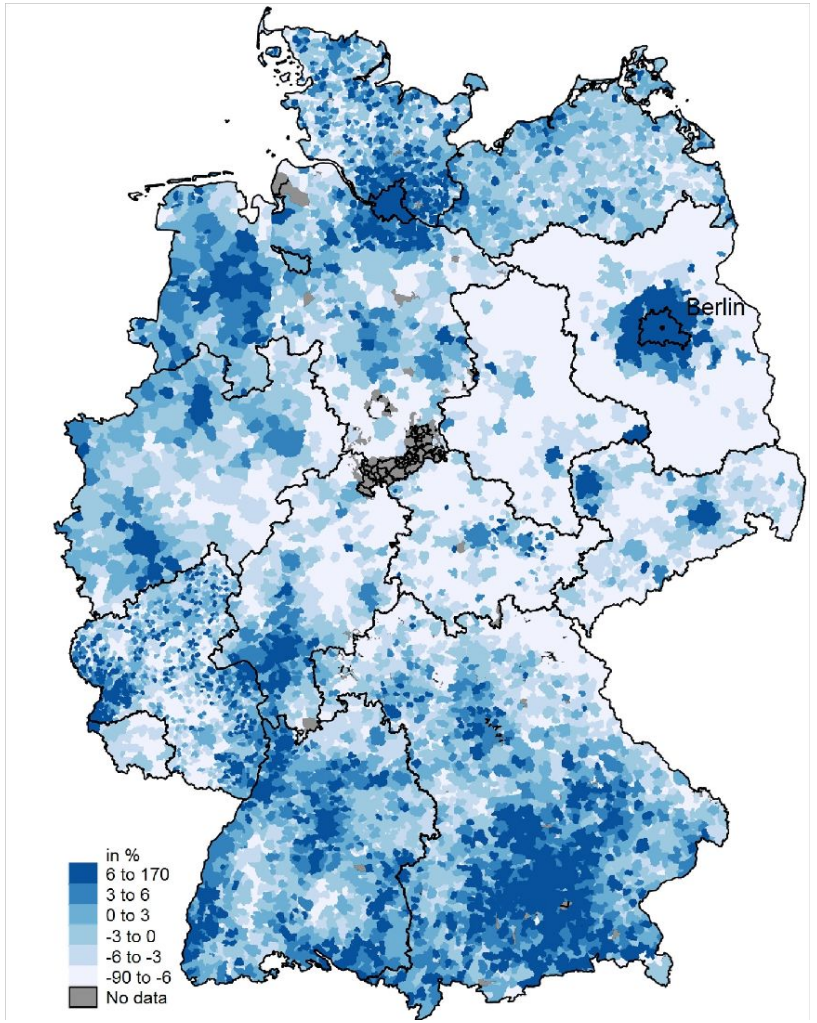
WATER CHALLENGE	ESTIMATED COST (US$, BILLIONS)
Total Estimated Cost	1,037
Access to drinking water	113
Access to sanitation services	150
Water pollution (industrial & agricultural)	153
Water scarcity	445
Water management	172



Source: Strong, Colin., et al. January 2020. Achieving Abundance: Understanding the Cost of Sustainable Future Water. Working Paper. World Resources Institute

Cost and productivity effects of demographic changes on local water service

- In a decade, the marginal costs of production have increased twice as much in shrinking regions than in growing regions.
- Rising water costs in depopulated regions increase the financial burden of local public services.
- Municipalities must weigh expensive adjustments to the technical infrastructure.



Population density growth in German municipalities between 2003 and 2014.

Source: Cullmann, Astrid and Stiel, Caroline. 27 September 2022. Cost and productivity effects of demographic changes on local water service Utilities Policy 79 (2022) 101435

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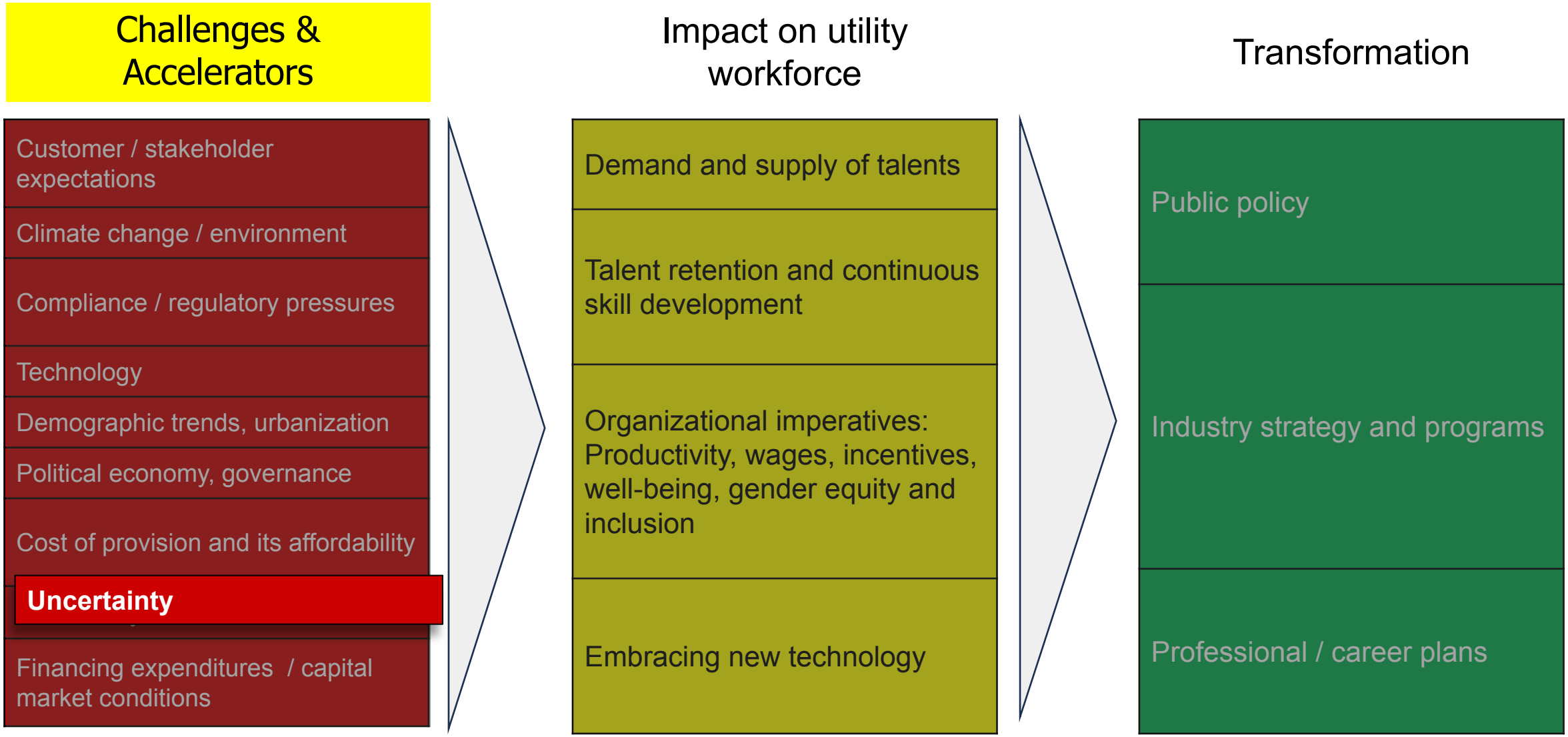
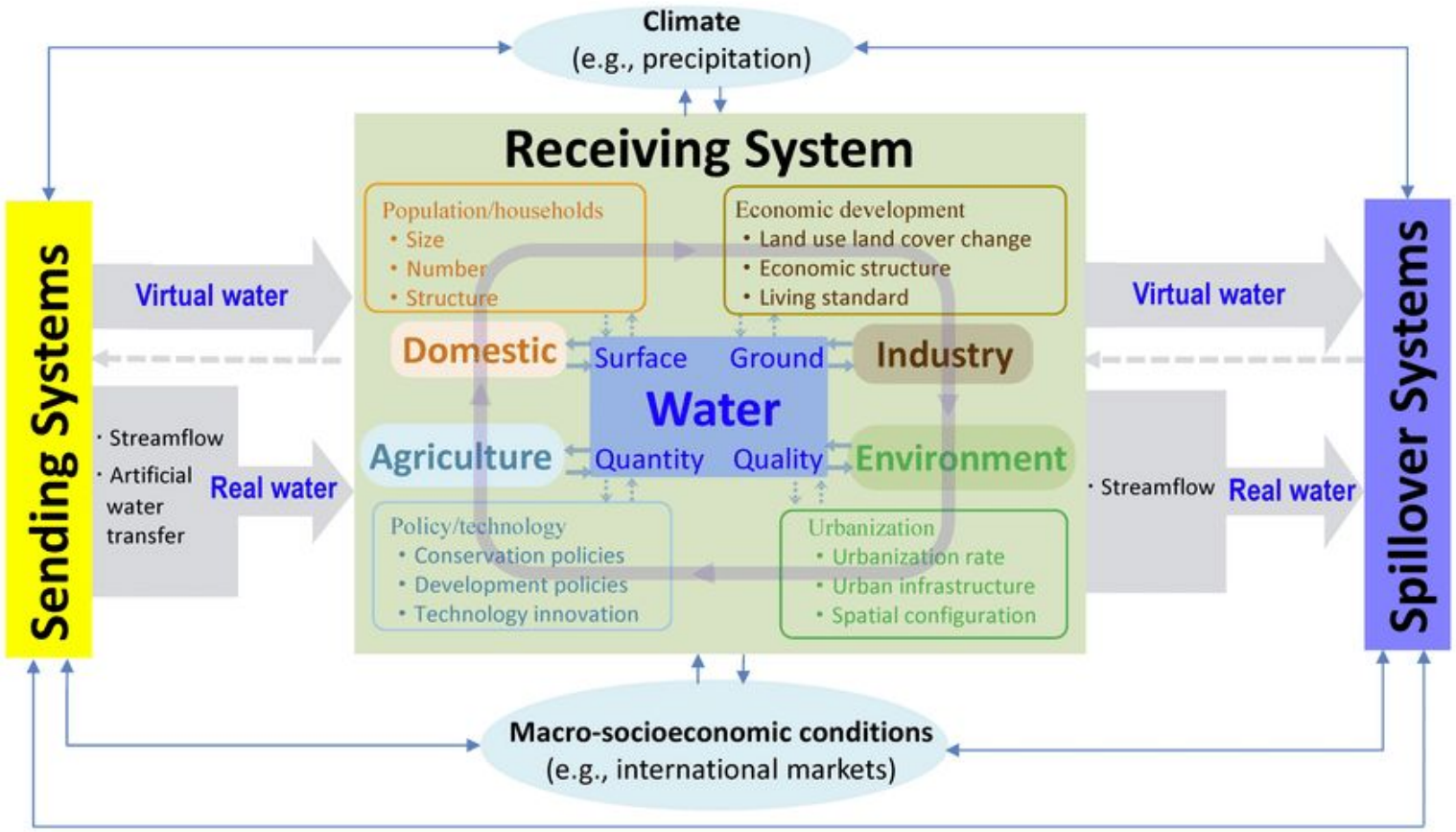
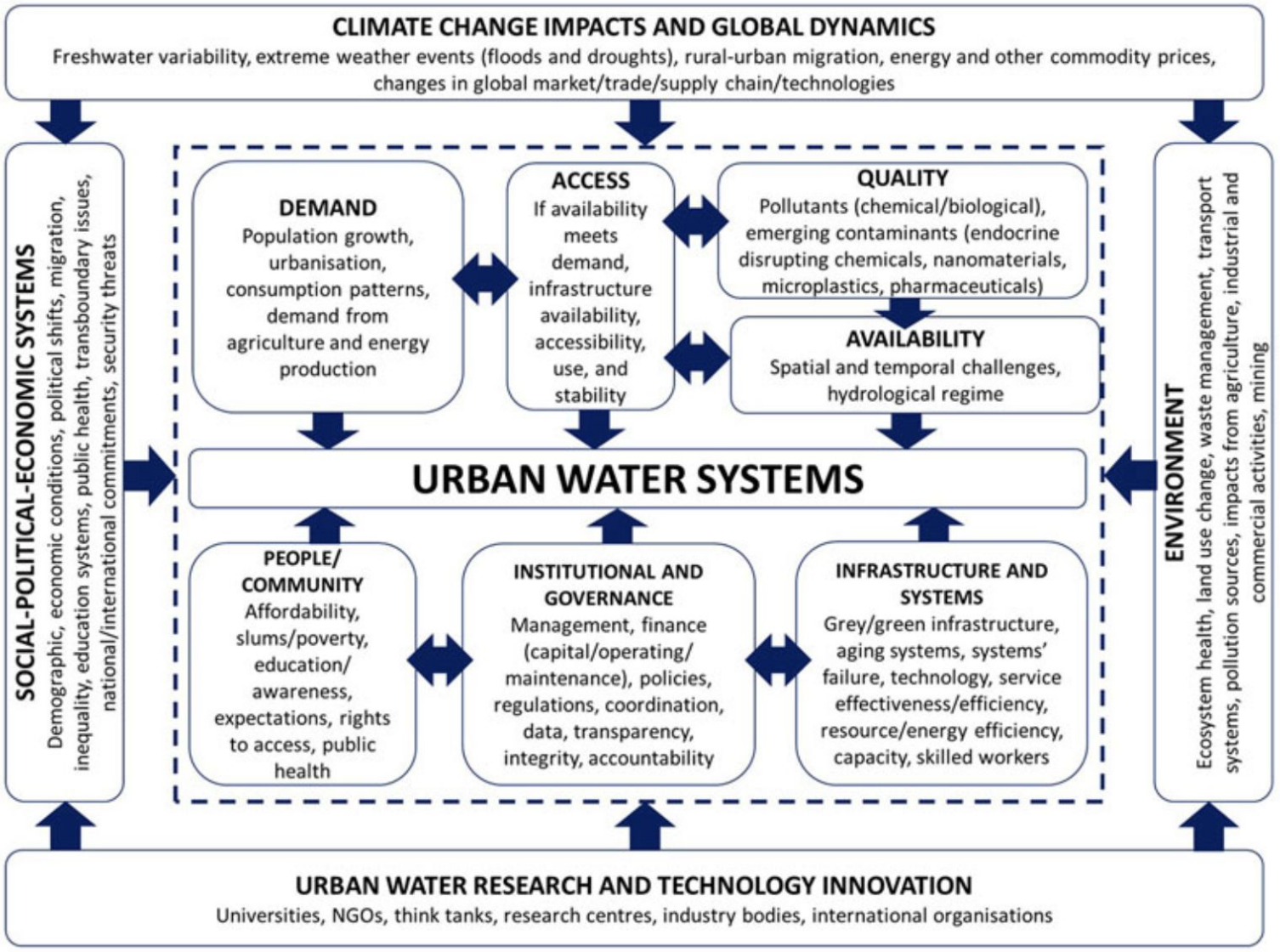


Uncertainty is magnified and outcomes are extremely difficult to predict



Source: Yang, Wu & Hyndman, et al. 2016. Urban water sustainability: Framework and application. Ecology and Society.

Systems thinking approach to address the challenges of urban water systems



Source: Wan Izar Haizan Wan Rosely and Nikolaos Voulvoulis. 2022. Systems thinking for the sustainability transformation of urban water systems. Centre for Environmental Policy, Imperial College London

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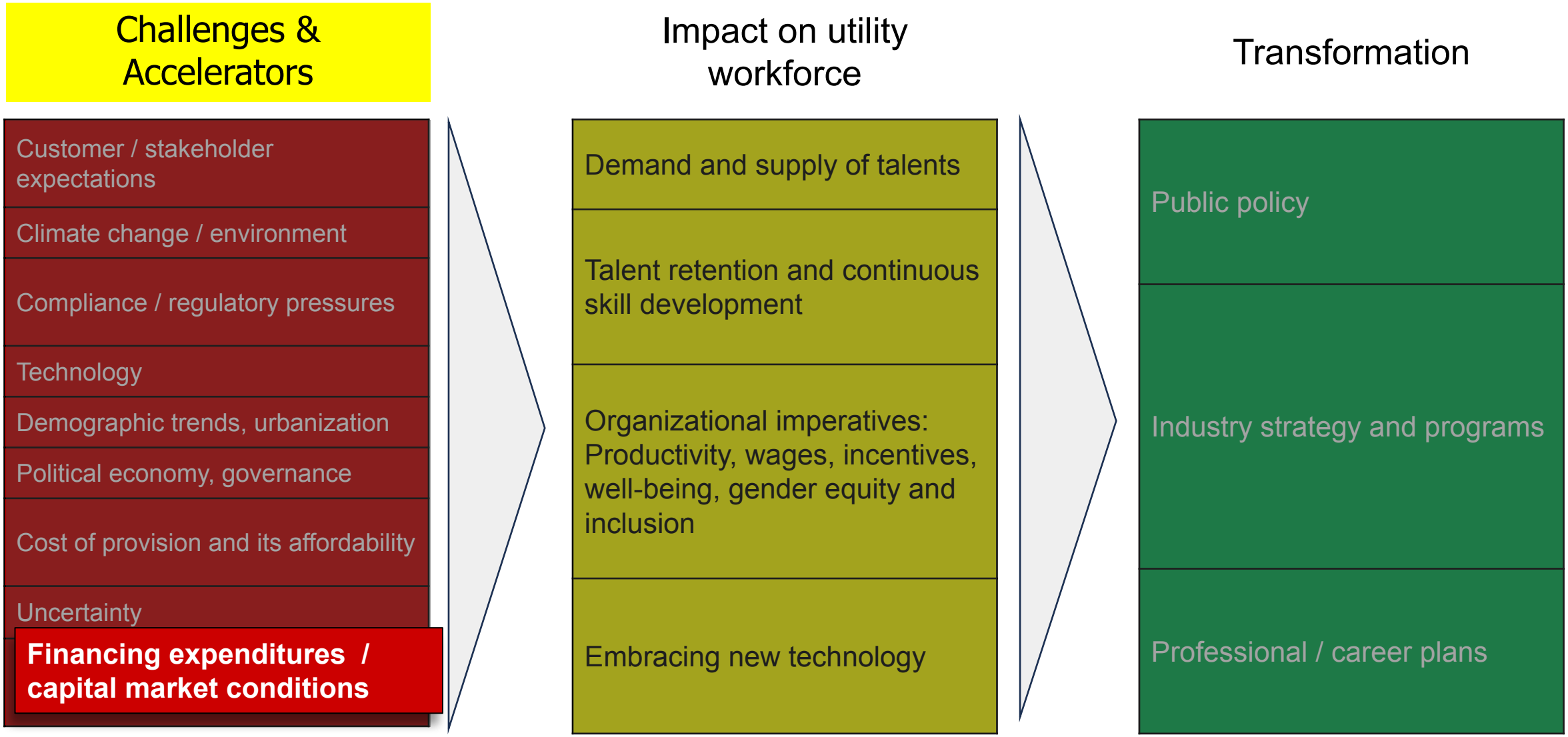
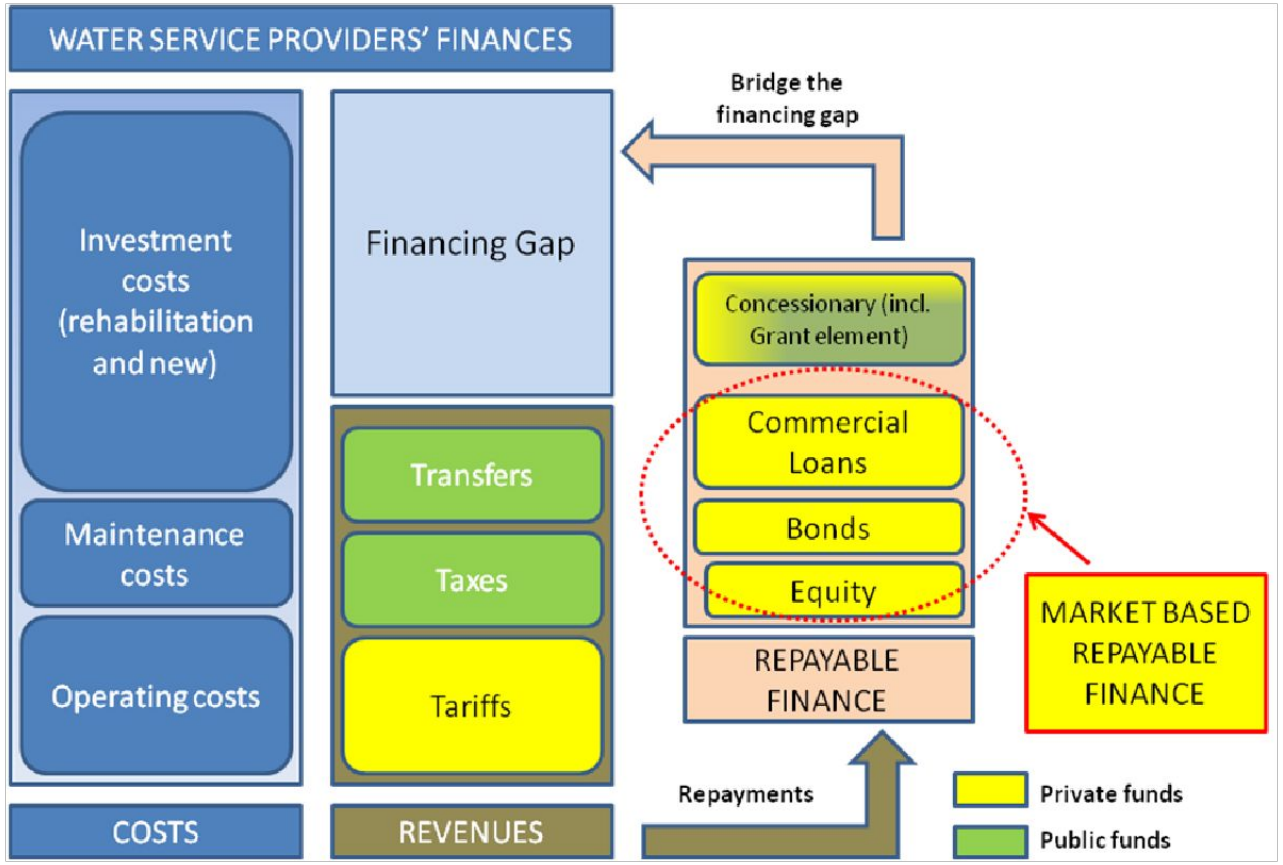


3 T's in funding WSS Expenditures: **Tariffs, Taxes, or Transfers**

- A well-designed, cost-reflective tariff is essential to fund the expenditures of WSPs.
- Taxes (and subsidy) and transfers (ODA-linked for developing countries) may be part of the mix of funding sources.



Source: OECD (2010b), Innovative Finance Mechanisms for the Water Sector, OECD, Paris.

Key Messages

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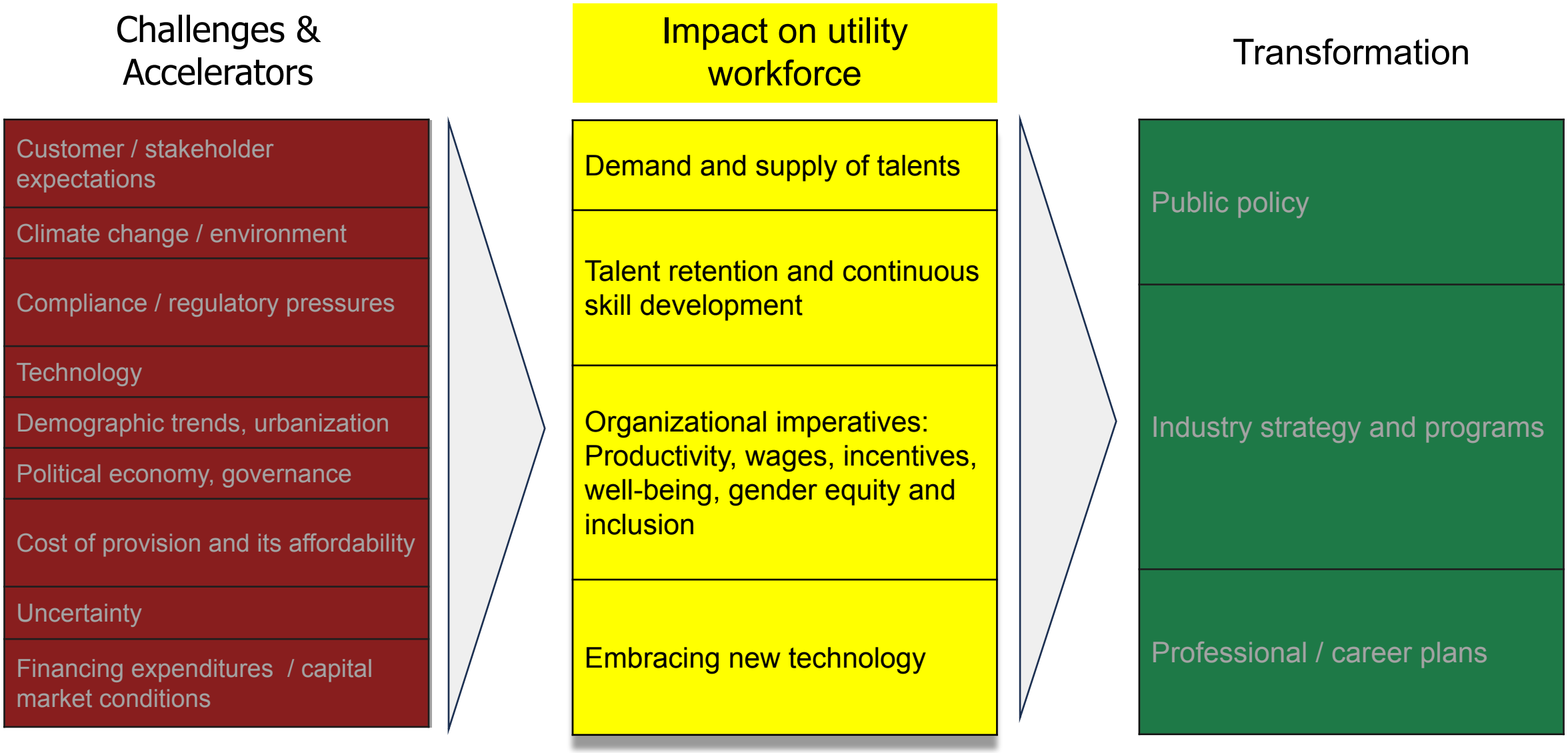
Framework for Analysis



Water Jobs

Jobs in water sectors fall under one of three functional categories:

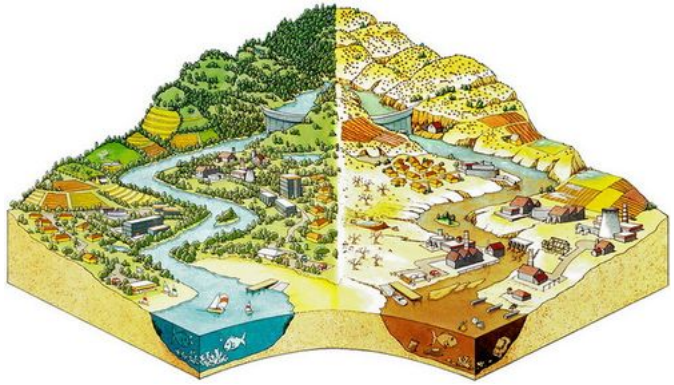


Image Credit: Waterwatch Queensland (2012) cited in Freie Universitat, Berlin)

MANAGING OF RESOURCES

Including integrated water resources management (IWRM) and ecosystem restoration and remediation

Image Credit: Rizza Garcia

BUILDING OF INFRASTRUCTURE

Building, operating and maintaining water infrastructure

Image Credit: UNICEF

DELIVERY OF SERVICES

Provision of water-related services including water supply, sanitation and wastewater management

Source: UN Water. 2016, United Nations World Water Development Report 2016

Jobs in the water sectors

It is difficult to draw an accurate portrait of human resources demand in the water sectors, given that data concerning demand, capacity and availability in the sector is poor in developed economies

- IBNET estimates that the total professional staff in these utilities number about 623,000.
- A variety of countries, from Indonesia to the Netherlands, are faced with systemic issues such as staff attrition, erosion of experience and weak interest from new graduates to join the water sectors.
- Across OECD countries in particular, the gap is increasing due to an ageing workforce.

Source: UN Water. 2016, United Nations World Water Development Report 2016

Jobs in the water sectors

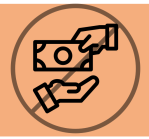
According to GLAAS*, majority of the 67 countries that reported on systems operation and maintenance had:

- Insufficient staff to operate and maintain their urban drinking water systems
- Incapacity to operate and maintain their rural drinking systems
- Insufficient supply of skilled labour and technicians to meet the needs in rural sanitation

*GLAAS = Global Analysis and Assessment of Sanitation and Drinking-Water
Source: UN Water. 2016, United Nations World Water Development Report 2016.

*Pursuit of MDG and SDG **"has not been paid to ensuring that the corresponding human resource base needed** to design, construct, operate and maintain the services is in place, nor whether it would be adequate to carry longer-term efforts towards universal coverage."*

Reasons for gaps

	Reason for Gaps
	Lack of financial resources for hiring and retaining staff (salaries and benefits), especially in the public sector
	Difficulty of attracting skilled workers to live and work in rural areas
	Mismatch between courses offered and job requirements
	Shortage of funding of educational institutions; cost of tuition
	Absence of continuous training systems in many countries

Source: UN Water. 2016, United Nations World Water Development Report 2016

Reasons for gaps

	Reason for Gaps
	Lack of government policies to create an enabling environment
	Image problems and a stigma associated with the sanitation sector in particular
	Shortage of staff due to reluctance to invest in this component
	Shortage of staff due to rigidly imposed government staff quotas
	Brain drain due to retirement of ageing workforce

Source: UN Water. 2016, United Nations World Water Development Report 2016

Jobs in the water sectors

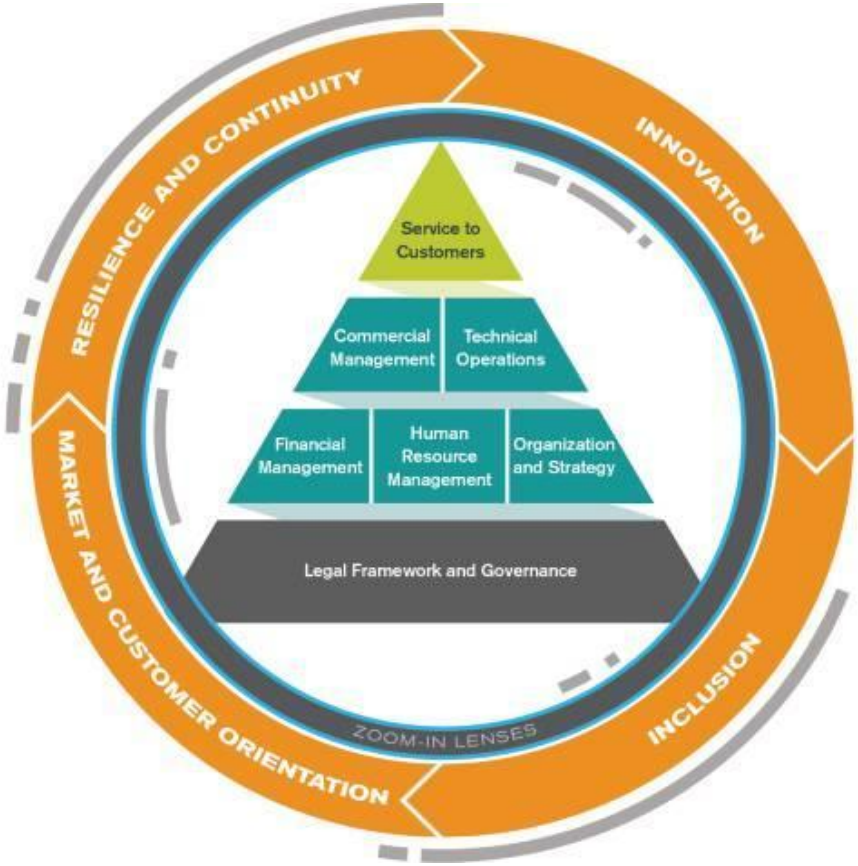
Developing countries face critical workforce-linked bottlenecks:

	Lack of human resources under Operations and Maintenance, Monitoring and Evaluation and the social development disciplines
	Gap between qualification levels and critical numbers of professional capacity in rural and urban systems
	Lack of incentives for workers
	Lack of coordination between industry needs and supply from education institutes

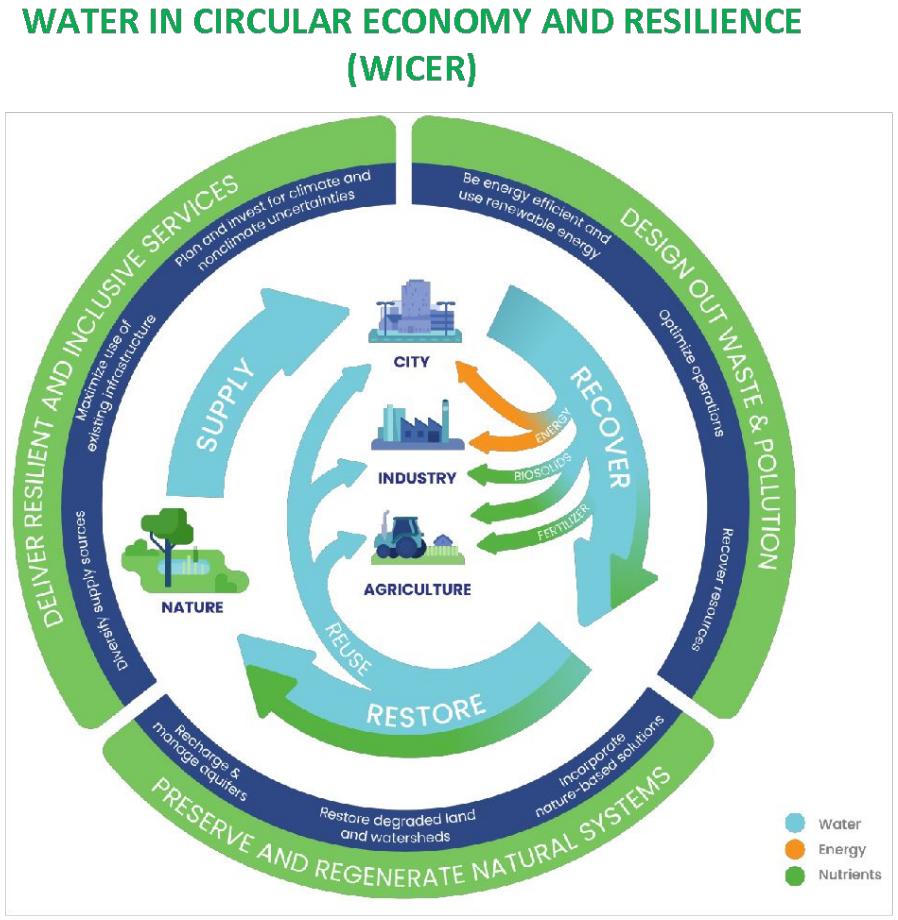
There is the risk for workers specifically trained for occupations that are green and entirely new to be left with limited options for employment.

Source: UN Water. 2016, United Nations World Water Development Report 2016

Effectively managing the challenges requires a transformation of a utility



Source: Cordoba, C.L., et la. 2022. Utility of the Future Taking water and sanitation utilities beyond the next level 2.0. World Bank



Source: Delgado, Anna., et al. 2021. Water in the Circular Economy and Resilience. World Bank

Transitioning to water utility of the future

- The transition may entail negative consequences for specific groups or individuals as a result of:

	Investment Choices		Technological Innovations
	New Sets of Policies		Shifts in Business Strategies

- It is essential that decision-makers and planners be cognizant of these potential impacts and make concerted efforts to consult the various stakeholders.
- Convergence of interest provides an opportunity for synergistic water investments beneficial to local economies and job creation.

Changing capacity needs

- Classic water treatment and network operation skills are still paramount, but the scope of expertise needed nowadays includes topics such as:

	Biodiversity Assessment		Information and communication technologies (ICTs)		Skills, knowledge and competences of professionals and civil society
	Nexus Issues (e.g. food and energy)		Human rights-based approaches and dialogue with stakeholders		Organizational and institutional capacity
	Modelling				

- Lack of capacity and the challenges facing the water sector require appropriate organizational design that ensures strategy culture

*"The industry needs **'specialized integrators'** - students and professionals trained deeply in their disciplines but **capable of linking their expertise across siloes** on problems that matter to society."*

John Briscoe
Harvard University & World Bank

Technology and Innovation – *Impact Jobs*

- The number and nature of jobs as well as the required skill sets and competencies are likely to change. Hence, those with limited skill set are at risk of possible employment loss.

- New technologies may improve existing methods and processes and make them more efficient and cost-effective. On the other hand, disruptive technologies may fundamentally change the way that water is used.

- Integration of local technology and knowledge may allow for better tailoring of solutions to local conditions and improve uptake.

Technology and Innovation – *Impact Jobs*

- ICT-based advances support various facets of water supply and demand.
  - STEM backgrounds are critical.
  - New job opportunities in R&D and ICT-versed professionals.
- Innovation originating in or benefitting the water sectors can both destroy and create jobs, albeit not always in tandem and affecting differing levels of competences.

*"**The digital journey is about change management and a business transformation process**. At the heart of all these things, it is really the people…they have to ensure they stay on top of changes and also **spend time and energy to adjust to using the new system**. It's really about bringing our staff along on this [digital] journey with us."*

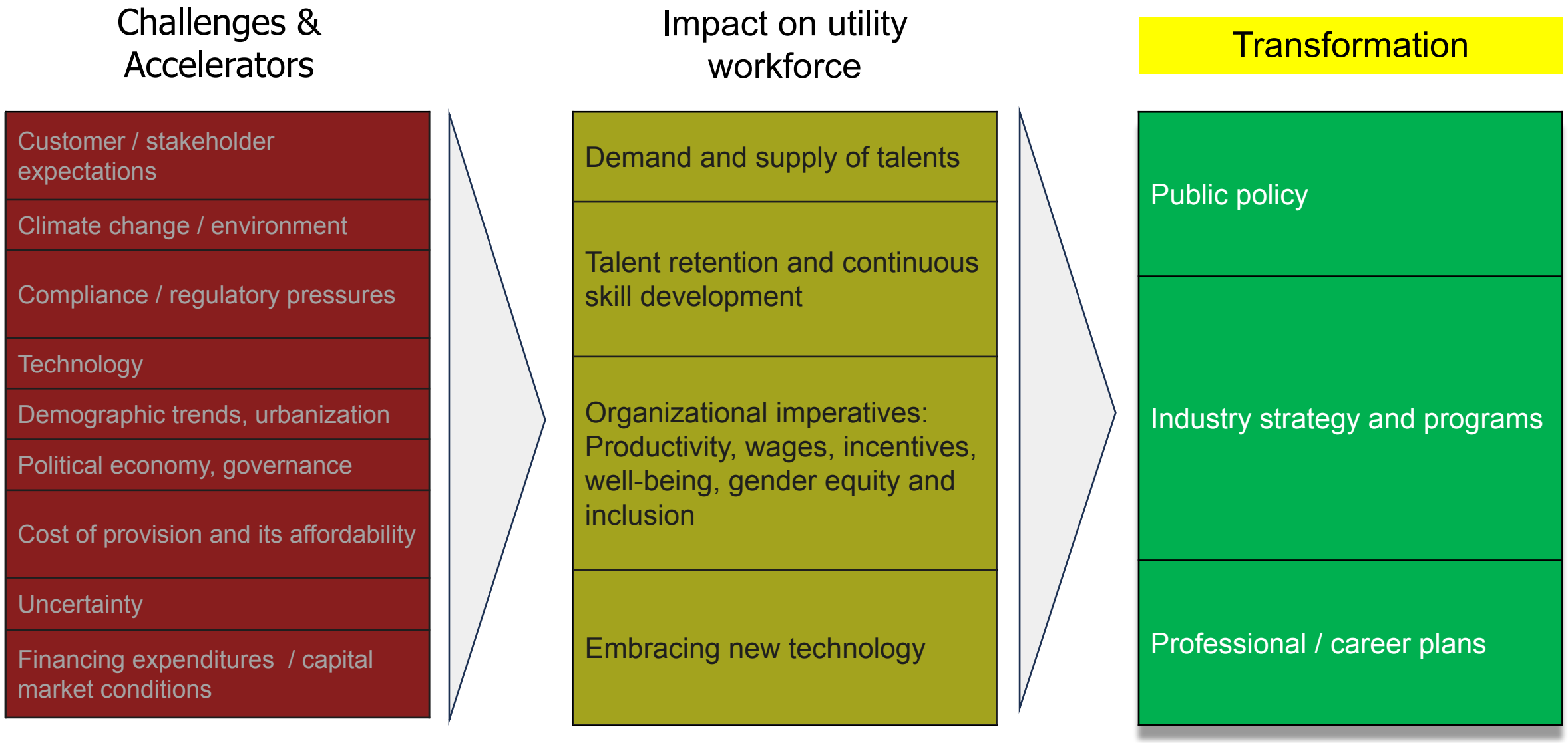
Source: Aqua Trade. May 2022. Creating Singapore's Digital Utility of the Future.

Dr. Pang Chee Meng
Chief Engineering & Technology Officer
Technology Department
PUB, the National Water Agency of Singapore

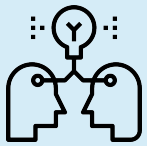
Key Messages

- Water utilities in urban areas face significant and unique challenges with **transformational impact** on human capital.
- The workforce **must adapt** to the water utility of the future.
- **Addressing the sector's workforce challenges require a strategic approach.**
- A glimpse of the **emerging competencies** required by the water utility of the future.

Framework for Analysis



Policy Responses - *National / Government*

	Approach
	**Invest** in educational programs that focus on water-related disciplines.
	**Establish** training and development programs to upskill existing water sector employees.
	**Organize** awareness-raising activities about the water-related challenges and their implications for and interrelations with.
	**Accumulate** and **transfer** lessons on knowledge and capacity development.

Policy Responses - *National / Government*

	Approach
	**Promote** strong social dialogue, effective coordination among ministries, and improved communication between employers and training providers.
	**Develop** strategic plans to anticipate and address future workforce needs for the aging employees.

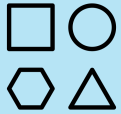
Industry Strategies

	Approach
	**Provide** ongoing training and development opportunities for both newcomers and existing employees.
	**Ensure** that salaries and benefits for water sector professionals are competitive.
	**Engage** in community outreach and educational initiatives to raise awareness about water conservation.
	**Address** new and transversal themes such as water integrity, human rights-based approaches, water diplomacy, water economics, gender, regulation and the use of technology.

Industry Strategies

	Approach
	**Create** a culture that encourages employees to propose and implement innovative solutions.
	**Collaborate** at local, national and international levels.
	**Conduct** organizational capacity development aiming for organizational or systemic change.
	**Build** evidence-based data for human resources policy and program strategy.

Industry Strategies

	Approach
	**Collaborate** with educational institutions to shape curricula that align with industry needs.
	**Develop** mental health support services for employees.
	**Promote** diversity and inclusion within the workplace.

Career Planning - *Professional*

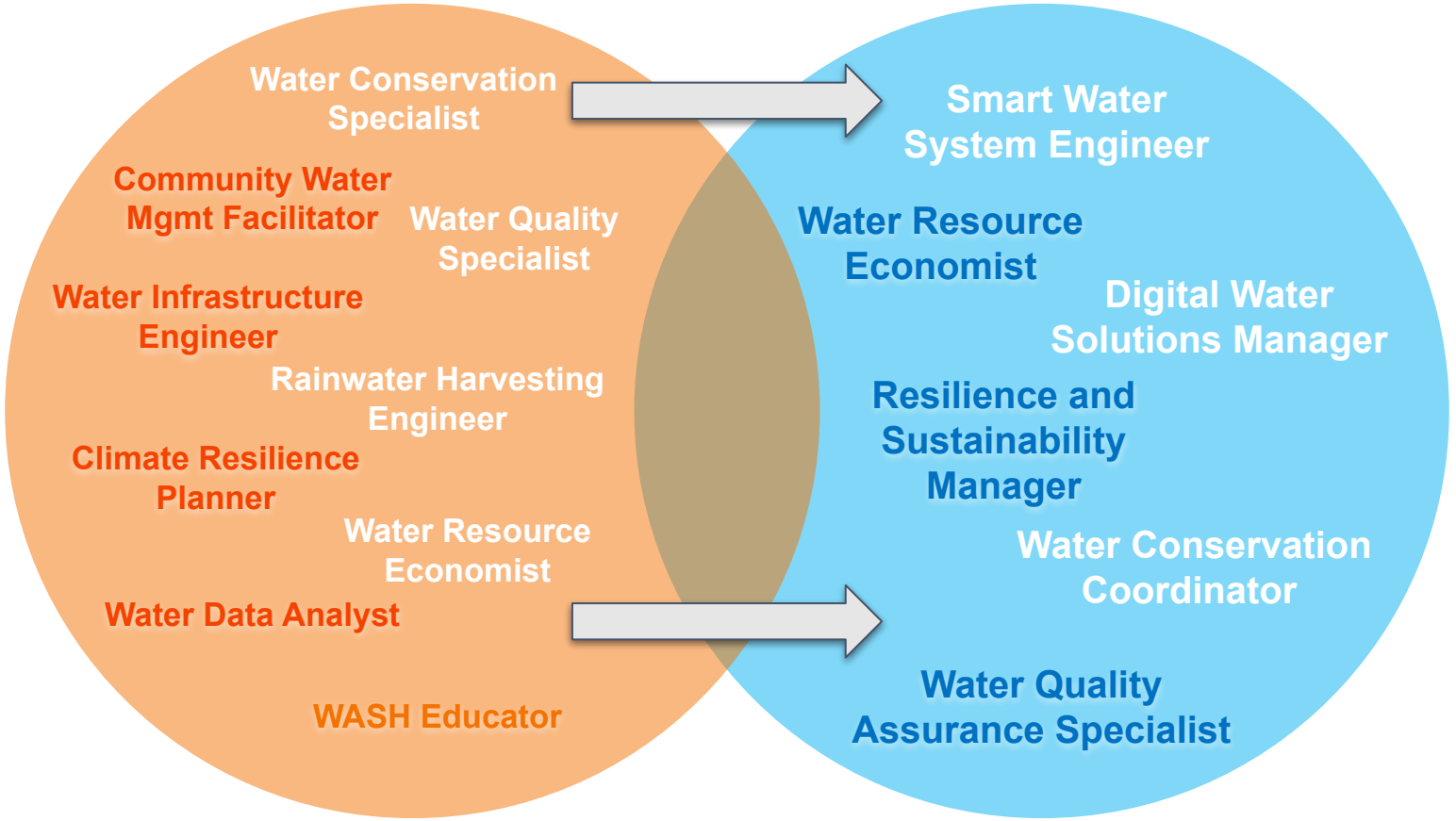
	Approach
	**Acquire** a diverse skill set that can make you a well-rounded professional.
	**Stay** informed about emerging trends, technologies, and regulations in the water sector.
	**Engage** in industry initiatives and associations that focus on addressing workforce challenges.
	**Develop** resilience in the face of challenges.

Key Messages

- Water utilities in urban areas face significant and unique challenges with **transformational impact** on human capital.
- The workforce **must adapt** to the water utility of the future.
- Addressing the sector's workforce challenges require a **strategic approach**.
- **A glimpse of the emerging competencies required by the water utility of the future.**

Emerging Jobs

Developing Countries

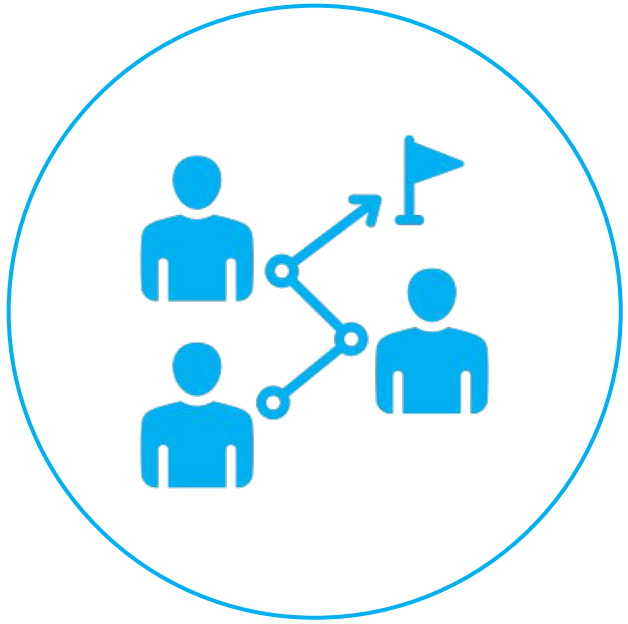


Developed Countries

Competency Model

LEADERSHIP

CRITICAL THINKING



COLLABORATION

Leadership

- *champion* leader
- *enabling* leader
- *cross-boundary*
- *team* leader
- *thought* leader
- *strategic* leader
- *trusted advisor* roles

Source: Water Leadership. International Water Centre / Griffith University

"Deregulation of key industries and the liberalization of the economy; he encouraged the privatization of public entities to include the modernization of public infrastructure through an expanded Build-Operate-Transfer law."

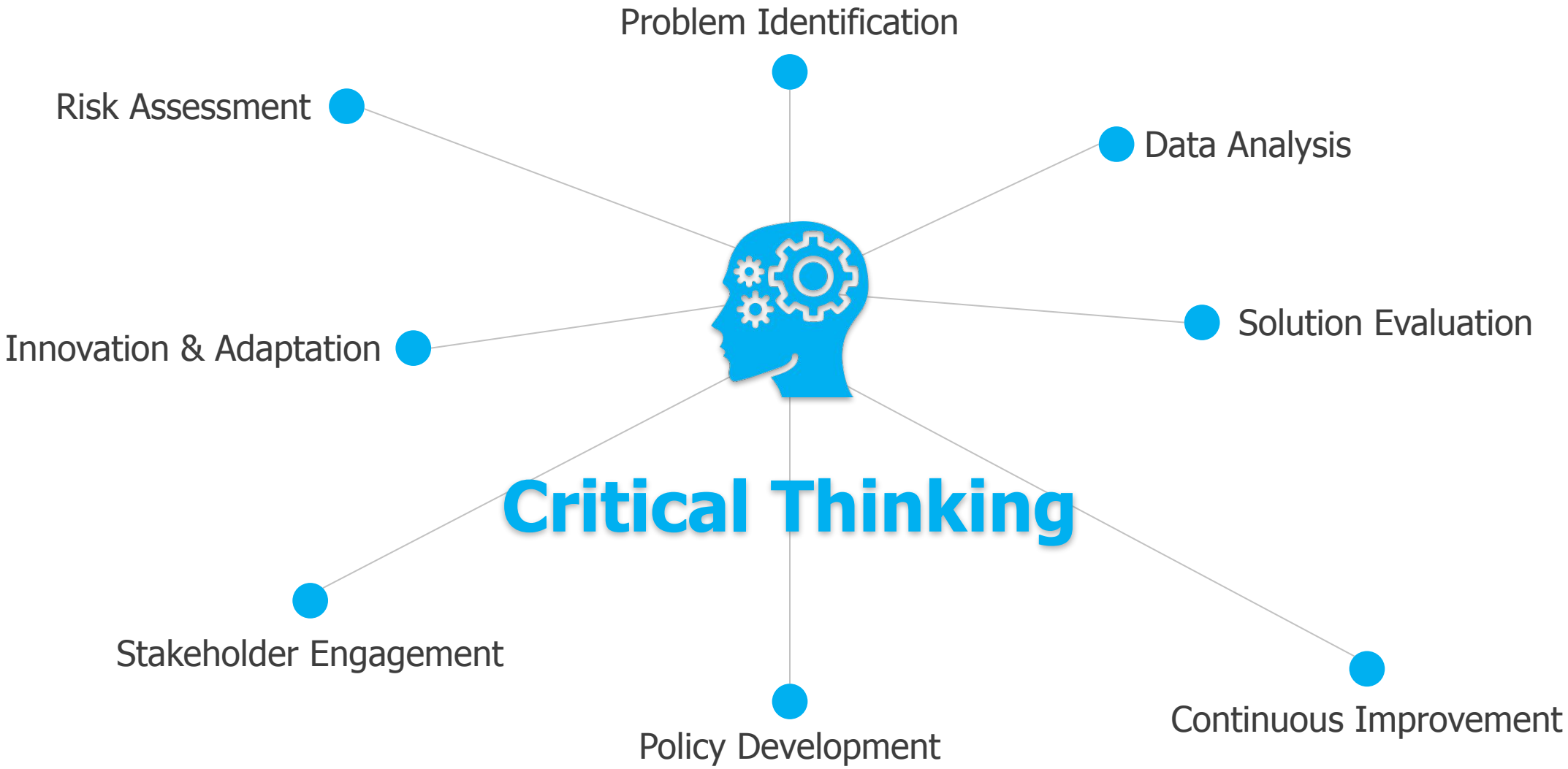
– Fidel V. Ramos

"Every other policy has to bend at the knees for our water survival."

– Lee Kuan Yew

"Decentralization and empowerment. Alignment of social and business goals anchored on Total Management System."

– Antonio T. Aquino


Problem Identification
Risk Assessment
Data Analysis
Innovation & Adaptation
Solution Evaluation
Critical Thinking
Stakeholder Engagement
Policy Development
Continuous Improvement

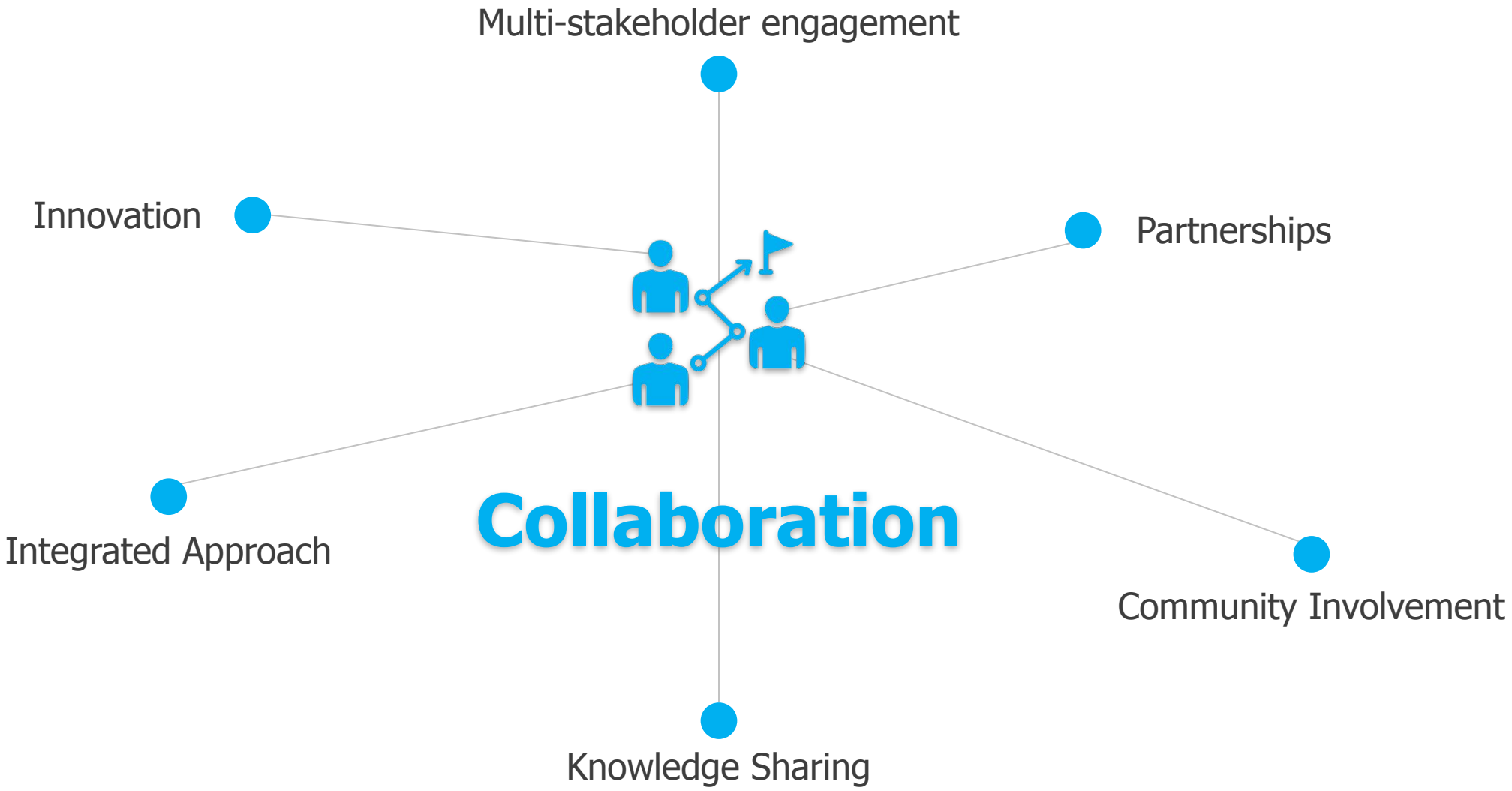

Multi-stakeholder engagement
Innovation
Partnerships
Collaboration
Integrated Approach
Community Involvement
Knowledge Sharing

Image Credit: Dmitry Kovalchuk

THANK YOU!

End of Presentation + Q&A

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