QUT eX

Real World Futures

Artificial Intelligence and The Smart City

Thursday 25 June 2020

Welcome

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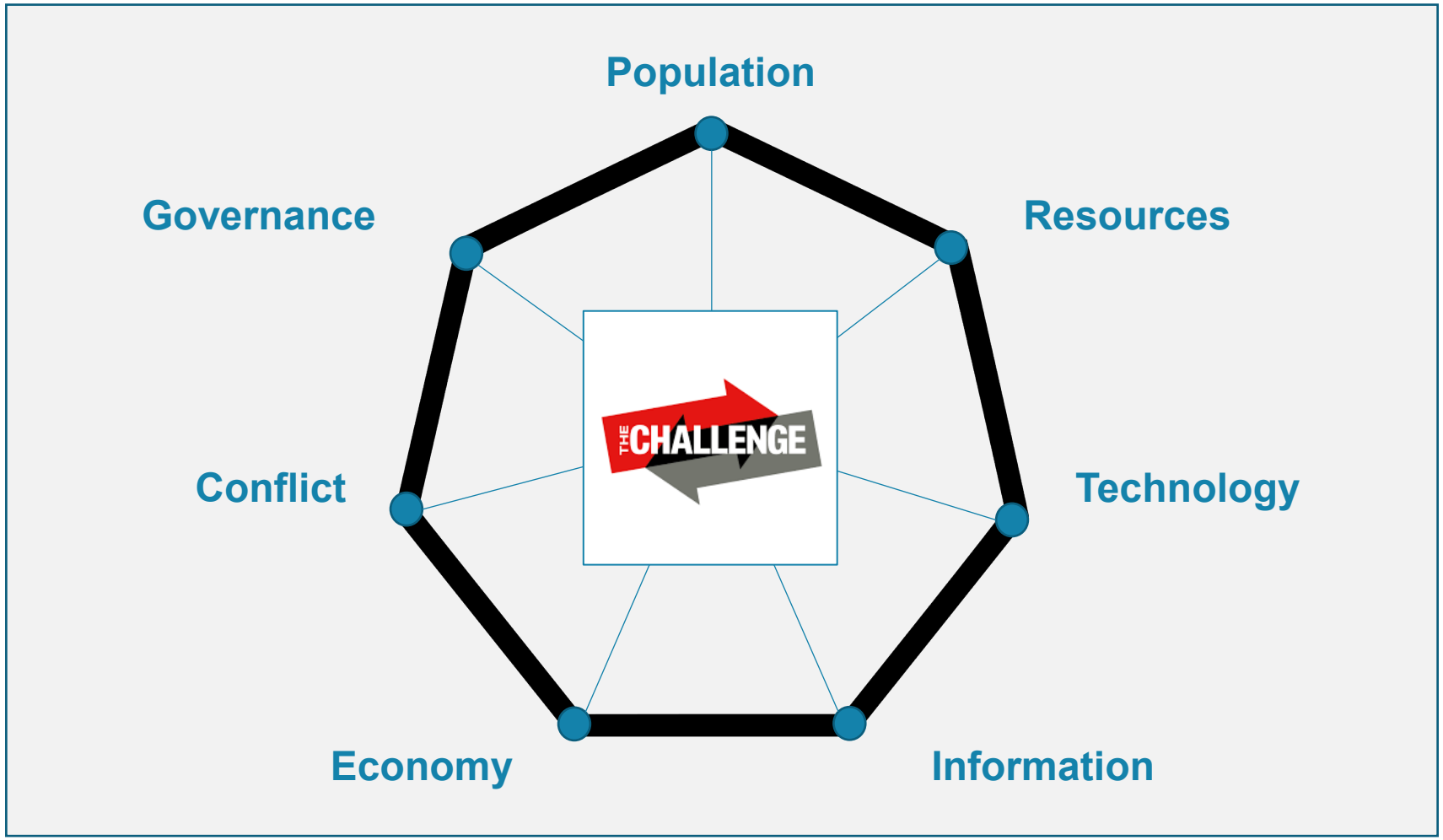
Artificial Intelligence (AI) & The Smart City

Interesting Times!

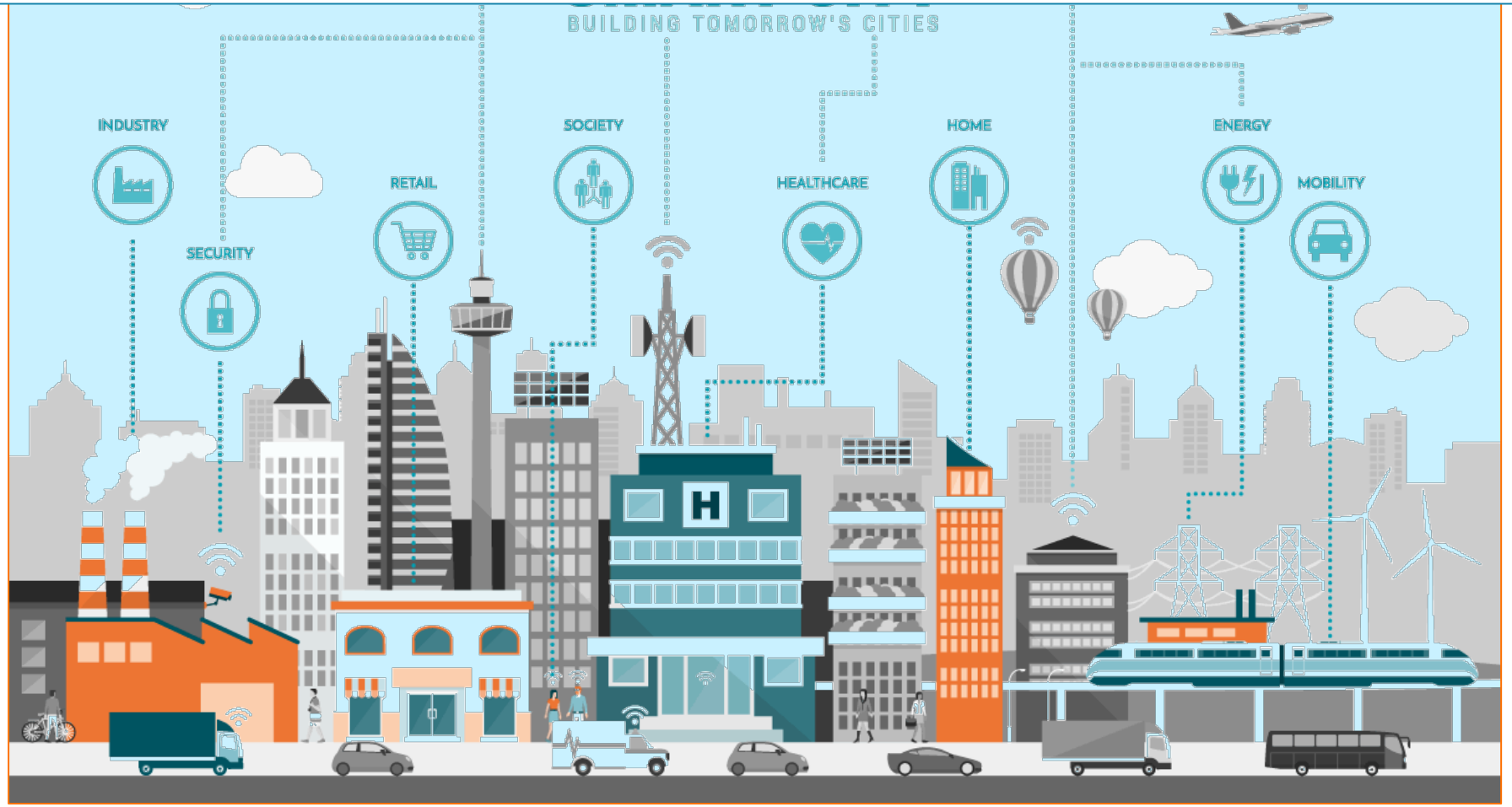
Global Challenges



Smart Cities

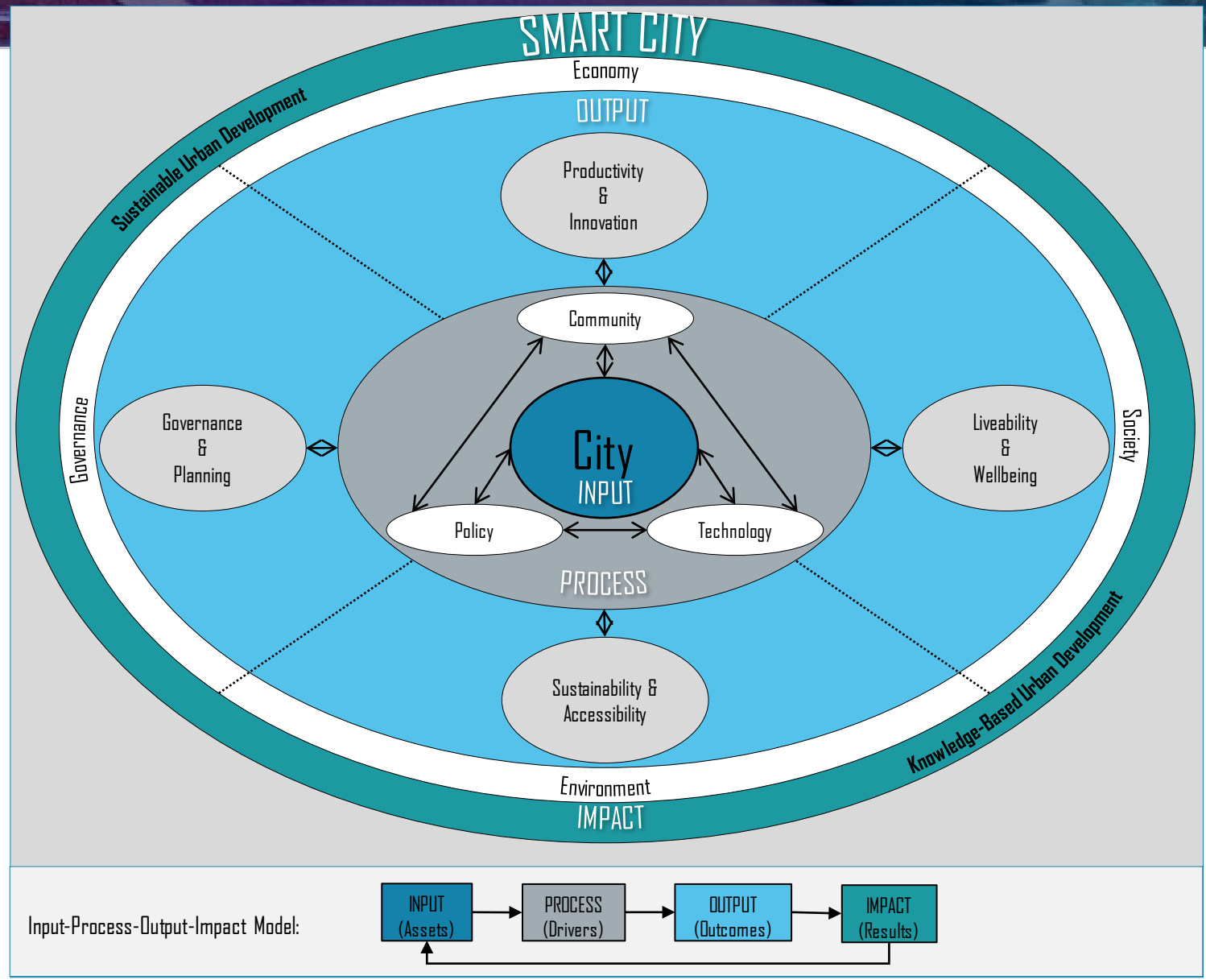
Definition

Smart City is an urban locality that employs digital data and technology to create efficiencies for boosting economic development, enhancing quality of life, and improving sustainability of the city.



Source: Mora et al. (2017)

Conceptual Framework



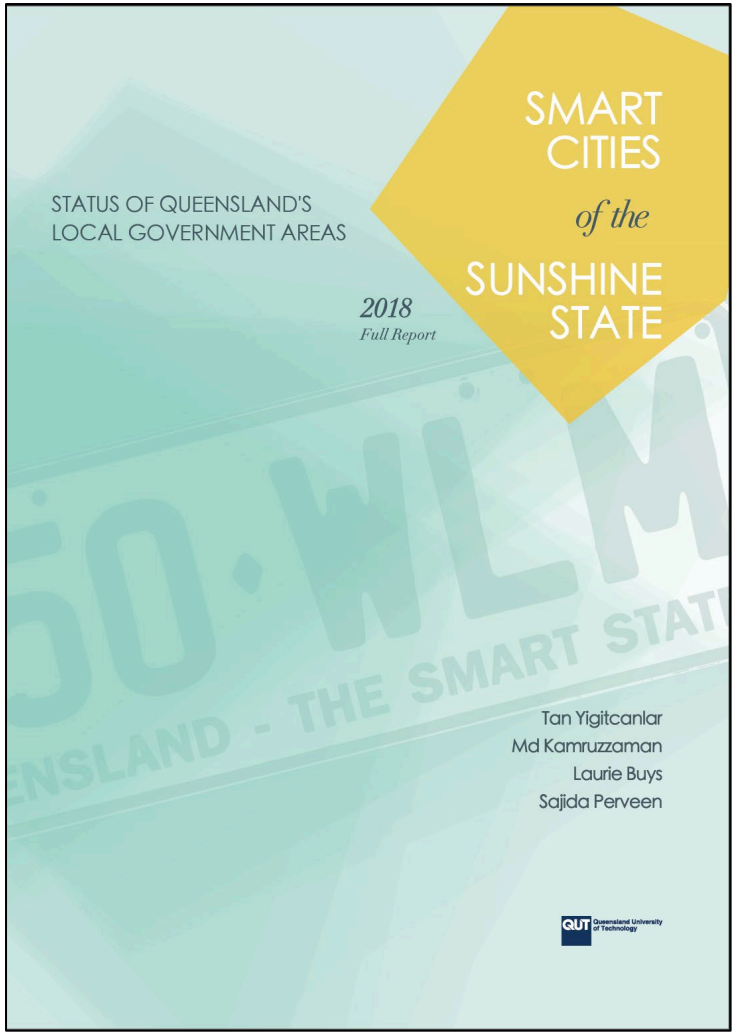
Source: Yigitcanlar et al. (2019a)

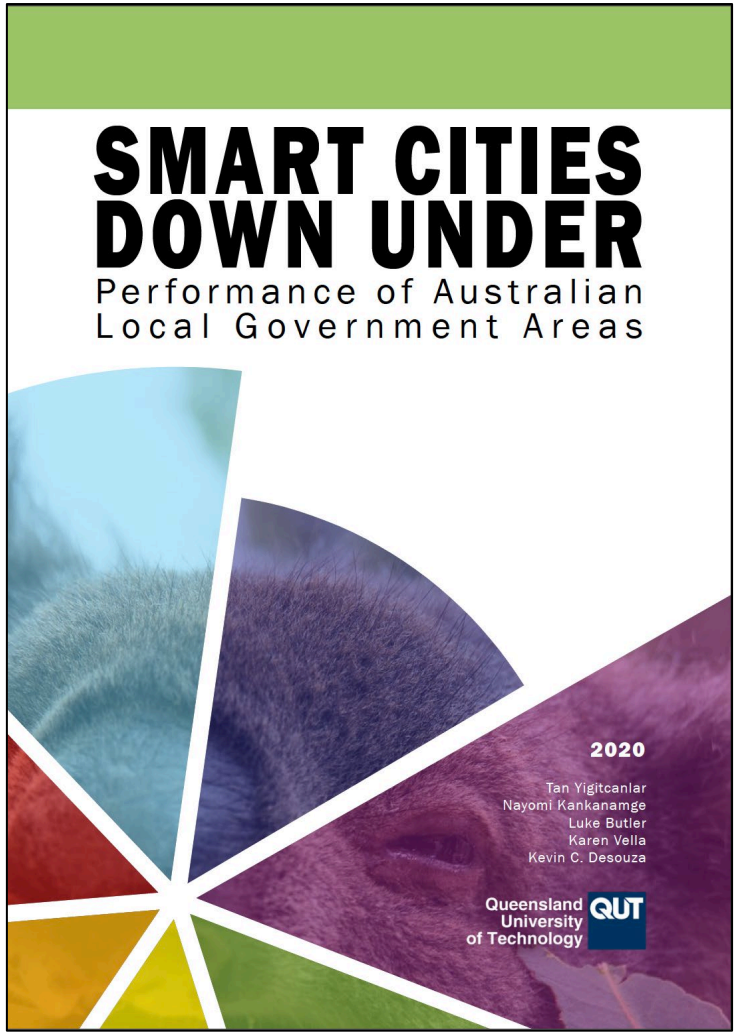
Definition

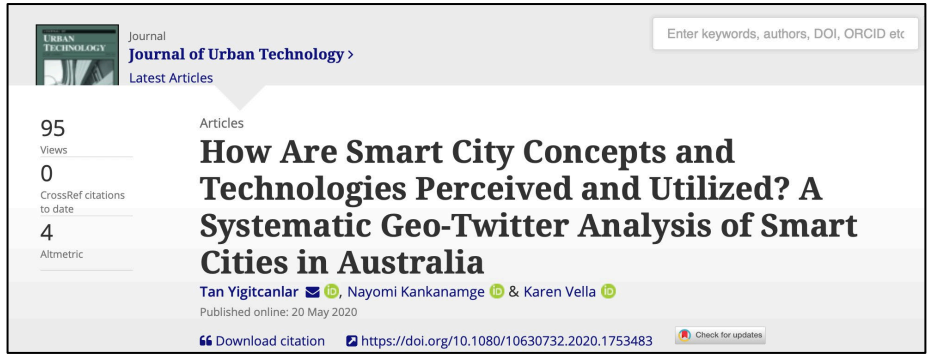
Smart City is an urban locality functioning as a robust system of systems with sustainable practices, supported by community, technology and policy, to generate desired outcomes and futures for all humans and non-humans.

Source: Yigitcanlar et al. (2019b)

Australian Smart Cities







States \ Concepts	Innovation	Sustainability	Start-ups	Governance	Mobility	Waste	Energy	Transport
ACT	54	40	14	23	10	12	10	12
NSW	213	140	145	125	44	46	2	4
QLD	30	50	17	31	15	11	2	2
SA	16	6	4	14	5	2	2	0
TAS	5	5	2	7	0	0	0	0
VIC	82	207	88	60	28	19	7	0
WA	11	1	5	6	3	0	1	3
AUSTRALIA	423	413	269	255	97	82	19	13

States \ Technologies	IoT	AI	AV	Big data	5G	Robotics	Open data	Blockchain
ACT	27	15	27	11	9	6	9	6
NSW	162	88	71	54	58	45	32	0
QLD	67	41	39	27	6	21	22	11
SA	21	18	12	12	4	5	8	4
TAS	9	0	1	1	0	0	1	1
VIC	103	66	68	44	47	45	34	30
WA	3	3	2	3	2	1	2	1
AUSTRALIA	392	231	220	152	126	123	108	53

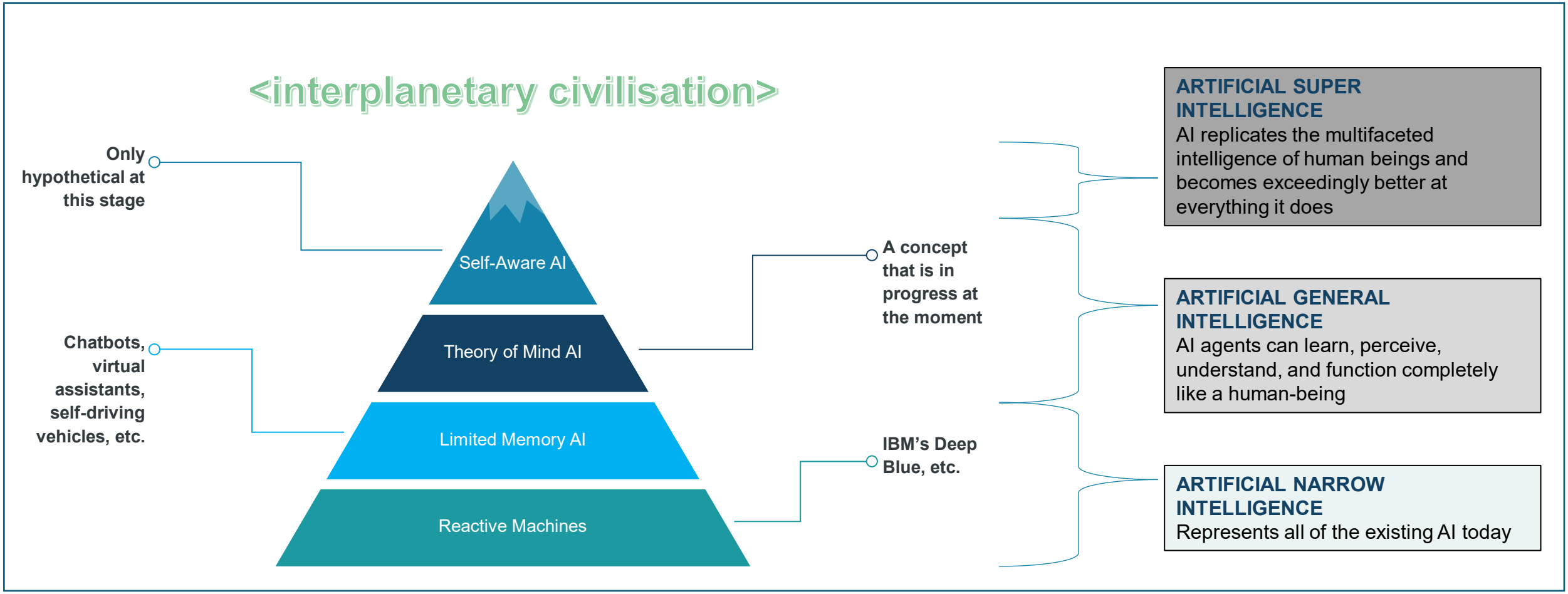
Artificial Intelligence (AI)

Definition

AI is the machines or computers that mimic cognitive functions that humans associate with the human mind, such as learning and problem solving.

Source: Schalkoff (1990)

Levels of AI



Source: Hintze (2016) & Joshi (2019)

Definition

AI is a software technology with at least one of the following capabilities:

Perception including audio/visual/textual/tactile (e.g., face recognition)

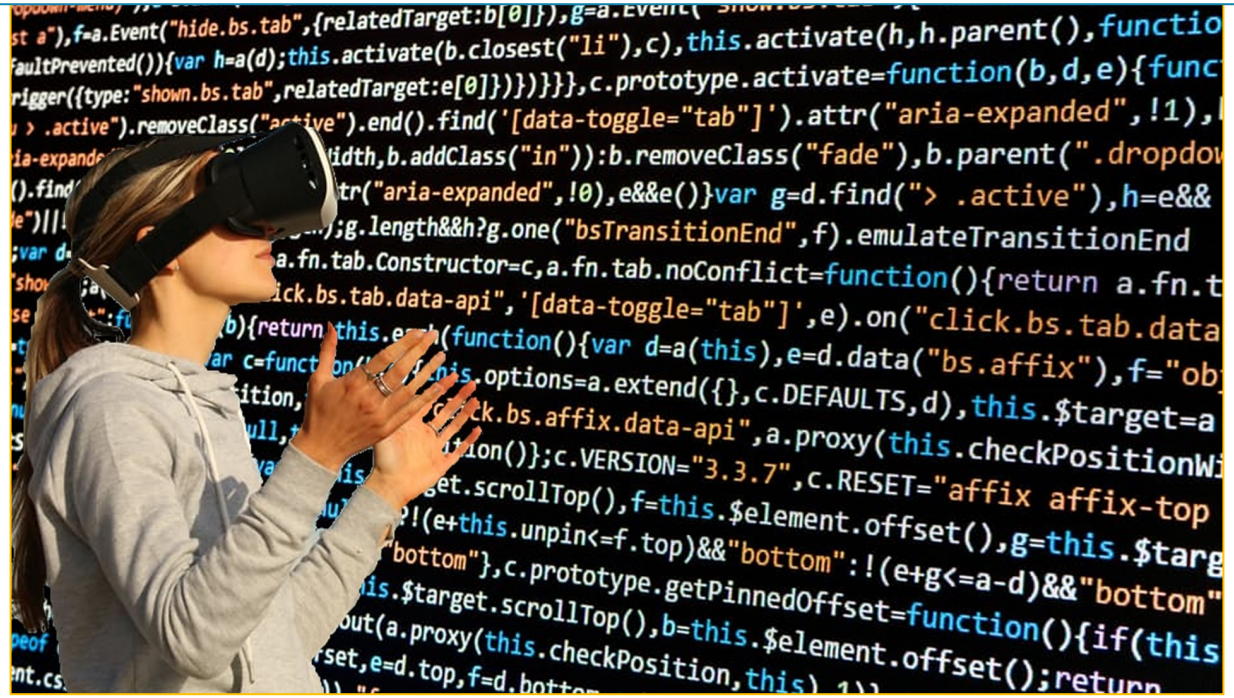
Decision-making (e.g., medical diagnosis systems)

Prediction (e.g., weather forecast)

Automatic knowledge extraction & pattern recognition (e.g., discovery of fake news)

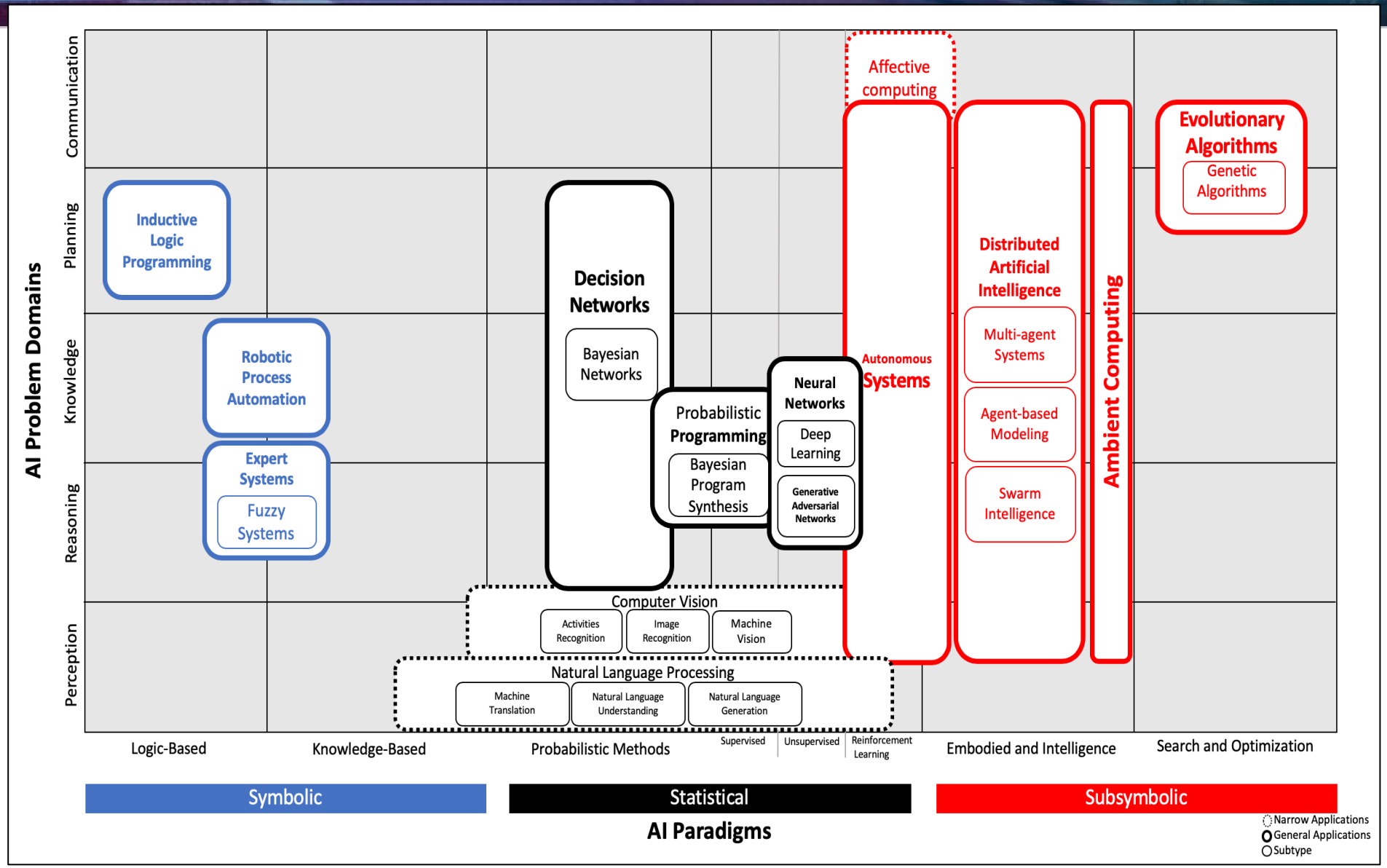
Interactive communication (e.g., social robots or chat bots)

Logical reasoning (e.g., theory development from premises).

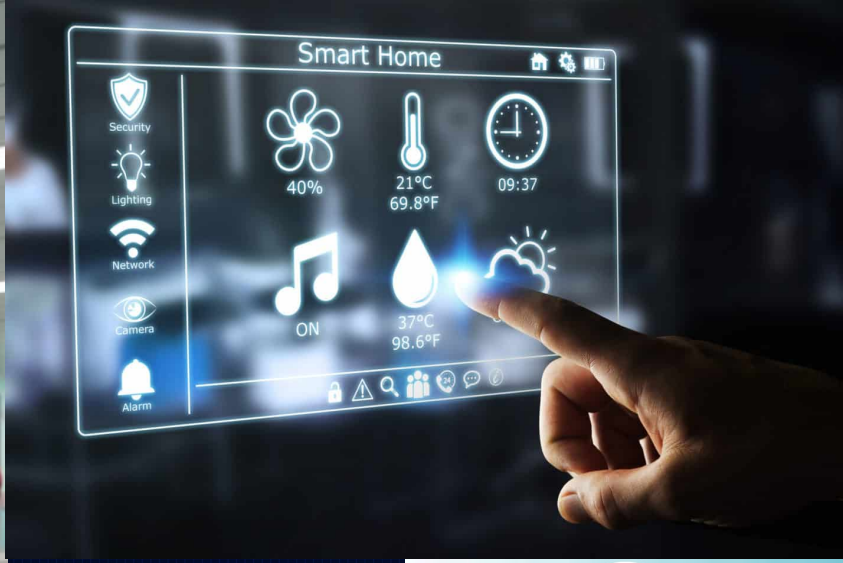


Source: Vinuesa et al. (2020)

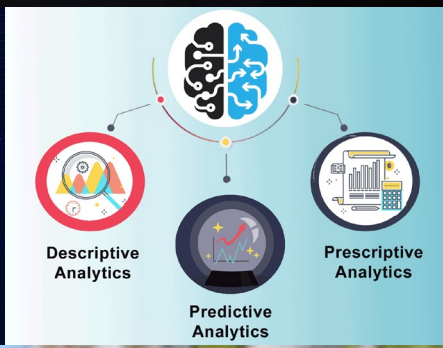
Classification of AI

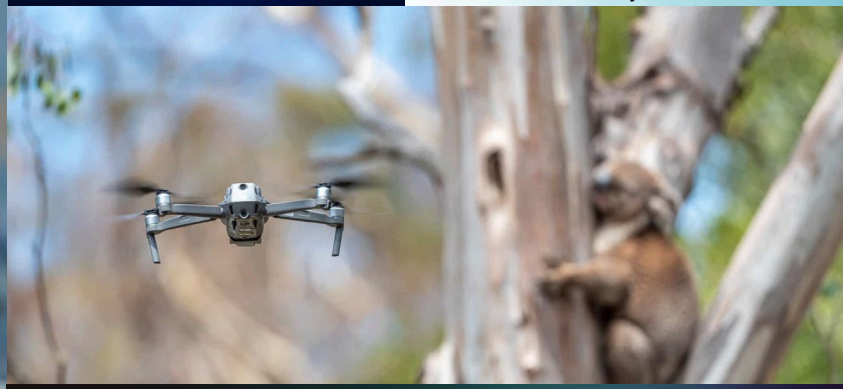


Source: Corea (2018)



Are We There Yet?





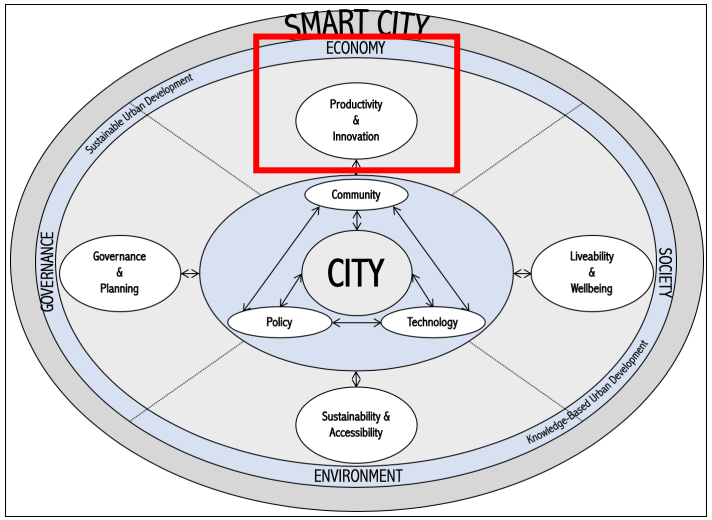
The AI & Smart City Symbiosis

AI in the Economy Dimension of Smart Cities

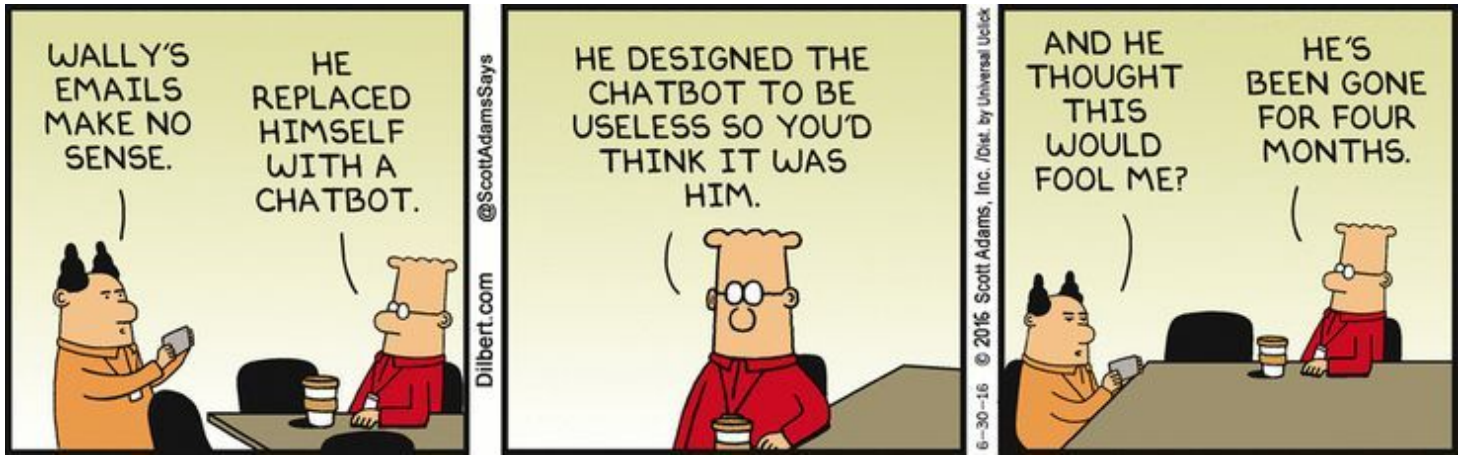
The focus is predominately on the technological innovation, productivity, profitability and management areas.

Examples of the contribution of AI:

(a) Enhancing productivity and innovation by automating data management and analysis.
(b) Increasing resources and reducing costs through pattern recognition.
(c) Supporting decision-making by analysing large volumes of data from multiple sources.
(d) Drawing conclusions for informed decisions based on logic, reason and intuition via deep learning.



Source: Yigitcanlar et al. (2020a)

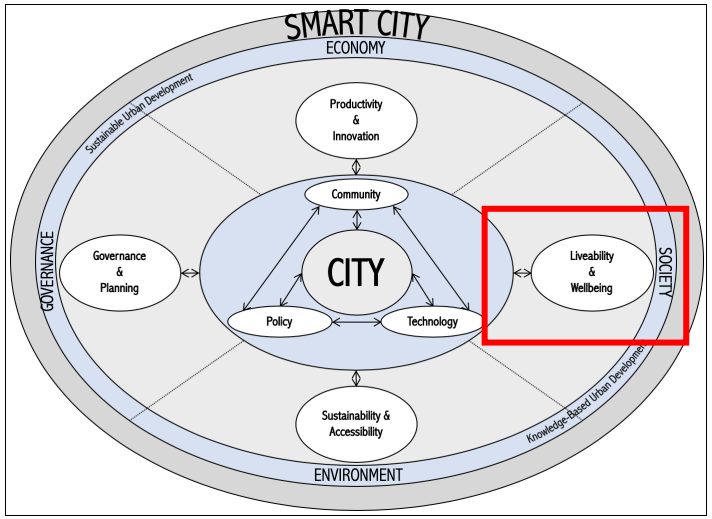


AI in the Society Dimension of Smart Cities

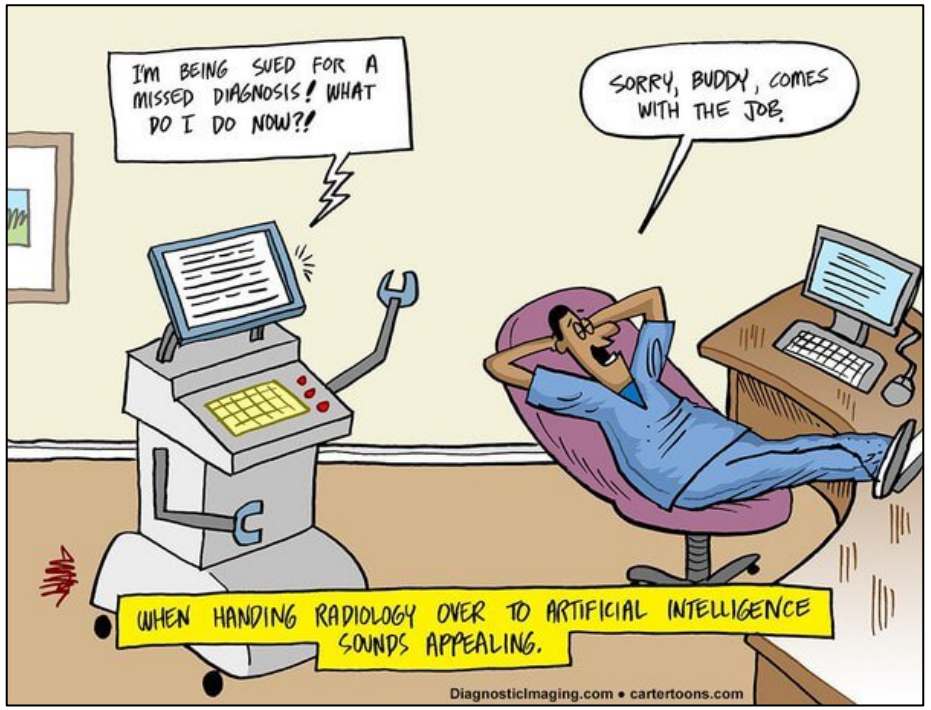
The focus is predominately on the health, wellbeing and education areas.

Examples of the contribution of AI:

(a) Improving health monitoring via smart sensors and analytics.
(b) Enhancing health diagnosis outcomes through medical imaging analytics.
(c) Providing autonomous tutoring systems to teach algebra or grammar.
(d) Offering personalised learning to manage how they progress through leaning activities.



Source: Yigitcanlar et al. (2020a)

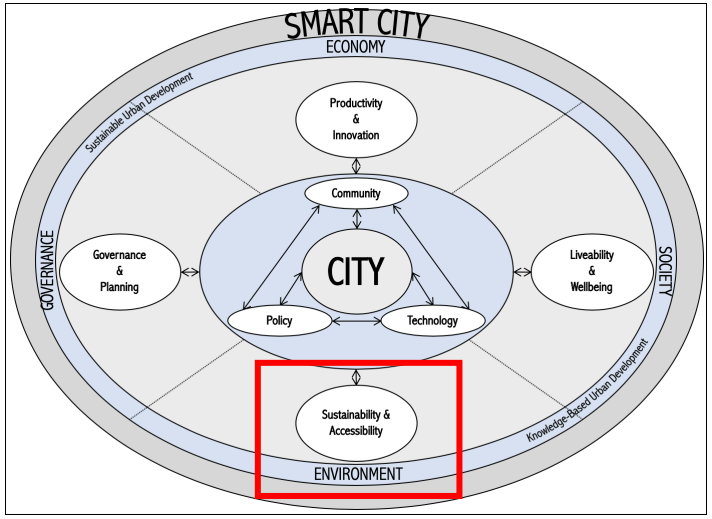


AI in the Environment Dimension of Smart Cities

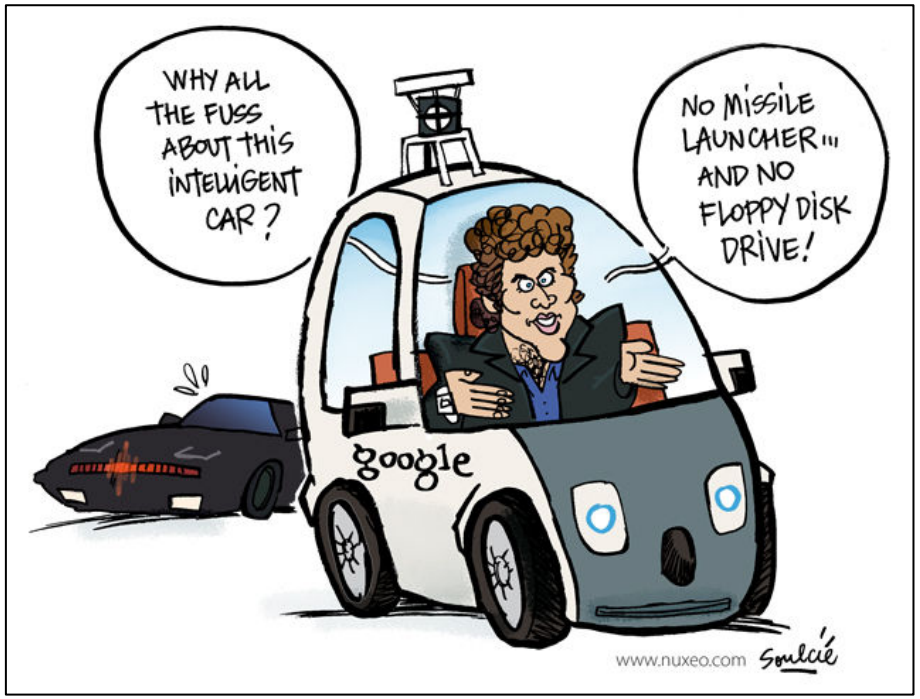
The focus is predominately on the transport, energy, land use, and environment areas.

Examples of the contribution of AI:

(a) Operationalising smart transport systems via MaaS.
(b) Optimising energy production and consumption via domotics.
(c) Monitoring changes in the natural and built environments via remote sensing with autonomous drones.
(d) Predicting the risks of climate change via machine learning algorithms to combine climate models.



Source: Yigitcanlar et al. (2020a)



AI for Planetary Challenges

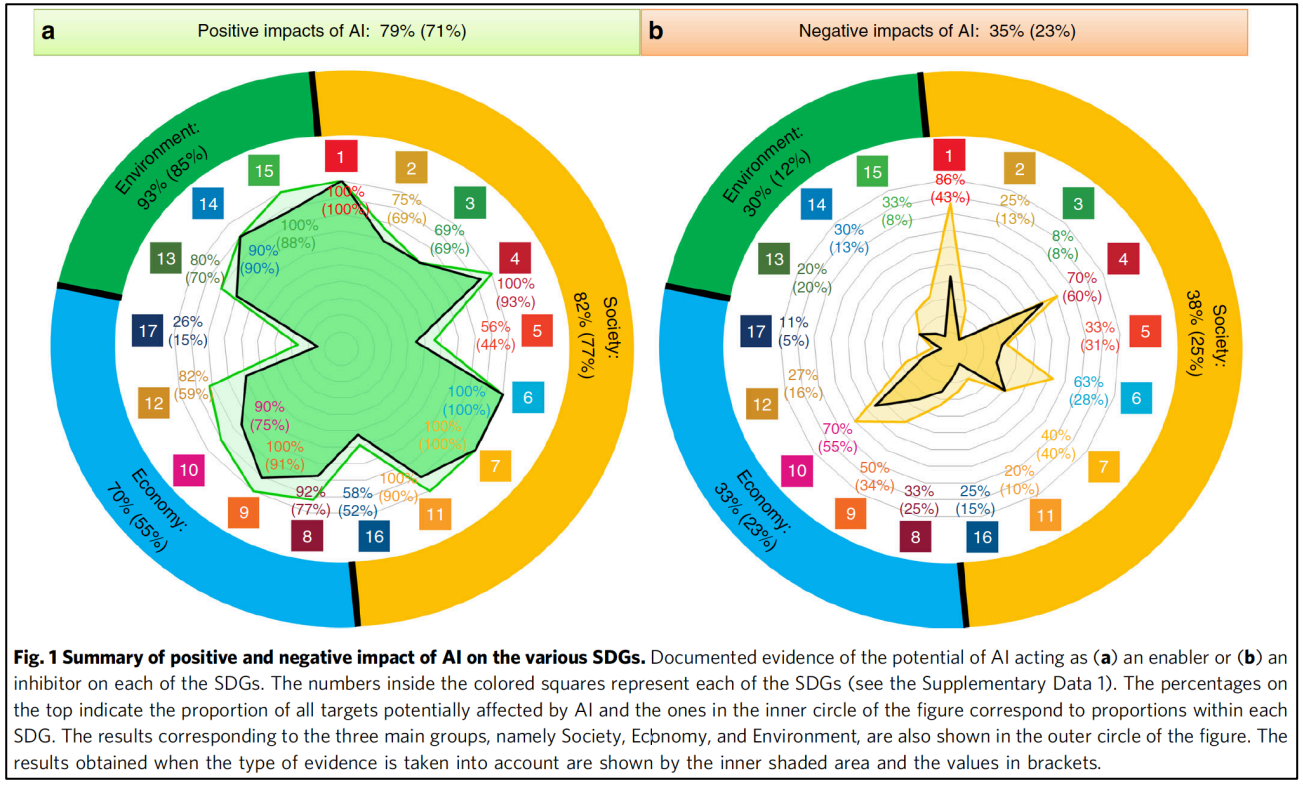


Fig. 1 Summary of positive and negative impact of AI on the various SDGs. Documented evidence of the potential of AI acting as (**a**) an enabler or (**b**) an inhibitor on each of the SDGs. The numbers inside the colored squares represent each of the SDGs (see the Supplementary Data 1). The percentages on the top indicate the proportion of all targets potentially affected by AI and the ones in the inner circle of the figure correspond to proportions within each SDG. The results corresponding to the three main groups, namely Society, Economy, and Environment, are also shown in the outer circle of the figure. The results obtained when the type of evidence is taken into account are shown by the inner shaded area and the values in brackets.

Source: Vinuesa et al. (2020) & Yigitcanlar et al. (2020b)

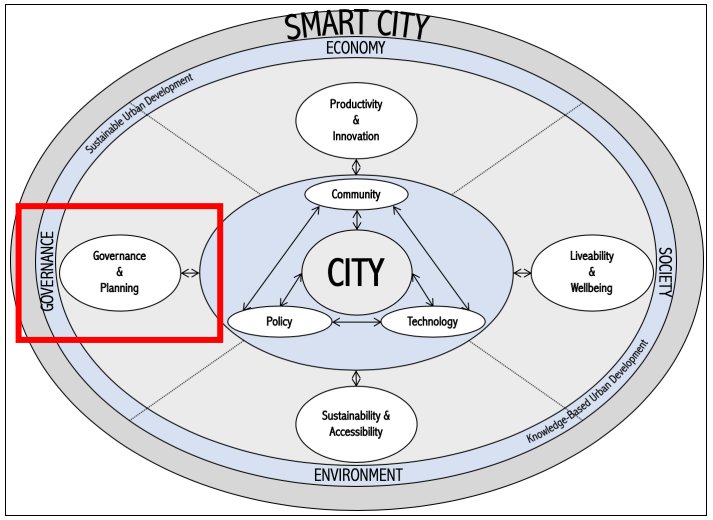
Planetary Challenges	AI Application Areas
Climate change	Clean power
	Smart transport options
	Sustainable production and consumption
	Sustainable land use
	Smart cities and homes
Healthy oceans	Fishing sustainability
	Preventing pollution
	Protecting habitats
	Protecting species
	Impacts from climate change (including acidification)
Clean air	Filtering and capture
	Monitoring and prevention
	Early warning
	Clean fuels
	Real-time, integrated, adaptive urban management
Biodiversity and conversation	Habitat protection and restoration
	Sustainable trade
	Pollution control
	Invasive species and disease control
	Realizing natural capital
Water security	Water supply
	Catchment control
	Water efficiency
	Adequate sanitation
	Drought planning
Weather and disaster resilience	Prediction and forecasting
	Early warning systems
	Resilient infrastructure
	Financial instruments
	Resilience planning

AI in the Governance Dimension of Smart Cities

The focus is predominately on the security, governance and decision-making areas.

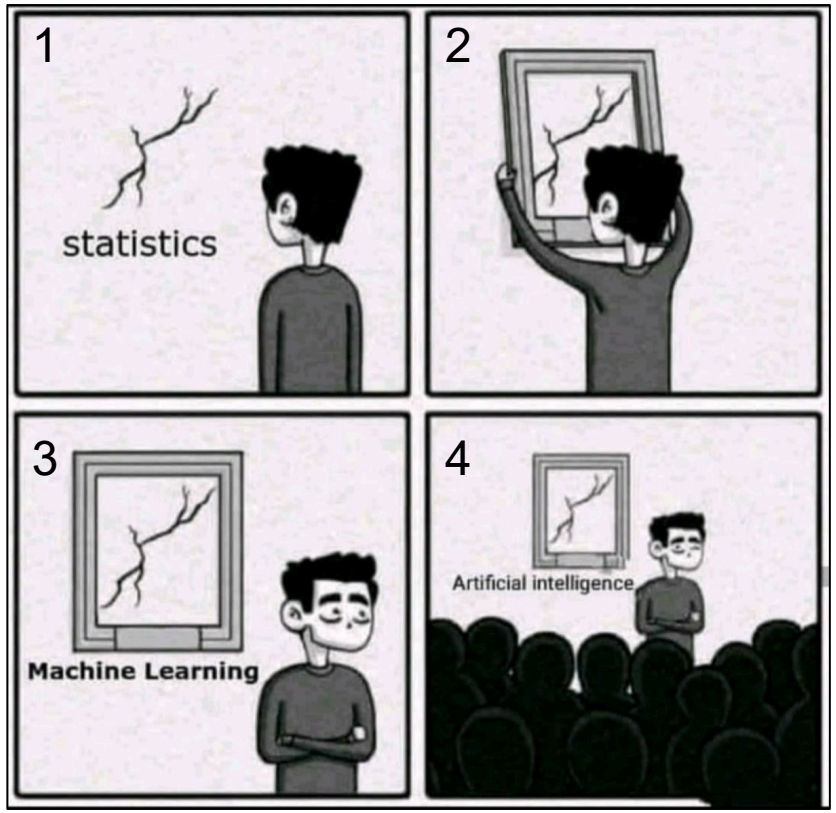
Examples of the contribution of AI:

(a) Assisting citizen scientists with new technology for informed decisions, and human AI oversight.
(b) Aiding the disaster and pandemic management planning and operations via predictive analytics.
(c) Enhancing the operability of surveillance systems via smart poles with AIoT.
(d) Improving cybersecurity by analysing cyber incident data, and identify potential threats.



Source: Yigitcanlar et al. (2020a)

Promises and Pitfalls of AI



Domains	Promises	Pitfalls
Economy	■ Enhance productivity and innovation ■ Reduce costs and increase resources ■ Support the decision-making process ■ Automate decision-making	■ Biased decision-making ■ Unstable job market ■ Loss of revenue streams ■ Loss of employment ■ Economic inequality
Society	■ Improve healthcare monitoring ■ Enhance health diagnosis outcomes ■ More adaptable education system ■ More personalized teaching ■ Task optimization	■ Biased decision-making ■ Misdiagnosis ■ Unstable job market ■ Loss of employment ■ Data privacy and security
Environment	■ Assist environmental monitoring ■ Optimize energy consumption ■ Optimize energy production ■ Optimize transport systems ■ Assist in developing more environmentally efficient transport systems	■ Biased decision-making ■ Increased urban sprawl ■ More kilometers traveled by motor vehicles ■ Changed property values ■ Energy intensive technology ■ Increased carbon footprint
Governance	■ Enhance surveillance systems ■ Improve cyber safety ■ Aid in disaster management planning and operations ■ Assist citizens with new technologies	■ Biased decision-making ■ Racial bias and discrimination ■ Suppression of public voice/protest ■ Violation of civil liberties ■ Privacy concern ■ Unethical use of technology ■ Risk of misinformation ■ Cybersecurity concern

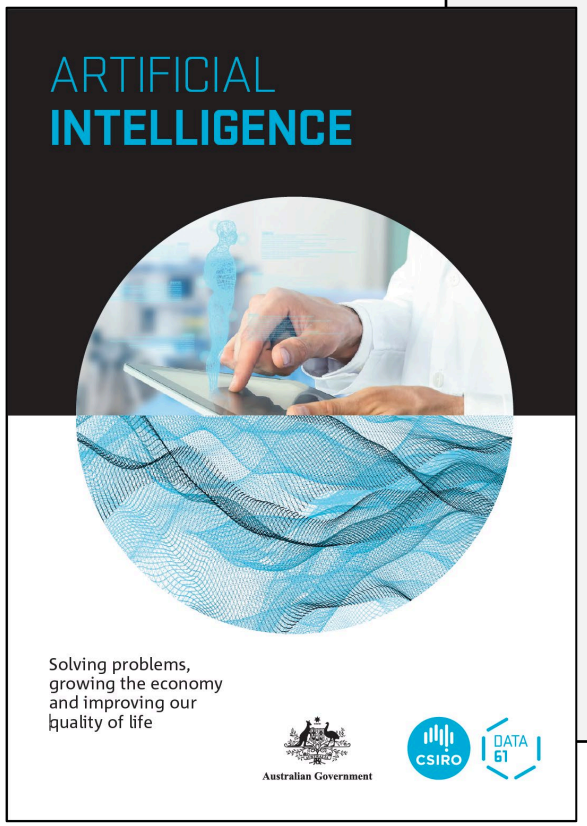
Source: Yigitcanlar et al. (2020a)

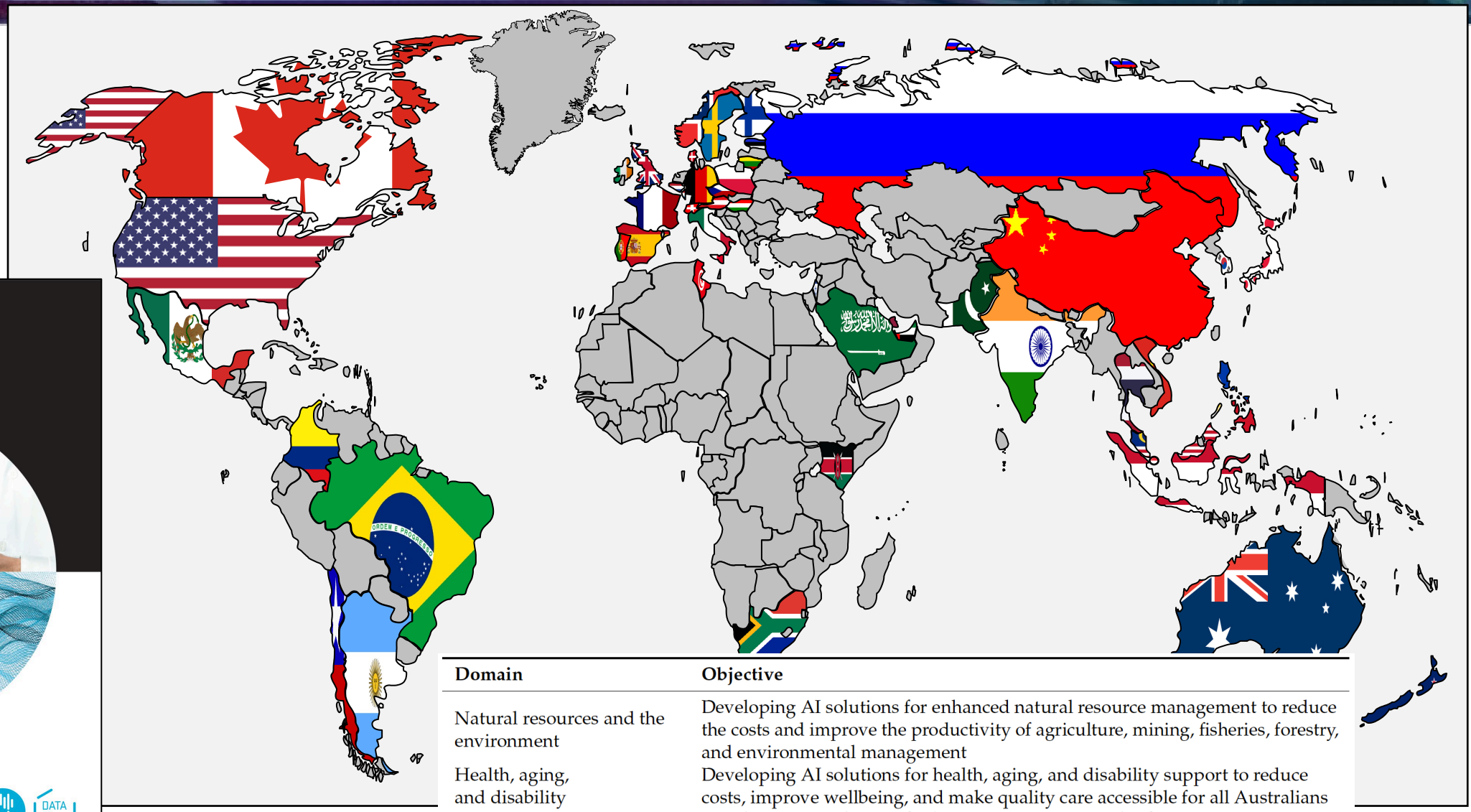
Better AI for Better Cities

Source: Yigitcanlar et al. (2020b)

National AI Strategies

The AI arms race is well underway!





Domain	Objective
Natural resources and the environment	Developing AI solutions for enhanced natural resource management to reduce the costs and improve the productivity of agriculture, mining, fisheries, forestry, and environmental management
Health, aging, and disability	Developing AI solutions for health, aging, and disability support to reduce costs, improve wellbeing, and make quality care accessible for all Australians
Cities, towns, and infrastructure	Developing AI solutions for better towns, cities, and infrastructure to improve the safety, efficiency, cost-effectiveness, and quality of the built environment

Conclusions

- Business efficiency, data analytics, health, education, energy, sustainability, land use, transport, governance, and security.
- Automated problem solving and decision-making processes, reform urban landscapes, and increase smartness of cities.
- Positive change in cities/societies/businesses by promoting a more efficient, effective and sustainable transformation.
- Upcoming disruptions of AI on cities and societies have not been adequately investigated, particular attention is needed.
- A symbiotic relationship between AI and smart cities for progression towards sustainable urbanism and futures.
- Policy apparatuses of local governments need modernisation to take full advantage of technology affordances.
- Emerging field of research and practice, further investigations are needed to consolidate the knowledge in the field.

Human oversight over AI decisions!

References

energies

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Review

Contributions and Risks of Artificial Intelligence (AI) in Building Smarter Cities: Insights from a Systematic Review of the Literature

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Received: 24 February 2020; Accepted: 16 March 2020; Published: 20 March 2020

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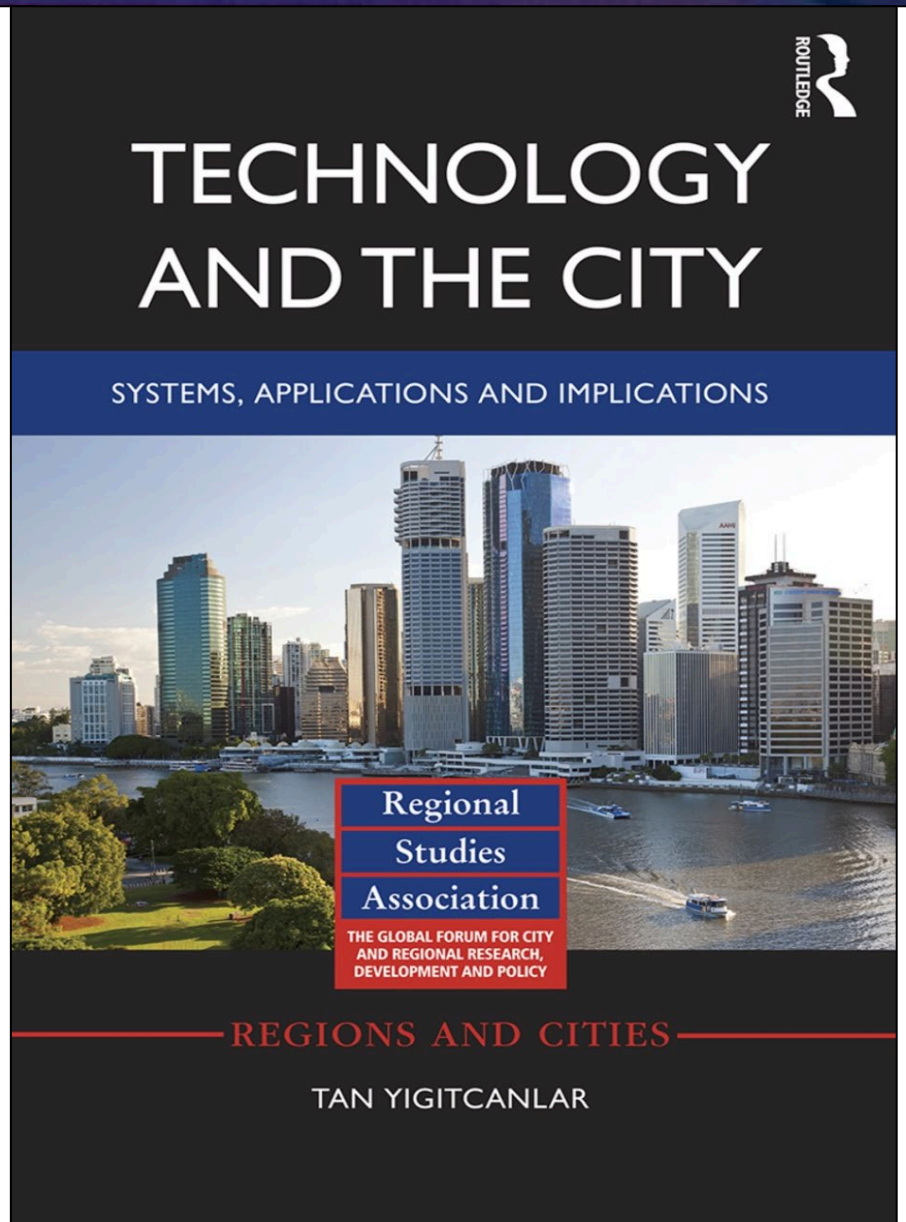
Abstract: Artificial intelligence (AI) is one of the most disruptive technologies of our time. Interest in the use of AI for urban innovation continues to grow. Particularly, the rise of smart cities—urban locations that are enabled by community, technology, and policy to deliver productivity, innovation, livability, wellbeing, sustainability, accessibility, good governance, and good planning—has increased the demand for AI-enabled innovations. There is, nevertheless, no scholarly work that provides a comprehensive review on the topic. This paper generates insights into how AI can contribute to the development of smarter cities. A systematic review of the literature is selected as the methodologic approach. Results are categorized under the main smart city development dimensions, i.e., economy, society, environment, and governance. The findings of the systematic review containing 93 articles disclose that: (a) AI in the context of smart cities is an emerging field of research and practice. (b) The central focus of the literature is on AI technologies, algorithms, and their current and prospective applications. (c) AI applications in the context of smart cities mainly concentrate on business efficiency, data analytics, education, energy, environmental sustainability, health, land use, security, transport, and urban management areas. (d) There is limited scholarly research investigating the risks of wider AI utilization. (e) Upcoming disruptions of AI in cities and societies have not been adequately examined. Current and potential contributions of AI to the development of smarter cities are outlined in this paper to inform scholars of prospective areas for further research.

Keywords: artificial intelligence (AI); AI technologies; AI algorithms; disruptive technology; smart city; smart urban technology; urban informatics; sustainable urban development; climate change

1. Introduction

There exists a strong scientific consensus that anthropogenic climate change is the biggest crisis of our time [1,2]. In a rapidly urbanizing world, climate change and the misuse and mismanagement of land and resources are triggering natural disasters and increasing their intensity [3,4]. Subsequently, cities are becoming frequently subjected to the direct or indirect impacts of natural disasters—for example, the 2019 Amazon Rainforest fires [5] and the 2020 Australian bushfires [6]. There have been numerous top-down (e.g., the Paris Agreement, Intergovernmental Panel on Climate Change, UN's Sustainable Development Goals, UN Climate Change Conferences) and bottom-up (e.g., school strikes, extinction rebellion protests, climate emergency declarations) attempts to raise awareness and develop policy actions to address the climate emergency [7,8].



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Viewpoint

Can Building "Artificially Intelligent Cities" Safeguard Humanity from Natural Disasters, Pandemics, and Other Catastrophes? An Urban Scholar's Perspective

Tan Yigitcanlar [1,*], Luke Butler [1], Emily Windle [1], Kevin C. Desouza [2], Rashid Mehmood [3] and Juan M. Corchado [4,5,6,7]

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Received: 28 April 2020; Accepted: 22 May 2020; Published: 25 May 2020

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Abstract: In recent years, artificial intelligence (AI) has started to manifest itself at an unprecedented pace. With highly sophisticated capabilities, AI has the potential to dramatically change our cities and societies. Despite its growing importance, the urban and social implications of AI are still an understudied area. In order to contribute to the ongoing efforts to address this research gap, this paper introduces the notion of an artificially intelligent city as the potential successor of the popular smart city brand—where the smartness of a city has come to be strongly associated with the use of viable technological solutions, including AI. The study explores whether building artificially intelligent cities can safeguard humanity from natural disasters, pandemics, and other catastrophes. All of the statements in this viewpoint are based on a thorough review of the current status of AI literature, research, developments, trends, and applications. This paper generates insights and identifies prospective research questions by charting the evolution of AI and the potential impacts of the systematic adoption of AI in cities and societies. The generated insights inform urban policymakers, managers, and planners on how to ensure the correct uptake of AI in our cities, and the identified critical questions offer scholars directions for prospective research and development.

Keywords: artificial intelligence (AI); artificially intelligent city; artificially intelligence commons; smart city; smart urban technology; urban informatics; sustainable urban development; climate change; pandemics; natural disasters

1. Introduction

What Is an Artificially Intelligent City?

During the current Anthropocene era—the geological epoch which has had significant human impact on Earth's geology and ecosystems—we have developed technological capabilities that have


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Questions?

For more information, please get in touch

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