



# CITY-AS-A-SERVICE

HOW CIRCULAR SERVICE MODELS  
WILL PRACTICALLY SHAPE THE  
CITY OF THE FUTURE



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# ACKNOWLEDGEMENT

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## ABOUT US

At Circle Economy, we believe in a visionary future for our planet — one in which we do not have to compromise to achieve economic, social, and environmental prosperity. As an impact organisation, we connect and empower a global community to create the conditions for systemic transformation. With nature as our mentor, we work alongside businesses, cities and governments to identify opportunities to make the transition to the circular economy, and provide a powerful combination of practical and scalable solutions to turn these opportunities into reality.

Our mission is to empower a global community of businesses, cities and governments to accelerate the transition to the circular economy through practical and scalable insights and solutions that address humanity's greatest challenges.

# RETHINK THE CITY

## AN EXPLORATION INTO THE CIRCULAR CITY OF THE FUTURE

This publication offers a first glimpse into the 'circular city of the future'.

It is an initial and practical exploration of how service models will shape the way in which societal needs can be met in a future urban environment. Housing, nutrition, mobility and clothing are the major needs that are directly linked to material extraction. For each of these needs, we examine familiar and fundamental products to illustrate the potential impacts that service models can have.

In an increasingly urban world, cities are playing a leadership role in driving sustainable transitions, and will lead the way on delivering the positive effects of a circular economy - and hence help to close the circularity gap. The circular economy offers a clear roadmap towards realising the low-carbon, human-centered and prosperous circular city of the future. The 'City-As-A-Service' is a key next step into this promising future.

\* [www.circularity-gap.world](http://www.circularity-gap.world)

The trend towards a shared economy of service provision, rather than product ownership, means that citizens can obtain goods and services directly from each others via the internet.

With a shift from product-ownership models to service models, cities will have the opportunity to reduce their product demand and, consequently, material consumption

In a circular city, key societal needs will be fulfilled not via ownership of products, but as ongoing services to which every citizen will have access

Housing, Nutrition, Clothing, Mobility, Healthcare, Communication - some of the fundamental human needs

Service models will boost closing the circularity gap in cities



# 1

## CLOSING THE CIRCULARITY GAP

### THE PIVOTAL ROLE OF CIRCULAR CITIES IN BRIDGING THE CIRCULARITY GAP

All over the world, urban areas are undergoing rapid growth, with 60% of the world's population predicted to be living in urban deltas by 2030.

Cities are tightly connected to economic growth, producing over 75% of the world's GDP, while contributing to 75% of carbon emissions and consuming 75% of global resources.

The approaches that cities currently follow to fulfill core societal needs are based on a linear economic model, leading to excessive waste and unsustainable exploitation of primary resources. By systematically applying circular economy strategies, however, cities can decouple human prosperity from environmental degradation.

In an increasingly urban world, which is currently only 9.1% circular, cities are essential in leading the way towards a circular economy that promotes high social and economic welfare, while safeguarding ecosystems. Amsterdam, Glasgow, and New York, for example, are among the pioneering cities in the transition towards circular economy. Yet, around the world, cities still hold vast untapped potential to become circular and can, therefore, play a key role in bridging the global circularity gap.

Globally, there has already been great action and engagement amongst cities to align on how they can achieve a common sustainable future. In 2016, following on from the UN SDGs, 170 countries agreed to a New Urban Agenda which introduces a new global standard for sustainable urban development, and will help us rethink how we plan, manage and live in cities. This new framework provides guidance on achieving both the SDGs and climate goals, putting cities, as well as their citizens and leaders, on centre-stage in the drive towards mitigating climate change.

In the circular cities of the future, businesses, civil society, and local governments will partner to find sustainable solutions to urban challenges and limit the increase in global temperatures to well below 2°C. The development of a forward-thinking circular economy action agenda is, therefore, essential for cities to achieve these goals and lead the way towards ensuring prosperity for all within our planetary boundaries.



# 2

## UNIVERSAL NEEDS IN THE CITY OF THE FUTURE

### REDESIGNING HOW WE FULFILL OUR NEVER CHANGING KEY SOCIETAL NEEDS

Cities are as human as society itself, existing for thousands of years. Although over the centuries these cities may have evolved, been remodelled, and recently, exploded in size, the needs of their urban citizens have remained constant. Today, however, we are living in the Age of Urbanisation and our cities are now synonymous with engines of consumption, fuelling our linear 'take-make-dispose' system. In order to fulfill their citizens' needs, modern-day cities have a huge material footprint. To create resilient and liveable cities, we need to develop them sustainably the cities and rethink the way we consume, live, and commute.

Here we describe the 7 societal needs and commodities that represent the largest material footprint globally\*.

#### COMMUNICATION

Communication and connectivity is becoming an ever-more important aspect of today's society, provided by a mix of equipment and technology ranging from personal mobile devices, to data centres. Increased connectivity is also an enabler of the circular economy, where digitisation can make physical products obsolete, or enable far better use of existing assets, including consumables, building stock or infrastructure.

#### MOBILITY

A considerable resource footprint is taken up by our need for mobility. In particular, two types of resources are predominantly consumed: the materials to build transport vehicles and technologies like cars, trains and aeroplanes; plus, the fossil fuels burned to power them.

#### HEALTHCARE

With an expanding, aging and, on average, more prosperous population, healthcare services are increasing globally. Buildings aside, typical resource groups include use of capital equipment, such as X-ray machines, pharmaceuticals, hospital outfittings (beds), disposables and homecare equipment.



#### HOUSING AND INFRASTRUCTURE

Our need for the construction and maintenance of housing, offices, roads and other infrastructure represents the largest resource footprint, especially in the developing world, with 42.4 billion tonnes of resources consumed globally each year.

#### CONSUMABLES

Consumables are a diverse and complex group of products - including, refrigerators, clothing, personal care products and paints - that generally have short to medium lifetimes in society. Textiles, including clothing, also consume many different kinds of resources such as cotton, synthetic materials like polyester, dye pigments, and chemicals.

#### NUTRITION

The second greatest societal need, in terms of resource use, is nutrition. Agricultural products, such as crops and livestock, consume 21.8 billion tonnes of resources yearly. Food products have short life-cycles in our economy, being consumed -and wasted - quickly after production.

#### SERVICES

The delivery of services to society ranges from education and public services, to commercial services like banking and insurance. The material footprint is modest in total and typically involves the use of professional equipment, office furniture, computers and other infrastructure.

# 3 SERVICES OVER PRODUCTS

## HOW SERVICE MODELS ARE ACCELERATING THE CIRCULAR ECONOMY

Circular cities of the future will fulfil our societal needs in fundamentally new and sustainable ways. Service models hold significant potential to embed circularity into the core of how we live, eat, travel and work, by changing our relationship to material ownership and consumption.

## CIRCULAR STRATEGIES & PRODUCT - SERVICE SYSTEMS

Nowadays in cities, there is a growing shift from product-based systems to service-based systems.

Car-sharing platforms and peer-to-peer accommodation sharing are already taking our cities by storm, but the reach of service models is vast; from pay-per-use lighting in our buildings, to leasing our clothes and subscription food services.

Within all these service models, the supplier remains the owner of the product - the lightbulb, the car, etc. This continuity of ownership actually encourages companies to design products in such a way that makes them easy to repair, so maintaining their residual value for as long as possible. As a result, the use of products, components and materials is optimised, while providing a greater service to users.

These new service models will give the opportunity for future cities to fulfill the core needs of their citizens', while reducing their demands for raw materials. Thereby, Product-as-a-Service systems will assist cities in the transition towards a circular economy and will play a key role in bridging the circularity gap.



**In a circular city of the future, traditional models of ownership will be redesigned**



**The emerging technology of blockchain has the potential to accelerate service models, by making transactions and interactions between actors more transparent**



**Platform-based and peer-to-peer service models, facilitated by the Internet-of-Things, will fulfill the needs of citizens**



**Big Data analytics will allow for understanding user profiles and providing predictions, plus suggestions for tailor-made services.**



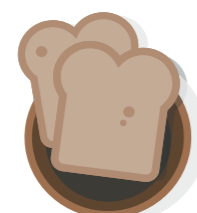
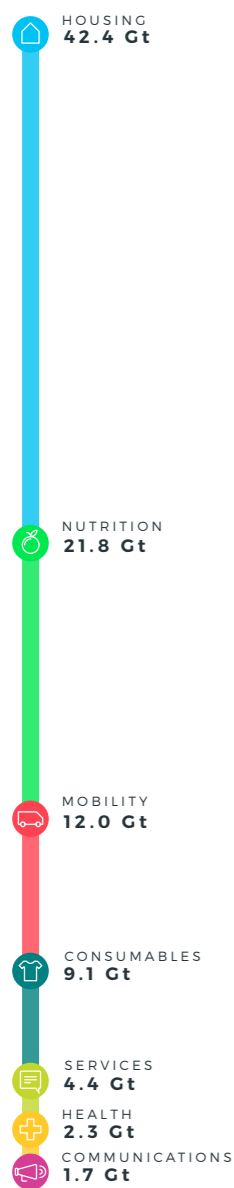
**Service models will lead to the smarter use of products, through improvements in design to increase maintenance and reuse**

# 4 A PRACTICAL EXPLORATION OF SERVICE-BASED MODELS

## FROM LINEAR TO CIRCULAR HOUSES, MEALS, CLOTHES AND CARS

According to the analysis presented in the Circularity Gap Report, Housing, Nutrition, Consumables, and Mobility are the four societal needs that represent the largest material footprint, accounting for over 90% of global resource consumption. In the following pages, we explore four familiar and fundamental products that shape our daily lives and fulfil these needs. For each, we illustrate some potential impacts on the environment and the economy.

Total resources entering the global economy  
92.8 Gt



### CURRENT PRACTICES

- Housing** is a core need for every citizen within our cities. On average, we have access to 45 m<sup>2</sup> of private living space per person in the Netherlands. However, 40% of that goes unused during the day. Can sharing space in apartments make living in densely populated areas more affordable and resource-efficient?
- Nutrition** is vital for human survival and cities demand vast quantities of food each day. On average, we consume 340 kg of food per person each year, but 13% of the food we buy is wasted. How can we optimise the way we prepare our meals, in order to save money and eliminate food waste?
- Mobility** is a core need of urban citizens and the privacy and comfort of cars are, for many, indispensable. On average, we own 0.42 cars per person. Yet, as we usually drive cars alone, with no passengers, 74% of the space in our cars goes unused during an average trip. Can service models provide us with exactly the right amount of space in our cars?
- Clothing** such as clothing, are also primary elements of our civilisation and a basic need in cities. On average, we own 173 pieces of clothing, but on average 20% of the clothes in our wardrobe are typically not worn. Can we limit the amount of bad buys and get a closet full of clothes we love and wear in return?



## HOUSING APARTMENTS-AS-A-SERVICE

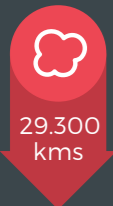
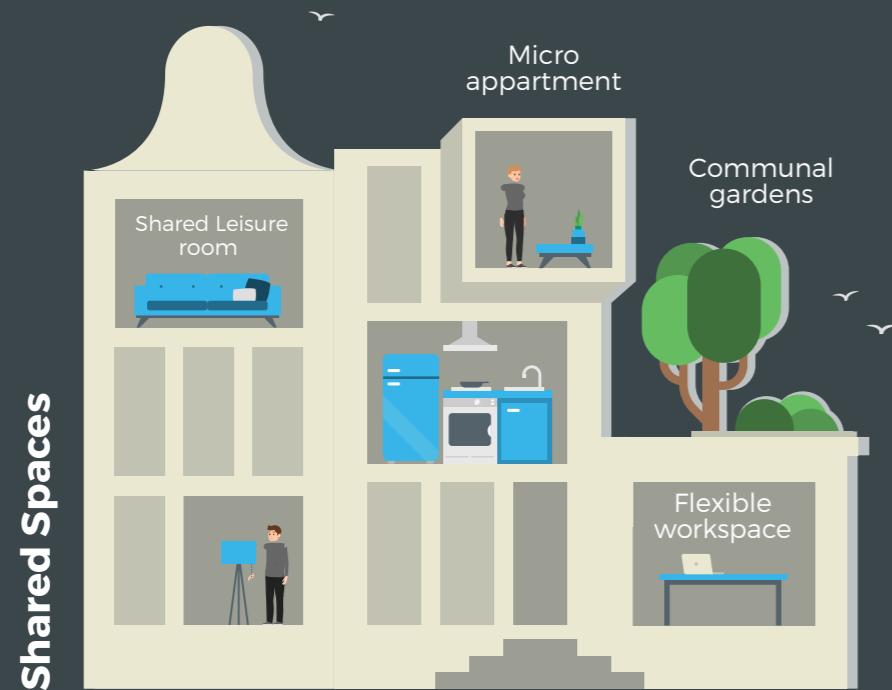
For over 40% of the year, our homes remain empty; the times when we are at work, on holiday, or out with friends. When at home, we tend to use only a small part of the space that is available to us. In many countries, living spaces in urban areas are also becoming increasingly expensive - perhaps prohibitively so for some citizens. What is more, the provision of housing is responsible for a vast proportion of global consumption: more than half of all resource consumption is related to the construction and maintenance of our built environment, as well as providing the energy to live comfortably.

By sharing some of your living spaces with others, such as areas for leisure, working or having friends over, significant savings can be made - both in terms of money and resources. You can rent out your apartment when

you are on holidays, make use of a communal garden, share larger rooms for cooking, working or leisure with your neighbours for when friends or colleagues come over; you can even rent out your living rooms as meeting spaces when you are at work. Such flexibility also means that our homes are more adaptable to the changes in our lives, such as having a single-level property when advancing years or restricted mobility make it more difficult to walk up and down stairs.

### IMPACT

Sharing living space will not only save a significant amount of Earth's resources though an overall decrease in building demand, but will also make living in an urban area more affordable for you by cutting expenses for housing by 18%, while encouraging new social interactions and making optimal use of the limited space in the urban areas of the future.



Sharing space with others means that communities will take up less space while you have access to more living room than before. Less need for build-up space means less need for construction and construction materials, causing a huge reduction in CO2 emissions per person: equal to a yearly drive from Amsterdam to Beijing and back - twice.



By sharing some of your living space with others, we can help share the burden of renting accommodation. If we would share 40% of our living area, this could save on average 1600 euros per year, per household.

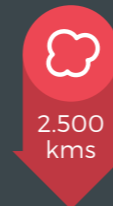
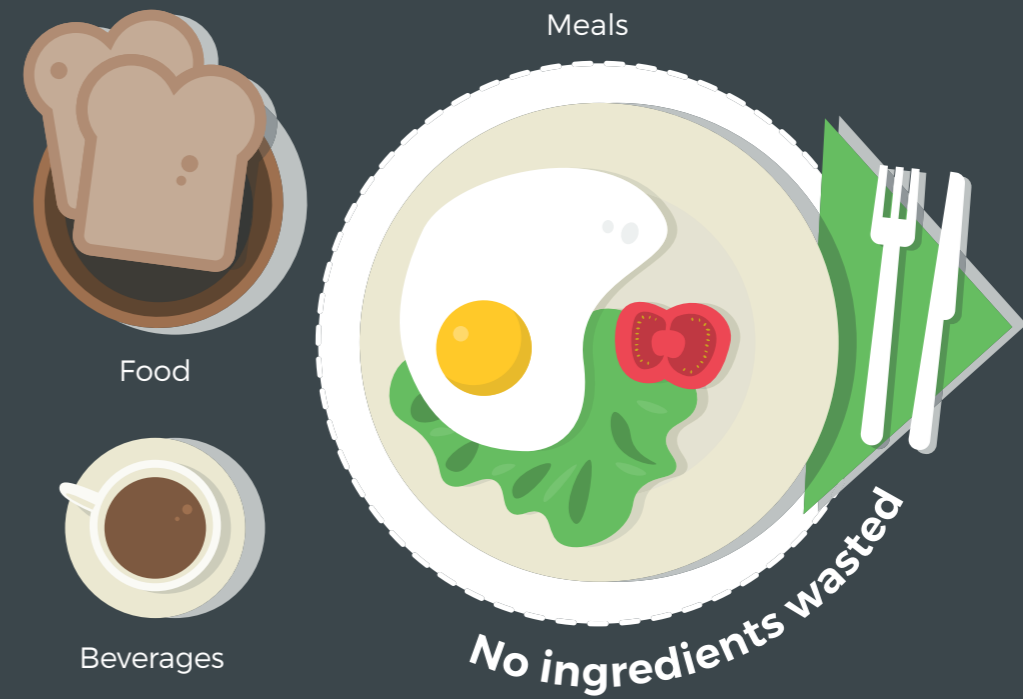
## NUTRITION MEALS-AS-A-SERVICE

Having sufficient nutrition is vital for life and represents one of our most basic needs. Approximately 25% of our resources globally are spent on providing food for consumers. However, around 12% of our food is not used to satisfy our need for nutrition, but is wasted. A common problem is overstocking our shelves with more food than we could ever eat, then throwing it out as soon as it hits its best before date.

### IMPACT

If Meals-as-a-Service could decrease food waste in households by 50%, this would not only save 2,100 kton of CO2 emissions in the Netherlands alone, but it would also save 11% of money spent on wasted ingredients.

Imagine a service that allows you to choose your favorite meals and then sends exact quantities of the necessary ingredients right to your door, while taking your dietary wishes into account - much like current meal subscriptions are starting to introduce. These services limit the risk of buying more ingredients than you need, or even buying the wrong ingredients.



Less consumption is more. At least, when it comes to the CO2-footprint of food. By wasting less ingredients, you cut the CO2 emissions caused by the production of your food, equal to a yearly road trip from Amsterdam to Moscow.



Getting exactly the amount of ingredients that you need, and not more, will obviously result in consumers having to buy less ingredients. Even when you compensate for the extra service, we estimate that your grocery expenses can drop on average by 360 euro per year per household.

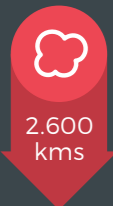
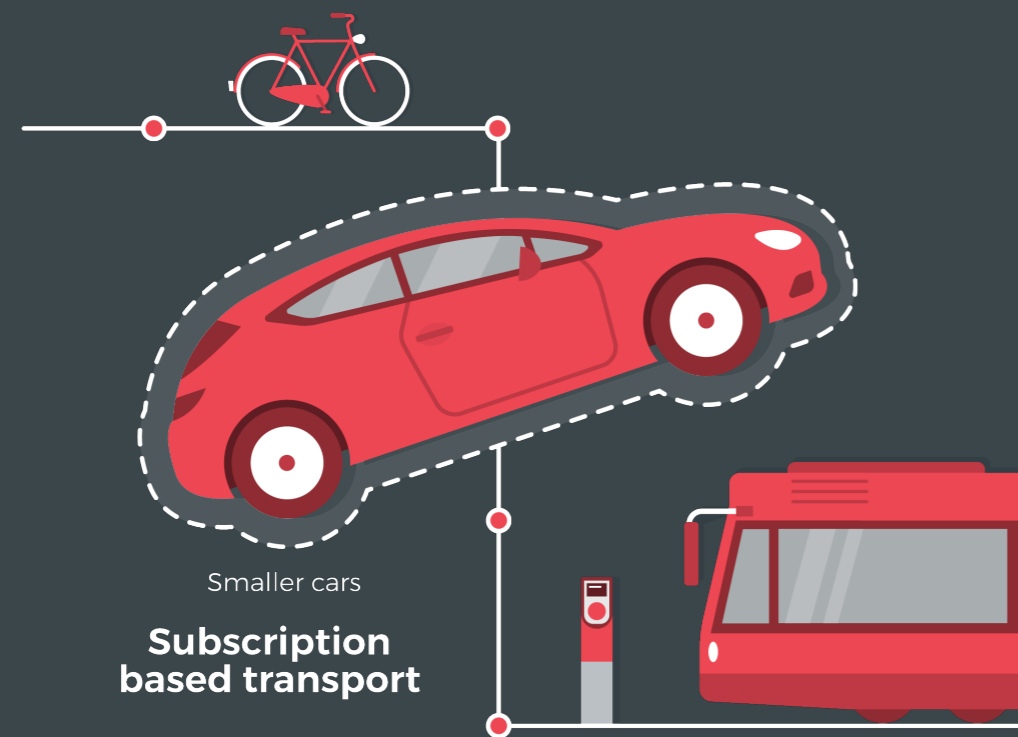
## MOBILITY CARS-AS-A-SERVICE

Mobility is vital for the functioning of cities, now and in the future. Almost 15% of our resources globally are consumed to satisfy our need to move from A to B. In the circular city of the future, subscriptions to one or more modes of transportation will be commonplace, often combined in one service. For each trip, you will have the ability to choose whichever mode of transport you prefer.

Cars are among the least efficiently used modes of transportation. Some 85% of the time, a car on our roads only has 1 occupant. This leaves 80% of the space in a car unused.

### IMPACT

By subscribing to a car-sharing service, we are able to choose smaller, cheaper and more efficient cars when driving solo. In the Netherlands alone, this would save 2,200 kton of CO2 annually, and will reduce our annual spending on motoring by 10%.



If you chose a smaller car when driving alone, the demand for larger cars decreases. A smaller car need fewer resources for manufacturing, reducing CO2 emissions caused by production equal to a yearly trip from Amsterdam to Gibraltar. And that is not even including the CO2 reduction by using more fuel-efficient cars.



Smaller cars are cheaper cars. If you drove a smaller vehicle for half of your journeys, it would already save you €150 per year, per household. This will increase even further if you also include the reduction in expenses for fuel, as smaller cars are generally more fuel efficient.

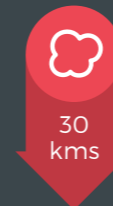
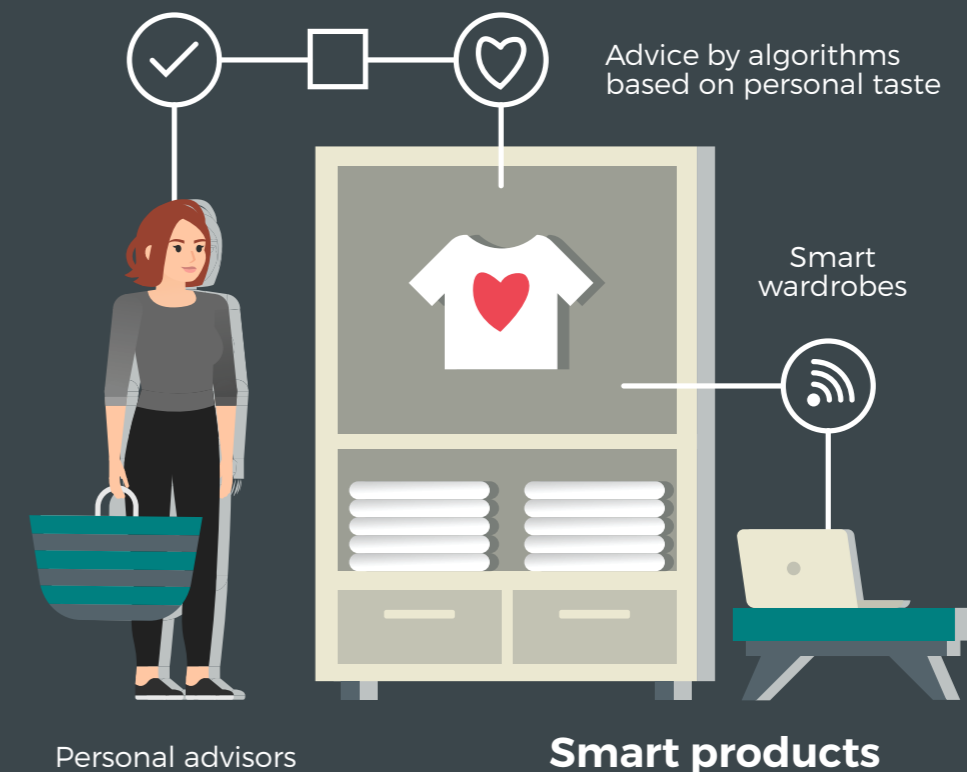
## CONSUMABLES CLOTHES-AS-A-SERVICE

Citizens consume products for various reasons. Consumables are, therefore, a diverse and complex group of products - such as mobile phones, refrigerators, clothing, cleaning agents, personal care products, and paints - answering to a variety of needs. In total, around 10% of the resources we consume globally fall into this category. These products have one thing in common: we can be smarter about consuming them. Take fashion. On average, we own 173 pieces of clothing. Yet, 20% of these will never be worn - we bought the wrong size, we misjudged how it would look, or it was simply a bad buy. With dramatic increases in online sales and related deliveries, this is not only a waste of our own money, but presents retailers with increasing costs for the logistics

of returns. If we were be smarter about the way we chose to buy our clothes and manage our wardrobe, we could save money and resources. For instance, by getting personalised advice from stylists on what we should buy, much as happens in traditional stores. Or, by having a subscription to clothes and swapping them for other items as soon as we don't wear them anymore, we could limit the number of clothes that would otherwise collect dust in our closets.

### IMPACT

By eliminating half of our bad buys, we would save 15% of our expenditure on clothing, and save 23 kton of CO2 in the Netherlands alone.



Although you would waste less clothes by limiting your number of bad buys, the effects on CO2 emissions will be limited: you would save the same amount of emissions caused by a 30 km drive. Other environmental concerns, such as water consumption for the production of cotton, will be more significant.



Buying less clothes because you get exactly those items you like and wear, saves you money: on average 240 euros per year per household. The use of smart algorithms to find the best clothes for your style, already common practice in web stores, will limit your expenses for the additional service.

# TOWARDS THE CIRCULAR CITY OF THE FUTURE

This publication offers a first glimpse into the circular city of the future and how moving to service models for key everyday products can drive the circular transition at speed and scale. We have shown that service models, in many cases, can provide a better customer experience, as well as offering ways to reduce emissions, make products more affordable and, at a city level, can boost employment opportunities, in particular by delivering services for the best use of fewer products.

For the scaling and adoption of service models to continue and advance, we have identified three key drivers that will need to be developed further:

- **DIGITAL TECHNOLOGIES** offer great opportunities to deliver services at scale. They do so by: providing the necessary infrastructure to connect everyone and everything; via the Internet of Things; by understanding, accommodating and managing user profiles through Big Data analytics, and by making transactions and interactions between actors more transparent through the use of Blockchain technologies.\*
- **NEW FINANCING MODELS** that harmonise with the delivery of services are essential for both businesses and financiers alike. Pioneering approaches are currently paving the way for scaling, as financiers develop new mechanisms to facilitate the mainstreaming of service models.
- **SOCIAL CHANGE** that moves past current obsessions with material ownership to the prioritisation of service access is vital for the adoption of service models. Such thinking is already gaining traction within the Gen Y Millennials generation, however inter-generational appeal will also have to be won. New, collaborative forms of governance must accompany this mentality shift, enabling open and transparent collaboration between public officials, business leaders and citizens to ensure the equitable provision of our key societal needs.

Ultimately, it is the interplay between all of the drivers above that can make service based models a game changer for cities. In fact, city governments can influence this by providing the right boundary conditions and incentives in their policymaking.

At Circle Economy we are committed to play a proactive role in driving the design of future cities and delivering on-the-ground implementation of (pilot) projects. In our Circle Cities Programme, we collaborate with global partners on matters of practical implementation on a daily basis and we invite you to engage with us to explore how we too might work together to help shape the circular city of the future.

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\* <https://www.ellenmacarthurfoundation.org/publications/cities-in-the-circular-economy-an-initial-exploration>

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