

7
SMART
CITYDigitalization in
the energy sector in ChileSmart
LightningSmart
TrafficSmart
home & buildingSmart
industrySmart
farmSmart
parkingSmart waste
managementSmart fleet
management

Smart City is a vision of future urban area where smart ICT technologies will connect every major sector of the city through rich features such as the smart economy, smart mobility, smart environment, smart people, smart living, and smart governance.

Application presence by country

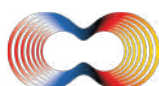
Uses/Applications	Germany	Finland	Japan	China	USA	UK	Sweden	France	South Korea	Singapore
Smart lightning										
Smart traffic										
Smart home & building										
Smart industry										
Smart farm										
Smart parking										
Smart waste management										
Smart fleet management										

Application potential by sector

Uses & Applications	Transportation	Industry	Buildings	Electricity Generation	Finance	Public Sector	Main type of energie
Smart lightning							Electricity
Smart traffic							Electricity and fossil fuels
Smart home & building							Electricity and fossil fuels
Smart industry							Electricity and fossil fuels
Smart farm							Electricity and fossil fuels
Smart parking							Electricity and fossil fuels
Smart waste management							Electricity and fossil fuels
Smart fleet management							Electricity and fossil fuels

Enabling Technologies

Technologies	Load monitor	In home display	Smart thermostat	Smart light	Smart plug/switch	Smart appliance	Hub	Smart meters	AMR/AMI	V2G	EV/PHEV	IED (relays, SCADA...	PMU	WAMS	Smart Sensors	Sensor and actuator	LAN/HAN/WAN/WAN	Cloud	5G	Machine learning	Data mining	Nature inspire	ANN	Multi-agent systems	Clustering	NLP	Digital twin	Autonomous vehicle	Blockchain	Actuators	3D printers
Uses & Applications	Smart home & Smart building							Smart grid							IoT & IoE					Big data, machine learning & AI											Physical action
Smart lightning																															
Smart traffic																															
Smart home&building																															
Smart industry																															
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Smart waste management																															
Smart fleet management																															



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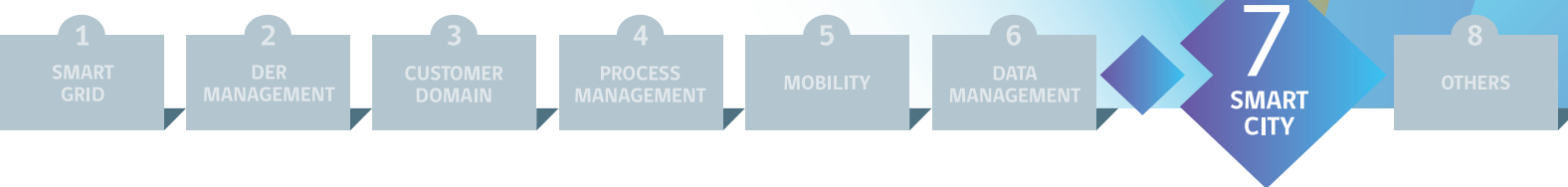
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7.1 Smart lightning

Smart lightning refers to lighting designed for energy efficiency, providing comfort and without neglecting safety. It usually consists of high-efficiency systems, controllers and sensors, in order to manage lighting considering the occupation and the presence of natural light.

Common examples



Grow Smarter was a project that receives the support of the European Commission in the first call for "Smart cities and communities". Among its lines of work, Smart street lighting stands out because it aims to implement the most successful technology to control a city's lighting program in order to provide optimal lighting for residents while reducing energy use and emissions of CO₂. After 12 months of evaluations the results were between 14.4% and 46% of annual energy savings.

Opportunities



It contributes to energy efficiency.



Improvements in road safety.

Information, infrastructure and regulation requirement

- ▶ Installation of a remote monitoring and control system is required.
- ▶ Customers information must be protected.

Barriers



Economic: high investment cost.



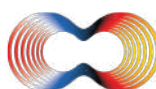
Security: the data of the intelligent lighting system must be safeguarded.



Others: it requires the support of citizens.

Application synergies

- ▶ Through **Forecasting and predictive analysis (6.2)**, it's possible to optimize the use of light by predicting the weather conditions.
- ▶ **DER (2.4)** and **Energy storage (2.2)** may be used in order to have a self-sustainable lightning system.



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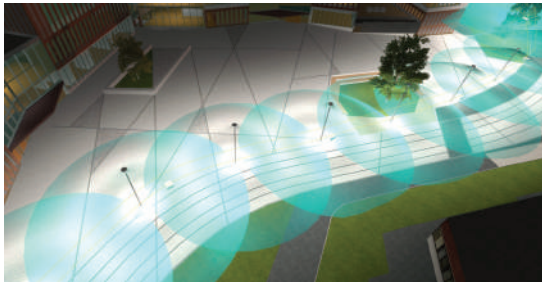


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International real application



LuxTurrim 5G it's a Nokia project that aims to allow viable commercial opportunities for digital services for the smart city environment. The project includes the technical development of the smart light poles with integrated 5G radio technology, different sensors and other devices, as well as modern urban planning and new digital services and business concepts related to security, navigation, smart lighting, climate monitoring, information exchange and publicity.

Examples of international goals

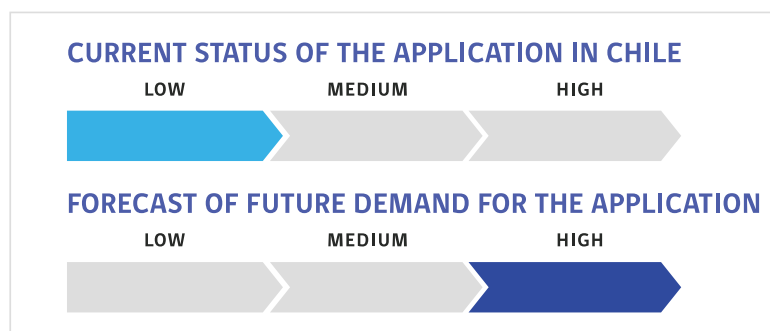
 The Singapore Land Transport Authority (LTA) announced that it will intensify its efforts to convert all roads in the city-state to more energy-efficient lighting systems by 2022. To this end, energy-efficient LEDs have been implemented and it is planned to replace the public lighting system with a Remote Control and Monitoring System (RCMS), in order to be able to control street lights remotely in response to lighting needs according to weather conditions.

National key partners and resources

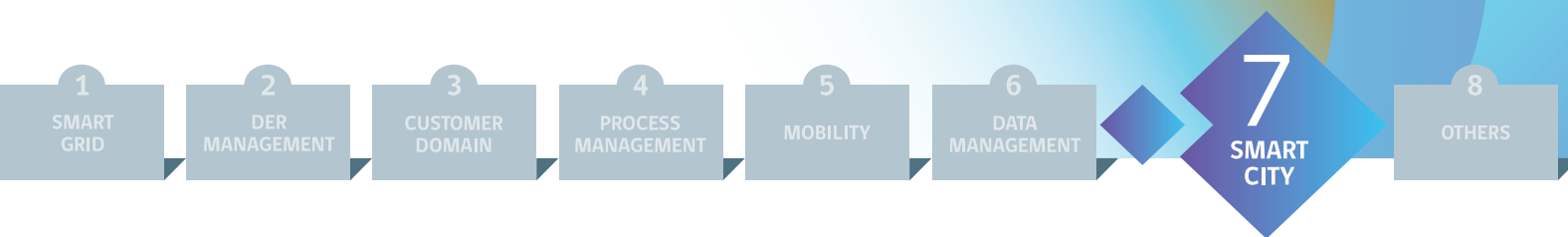


Public policies recommendations to Chile

- ▶ Application of pilot projects that show the benefits for society.
- ▶ Consider citizen education plans.
- ▶ Develop comprehensive strategic plans that include the implementation of various uses related to Smart City, in order to take advantage of synergistic opportunities and common solutions to detected gaps or barriers.



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7.2 Smart traffic

Smart traffic refers to the improvement of vehicular traffic flow using traffic signals and status data (number of vehicles and pedestrians), in addition to keeping travelers informed about the next bus or train in real time through the use of digital signage.

Common examples



The "smart mobility 2030" program, whose objectives are complemented by this use. Within its objectives is the reduction of traffic congestion and mitigating the impact of accidents on the roads; to achieve this is necessary to renew both fleets and infrastructure, allowing the use of new technologies to implement intelligent traffic.

Opportunities



Contributes to the reduction of emissions thanks to the reduction it implies in travel times.



Increases the well-being of people due to the better functioning of the traffic.

Information, infrastructure and regulation requirement

- ▶ Required telecommunications infrastructure and fleet renewal for greater penetration

Barriers



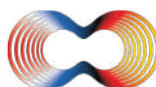
Infrastructure: A greater implementation of VANETs and 5G stations is required; renewal of fleets so that more vehicles can participate; lack of capacity to analyze large amounts of data and integration of platforms.



Others: not all users will have vehicles capable of interacting with this technology.

Application synergies

- ▶ All uses in the mobility class (Private (5.1), Public (5.2), Cargo (5.3) and Shared mobility (5.4)) benefit from smart traffic applications.



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International real application

Fintraffic is a Finland company specialized to provide and develop traffic control and management services in all traffic forms (air, railway, land and maritime traffic). They're responsible for road traffic management in Finland and they're dedicated to provide and develop services that ensure safe and fluid transportation.



Examples of international goals



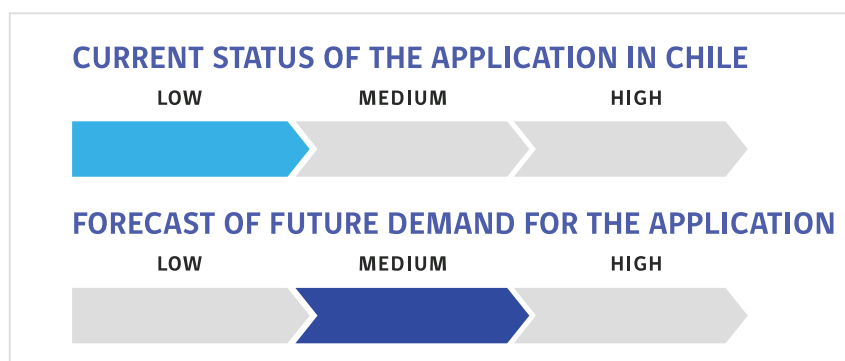
In England there is the National Traffic Control Center (NTCC), whose objectives promote this use. To achieve the desired state of this use, it is necessary to implement VANETs and 5G, technologies that are currently under development by the department for transportation.

National key partners and resources

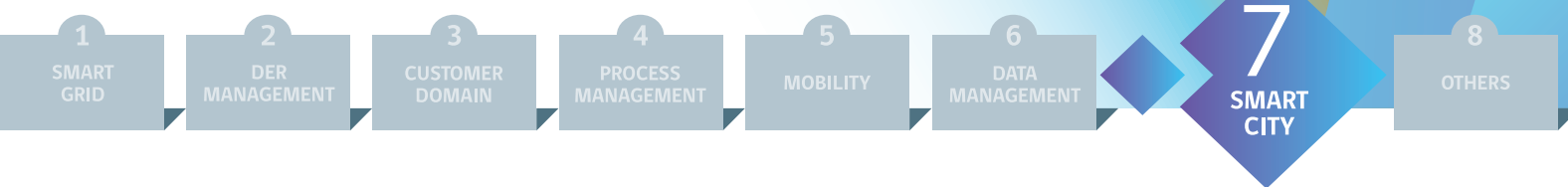


Public policies recommendations to Chile

- ▶ Support companies for the development of innovation in software related to the efficient management of the city.
- ▶ Consider citizen education plans.
- ▶ Develop comprehensive strategic plans that include the implementation of various uses related to Smart City, in order to take advantage of synergistic opportunities and common solutions to detected gaps or barriers.



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7.3 Smart home & building

A smart home incorporates a communications network that connects the key electrical appliances and services, and allows them to be remotely controlled, monitored or accessed.

Common examples



Of about 117 million U.S. homes in 2016, about 17 million had some type of smart home device. By 2020, 40 million smart thermostats are expected in U.S. homes with 50 million smart light bulbs, and 12 million smart water leak detectors.



Smart home devices are becoming ever more present in UK households. Penetration has reached almost a quarter (23%) with smart speakers (11%) leading the way (Tech UK, 2019). A PWC survey indicated that £10.8 billion will be spent on smart home devices in 2019, in the UK.



The South Korea smart home market is anticipated to exceed US\$ 6 Billion by 2025. In the country, household penetration for smart home applications was estimated at 20.6% in 2018.

Opportunities



Increase in the security of supply thanks to the greater control of the network.



Increase in the well-being of people by improving security, commodity, energy efficiency, etc.

Information, infrastructure and regulation requirement

- ▶ Equipment required in order to monitor and control home applications.

Barriers



Economic: high cost of the technology necessary for this use and unclear benefits to consumers.



Others: there is no single technology standard established; lack of interoperability.



Security: customers may be against to share their data.

Application synergies

- ▶ Through a smart home application is possible to manage DER (2.4) and check surplus of generation to sell it to the system; also, it's possible to respond to economic signals and participate in a DR (2.1) program.



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International real application

HomeKit is a software framework by Apple, that lets users configure, communicate with, and control smart-home appliances using Apple devices. By designing rooms, items, and actions in the HomeKit service, users can enable automatic actions in the house through a voice command or through the Home app. The software can control, among others, air conditioners, cameras, doors, lights, locks, speakers, televisions and windows¹⁰.



HomeKit

¹⁰ Marin Clean Energy, Available on <https://www.mcecleanenergy.org/>

Examples of international goals

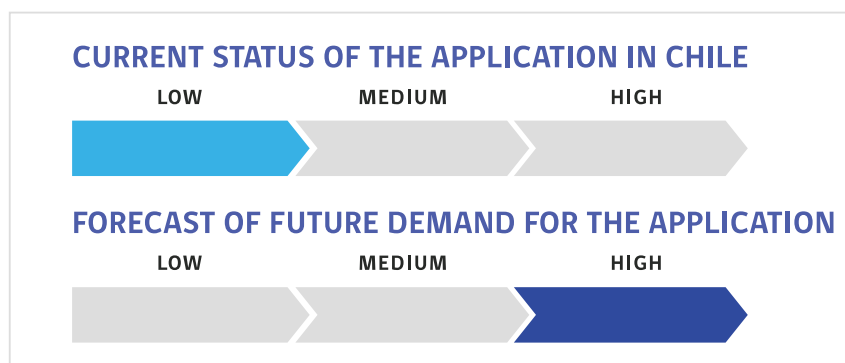
- ▶ Develop broad standards in the smart home and building industries.

National key partners and resources

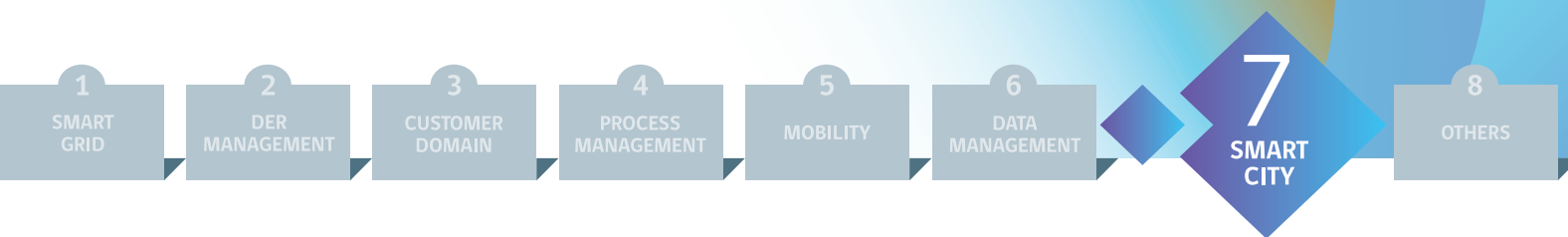


Public policies recommendations to Chile

- ▶ Consider citizen education plans.
- ▶ Develop comprehensive strategic plans that include the implementation of various uses related to Smart City, in order to take advantage of synergistic opportunities and common solutions to detected gaps or barriers.




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7.4 Smart industry

Smart Industry seeks to allow easier tracking of transport and logistics flows. It also involves the automation of industrial processes and manufacturing.

Common examples

 The Industry of the Future initiative (European Commission, 2017) is transversal and aims to modernize the entire French industry. For this, more than 500 trained experts provided support to more than 7,400 SMEs throughout France between 2016 and 2017. On the other hand, industrial companies have invested around 25,000 million euros a year in R&D since 2016, which represents two thirds of the total R&D expenses contracted by French companies, where the automotive sector has become the engine of innovation, taking 13% of the total.





Opportunities

-  Improves the efficiency of production processes.
-  Streamlines administrative processes by incorporating digitization of information.

Information, infrastructure and regulation requirement

- ▶ Equipment for processes automation.

Barriers

-  **Economic:** important investments in equipment and training.
-  **Security:** data might be associated with sensitive information so cybersecurity is crucial.
-  **Human capital:** lack of personnel trained in data analysis.
-  **Others:** lack of standardized measurement and verification.

Application synergies

- ▶ With **Process optimization & automation (4.1)** it's possible to automate certain processes in order to improve energy efficiency.



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International real application

ABB launched a new generation of robots to be used to automate processes in sectors like electronic, health attention, logistic, food and drink. The robots are intuitively designed so that clients don't need a great knowledge in programming, so they help to unlock industries that today have low levels of automation.



Examples of international goals



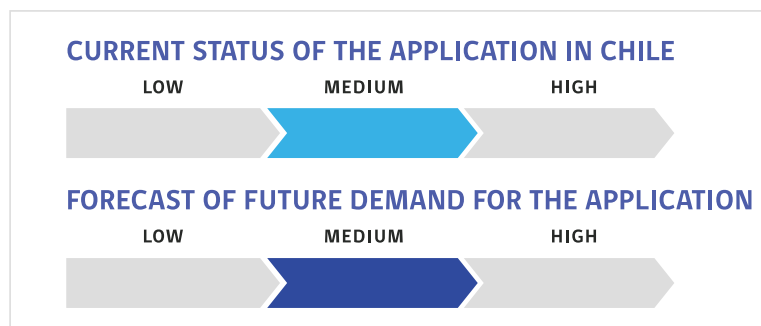
The Korean New Deal proposes that by 2025 there will be 15 smart industrial complexes, which will be simulation centers to test manufacturing processes and adopt remote monitoring systems against the emissions of toxic chemicals, using AI and drones. On the other hand, its National Artificial Intelligence Strategy aims to build 100 smart factories by 2022, and 2000 by 2030, which are based on AI, which increases productivity and reduces waste through process optimization. by analyzing digital data using AI.

National key partners and resources

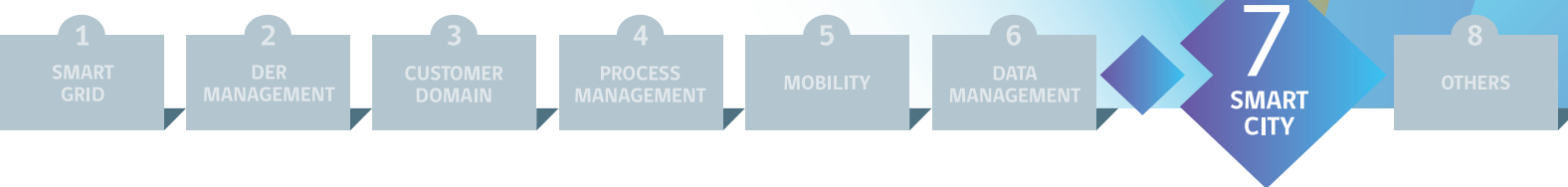


Public policies recommendations to Chile

- ▶ It requires state support for those SMEs that cannot make the transition to smart industry, considering their economic capacity and knowledge on the subject.
- ▶ High investment cost could be beaten through government intervention by incorporating a tax relief for investment in robotics or information technology for SMEs.



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7.5 Smart farm

Smart farm aims to improve water utilization and irrigation by taking advantage of weather forecast and agricultural data, key trends and anomalies, and evapotranspiration index.

Common examples



Smart Farm is part of the government's "Industrial Strategy" which, among other objectives, seeks to boost agricultural productivity through new technologies. For smart farming, the gap between the current and the desired state is the adoption of artificial intelligence and automation in the agricultural industry.



Smart Farming is currently being used in China, taking advantage of advances in big data and even 5G. The use of 5G technologies is an innovation waiting for its breakthrough, because although they have already started to configure 5G stations for smart cultivation, a greater adoption of these stations is expected in the future to optimize production.

Opportunities



It allows the optimization of water use.



It reduces the costs of electricity services thanks to the efficient use of energy.



It increases social welfare thanks to the improvement in the productivity of farms.

Information, infrastructure and regulation requirement

- ▶ Internet access must be guaranteed in mostly rural areas.

Barriers



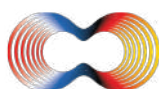
Others: constant need to have access to the Internet (especially complex in rural communities); since it's an intervention of highly manual processes, farmers could resist to it and maintain the status-quo.



Human capital: lack of knowledge or interest on the part of potential users.

Application synergies

- ▶ **Forecasting and predictive analysis (6.2)** could help to predict weather conditions in order to improve plantation performance.



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International real application

The Smart Agri-Systems initiative spearheaded by the University of Leeds seeks to work with farms and businesses to develop solutions, from advanced monitoring technology to big data analytics. Examples of smart farming to be looked at include the incorporation of sensors on the farm, either fixed, or on drones and robotic crawlers. These can monitor soil temperature and humidity, map crop growth and density, assess ground water composition, and track the weather, with data analyzed to project crop performance.



Examples of international goals



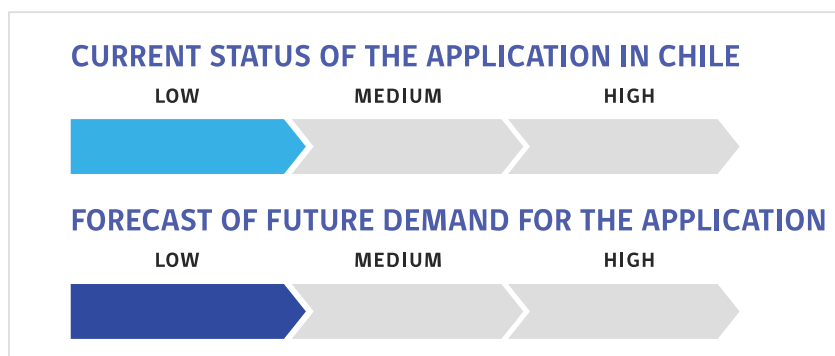
The goal is to adopt artificial intelligence and automation technologies in the agricultural industry.

National key partners and resources

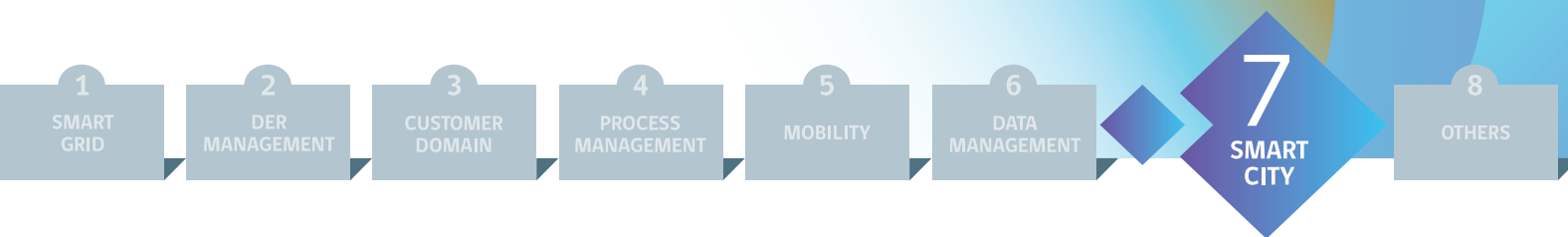


Public policies recommendations to Chile

- ▶ Accompany the implementation of any program or initiative by a campaign that aids in justifying the adoption of these uses.
- ▶ Support companies for the development of innovation in software related to the efficient management of the city.



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7.6 Smart parking

Smart parking is a system that allows energy saving and the delivery of information in real time to users in order to minimize waiting and circulation times.

Common examples



In San Francisco, through smarter pricing for parking, the city helps to achieve the right level of parking availability by periodically adjusting meter and garage to match demand. Known as "demand-responsive pricing," this encourages people to park in underutilized blocks and garages, helping to open up spaces in busy areas and at busy times.

Opportunities



It increases the well-being of the population by reducing both the time spent looking for parking and the time that a vehicle is parked.



It helps the authority to supervise the compliance of regulations (vehicular restriction) or in emergencies (stolen cars).

Information, infrastructure and regulation requirement

- ▶ Cameras and sensors needed to monitor and manage car positions.
- ▶ Requires a real-time information system.

Barriers



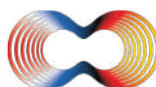
Regulatory: a regulatory reform may be needed in order to implement smart parking in populated cities with parking regulation that do not conceive dynamically assigned prices nor spaces.



Infrastructure: equipment required for spatial-temporal monitoring of parking space and traffic.

Application synergies

- ▶ Smart parking helps users of **Personal transport (5.1)** to find the optimal location to park their cars, based on destination location, parking availability, among others.



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International real application

The US-based company Parkwise develops a phone application using artificial intelligence (AI), which connects drivers through their smartphones, so they are helping each other to find empty parking spots easier. Furthermore, when a driver is about to leave their parking spot, the application notifies other drivers about the free parking space¹¹.



¹¹ "5 top smart parking startups out of 634 in smart cities", July, 2019, Available on: <https://www.cleverciti.com/en/resources/blog/5-top-smart-parking-startups-out-of-634-in-smart-cities>

Examples of international goals

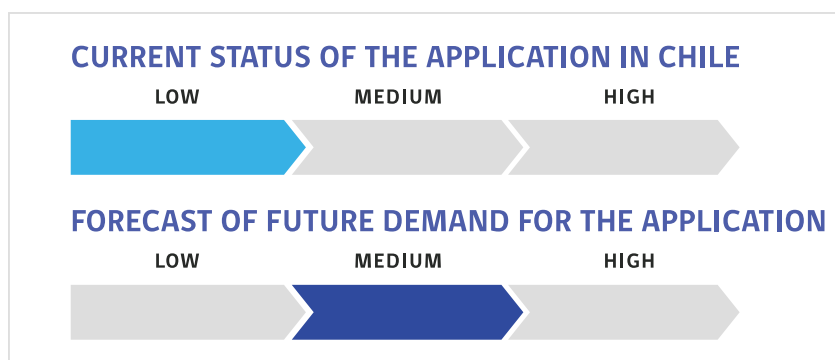
- ▶ No specific targets were found.

National key partners and resources

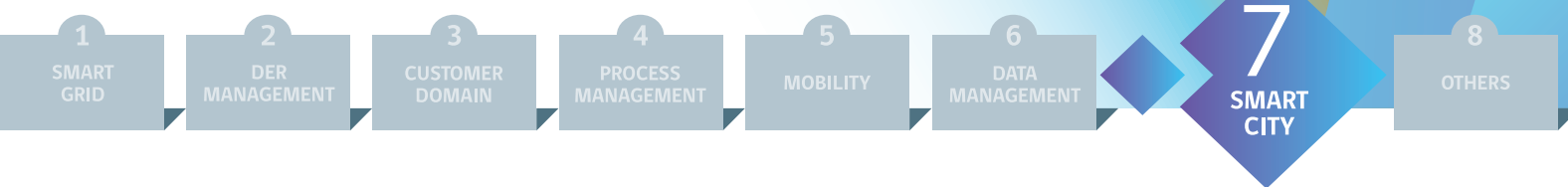


Public policies recommendations to Chile

- ▶ Support companies for the development of innovation in software related to the efficient management of the city. Application of pilot projects that show the benefits for society.




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7.7 Smart waste management

Smart waste management refers to the use of sensors and connectivity between garbage containers to monitor the level of garbage inside and improve collection routes, in order to generate cost savings, reduce CO2 emissions from trucks and increase the satisfaction of citizens.

Common examples

-  The Waste Management Plan (WMP) is a framework for actions related to waste aimed at citizens, businesses and the municipality of Kolding. This plan has a focus on zero waste and circular economy, and involves the refurbishment of commercial buildings, educating the population on the subject, among others.





Opportunities

-  This use brings with it an improvement in the well-being of people thanks to the efficient management of waste (visual and odor pollution).
-  Automated categorization of waste.
-  Route optimization of waste pick-up trucks.

Information, infrastructure and regulation requirement

- ▶ Equipment to monitor fill rate, location, usage, etc. and for categorization of waste.

Barriers

-  **Regulatory:** High investment cost
-  **Human capital:** it requires an awareness program for citizens, regarding the problem of emissions and the importance of its monitoring and incorporation of mitigation measures.
-  **Regulatory:** lack of regulatory and market pressures.
-  **Others:** high computational cost.

Application synergies

- ▶ When optimizing waste pick-up trucks routes, it's possible to contribute in the **Smart traffic (7.2)**.



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Smart waste management



International real application

The Track 1000 of the Belgian company Sensolus is a sensor and a tracker that has to be attached to the waste container and through a mobile app gives information of containers occupation, pick up schedule, recycling points, among others.



Examples of international goals



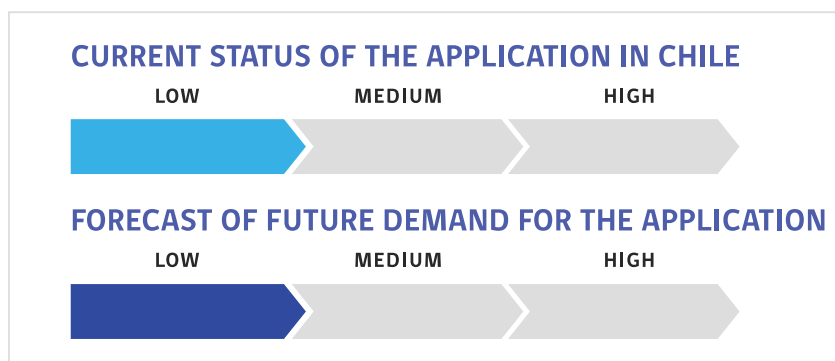
The goal of WMP is to achieve a high level of recycling: from 25% in 2013 to 50% by 2022.

National key partners and resources

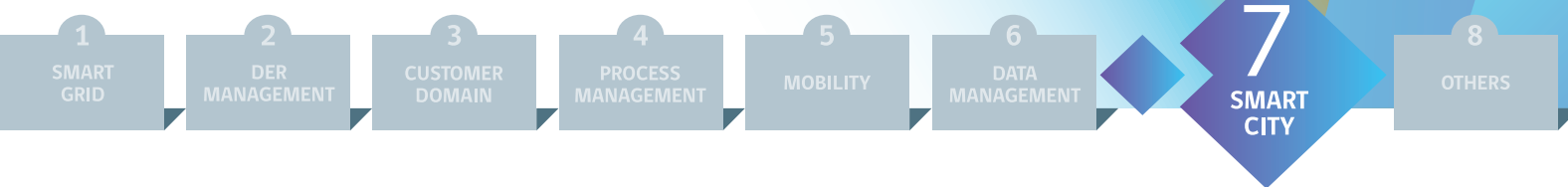


Public policies recommendations to Chile

► Promote awareness program for citizens.



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7.8 Smart fleet management

This application addresses several specific challenges of controlling fuel and maintenance expenses, driver and passenger safety, and providing good customer service. Smart cities can employ fleet management solutions to manage the vehicles in their fleet more efficiently and analyze the causes of traffic congestion through the data captured by those vehicles.

Common examples



Within the "Smart Mobility 2030" program, the Intelligent Fleet Management System is considered, whose goal is to integrate and simplify resource management, together with improving productivity and quality of service. The gap in achieving these improvements is the integration of information from different bus operators, as well as greater integration of sensors and location-based services.

Opportunities



Reduction of fuel consumption.



Reduction in operating costs.



Reduction of traffic congestion.

Information, infrastructure and regulation requirement

- ▶ New technologies and algorithms required to optimize routes and occupation.

Barriers



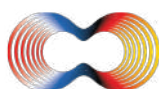
Technical: It considers an important penetration of sensors.



Security: Sovereignty of the information processed must be determined

Application synergies

- ▶ Smart fleet management is crucial to optimize **Public transport (5.2)** systems (buses, subways, airplanes, etc.) in order to improve the quality of life of users.
- ▶ **Transport cargo (5.3)** get benefices from smart fleet management, since it gives the possibility to manage different kind of transport to reduce costs and times both on and off the route.



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Smart fleet management



International real application

Avnet is a distributor of electronic components based in Arizona and it offers a real-time fleet monitoring service that includes optimal routing, engine data sensors, vehicle's idling time, among others.



Examples of international goals



As in smart traffic, this use is for the objectives of the NTCC, whose gap between the current and desired state is the implementation of VANETs (vehicle ad hoc networks) and 5G stations.

National key partners and resources



Public policies recommendations to Chile

- ▶ Develop comprehensive strategic plans that include the implementation of various uses related to Smart City, in order to take advantage of synergistic opportunities and common solutions to detected gaps or barriers.

