Circular Economy in the Built Environment

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European Legislative Framework

Implementing circular economy policies requires a detailed study of current policies and their effects. At the end of 2015, the European Commission adopted a new set of measures for the circular economy to monitor its development. But the circular economy concept first appeared in the 1970s. There are several definitions, one of them is the following:

“The circular economy is an economic system based around the principle of exchange, espousing production methods that, at every stage of the product life cycle (goods and services), aim to increase the efficiency of resource usage and diminish environmental impact, while also improving the wellbeing of individual citizens.” (the Ademe definition).

Following the European Circular Economy Stakeholder Conference held in Brussels in March 2017, the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe’s transition towards a circular economy which boosts global competitiveness, fosters sustainable economic growth and generates new jobs.

The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a concrete and ambitious programme of action, with measures covering the whole cycle: from production to consumption to waste management and the market for secondary raw materials. The annex to the action plan sets out the time line when the actions will be completed.

The proposed actions will contribute to “closing the loop” of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy.

France

The policy strategy in France develops a set of indicators to measure and monitor the results and to compare them with other European Countries.

The Strategy for Ecological Transition and Sustainable Development
Circular Economy Definition and Targets

The national 2015/2020 Strategy for Ecological Transition and Sustainable Development was developed in France. It set the circular economy definition based around three areas and seven pillars:

- Supply from economic stakeholders
  - Extraction/manufacturing and sustainable supply chain
  - Eco-design (products and procedures)
  - Industrial and territorial ecology
  - Functional economy

- Consumer demand and behaviour
  - Extension of product lifespan (reuse, repair, recycle)
  - Responsible consumption (purchasing, collective consumption, use)
  - Waste management
  - Recycling (materials and organic matter)

In 2016, a deliberately limited number of indicators were selected, such as:

- Domestic Material Consumption per capita
- Resource Productivity
- Ecolabel Holders
- Number of industrial and territorial ecology projects
- Car sharing
- Food waste
- Household spending on product repair and maintenance
- Quantity of waste sent to landfill
- Use of recycled raw materials in production processes
- Employment in the Circular Economy

“All in all, the transition towards a circular economy appears to be taking effect. Of the 10 indicators considered, two show signs that circular economy is not yet occurring. Food waste, a hallmark of the linear economy, has not decreased. Spending on household repair services is not rising, leading to the need to replace these items with new products. A reduction in food waste and greater use of repair services are both potential sources of employment. Finally, the incorporation of recycled plastic into production processes along with the cyclical material use rate remain relatively weak on an economic scale and demonstrates that plastic waste and deconstruction constitute rich resource of materials that must be put to greater use.”

**Germany**

The German policy focuses on raw materials and to improve, the government reviews progress every four years. A centre for resource efficiency, promoted by German Environmental Protection Agency, is essential in providing sector specific tools and guidance, build skills and improve education at all levels.

“German Government
German Resource Efficiency Programme (ProgRess II)”
German Environmental Protection Agency
targets and measuring of the results.

The German policy was initiated in 2002 with the broader National Sustainable Development Strategy which includes a strategy on the sustainable use of raw materials and sets a target to double the resource productivity of the German economy between 1994 and 2020. Then in 2012, the German Resource Efficiency Programme (ProgRess) started focusing on the use of raw material such as metal ores and industrial minerals.

The programme also tracks the development of resource efficiency in Germany, provides an overview of existing activities, and identifies the needs for new or adjusted actions. To ensure the smooth implementation, the government reviews progress every four years. The first revision was in 2016 and resulted in the publishing of ProgRess II.

The programme uses the indicator raw material productivity as a key point of reference.

In addition to the use of materials and their related environmental impacts, ProgRess II also promotes the joint analysis of energy required in the processing operations. Using recycled materials does not always mean a reduction in energy consumption.

The programme is based on four main principles:

1. Combining ecological necessities with economic opportunities, innovation support and social responsibility;
2. Viewing global responsibility as a key guide of national resource policy;
3. Making economic and production practices gradually less independent on primary resources by managing closed-cycles;
4. Securing sustainable resource use for the long term by guiding society towards quality growth.
Critical Points to Increase Resource Efficiency

- The agreement on a definition of resource efficiency and the metrics to measure it, is essential to achieve results.
- The common understanding in the mindset of stakeholders on resource-efficiency, is a long process that policy must aim and support.
- The policy programme should create an environment where private actors are included to have very large investments.

Key Outcomes

The network among stakeholders is strategic to amplify policy measures: exchanging knowledge, sharing best practices, expertise and experience enables taking advantage of possible new growth opportunities.

A centre for resource efficiency, promoted by German Environmental Protection Agency, is essential to providing sector specific tools and guidance, build skills and improve education at all levels.

Denmark

Denmark has a systemic approach to review existing regulations affecting resource efficiency and circular economy practices, identifying barriers and finding solutions. Partnership among different government levels and private stakeholders involved on the green public procurement to support the transition towards circular economy.

Danish Business Authority

Denmark: Taskforce for Resource Efficiency

Danish Environmental Protection Agency

Denmark: Public Procurement as a circular economy enabler.

In Denmark, the Taskforce for Resource Efficiency was established in 2014 as a joint initiative of the Ministry of Environment and Food, with the goal of boosting the strength of the Danish economy. The aim of the taskforce was a systemic approach to review existing regulations affecting resource efficiency and circular economy practices, identifying barriers and finding solutions. The taskforce identified potential focus sectors:

- Manufacturing (including machinery, furniture and food), waste management, construction and retail/wholesale.

The work of the taskforce is an iterative process that alternates business studies, other analysis such as regulations or administrative procedures and development of solutions, in dialogue with companies and relevant authorities. The full mapping and analyses of barriers is still to be completed.

Other initiatives are developed by the Minister of Environment of Denmark. Danish regions, municipalities and the Minister of Environment and Food joined their efforts setting up a partnership for green public procurement to support the transition towards a circular economy. The Partnership for GPP established in 2006 is in close collaboration with the Forum for Sustainable Procurement which has represented all stakeholders with an interest in the procurement market since 2011.
Key Outcomes

The taskforce has shown how complex the issue of resource-efficiency is, and where some key research gaps are. It is important to research how regulations can cause barriers, to find a model for measuring the impact and to look across the entire value chain.

In Denmark, the market of goods and services for public administration is around 38 billion annually and its impact on the transition to a circular economy is significant: public administration can lead the market to change the economy model from a linear pattern of production and consumption to a circular model. Sustainable environmental criteria and economic requirements can be put into tenders to promote organic building materials or prevent waste production or reduce the amount of raw materials.

Portugal

It is essential for a wide range of stakeholders, representing around 100 organisations, to find a shared vision to grow the circular economy. The main issues chosen to be developed are the use of waste and the ratio of building renovation.

Portuguese Ministry of Environment, Spatial Planning and Energy
“Portugal: Green Growth Commitment”

In 2014 the Portuguese government established a Green Growth Coalition to represent around 100 organisations from the business, science and finance sectors, along with public body, NGOs and foundations. The coalition set up a four-month intensive public consultation to try to find a view from a wide range of stakeholders. The resulting vision has 14 objectives, each with quantified targets for 2020 and 2030, and it is updated annually.

They are recapped in these three following issues:

- stimulating green activity sector, including creating new jobs;
- promoting resource-efficiency including increasing water and energy efficiency;
- increasing renewable energy use, and improving biodiversity quality.

Some objectives are particularly interested in promoting efficient use of resources and moving towards a circular economy as increasing the use of waste and the ratio of building renovations.

Key Outcomes

The stakeholder’s involvement at an early stage is crucial to set out a solid and well-balanced framework and a clear and shared vision of green growth in 2020 and 2030, as well the collaboration at the start of the project with other government bodies at regional and local levels. The Portuguese policy is an important example on how to reach a shared economy-wide vision rather than a political unilateral initiative to achieve the reduction of greenhouse gas emissions. ellenmacarthurfoundation.org

Scotland

Public consultation that involved industry, academia, community organisations, local government, trade organisations and individuals was crucial for raising awareness towards environmental objectives. The main issues are to reduce food waste and to develop remanufactured resource reuse and promote educational programmes on product design.

Scottish Government
Scotland: Making Things Last - A circular economy strategy
The Scottish Government started moving towards a circular economy with public consultation that involved industry, academia, community organisations, local government, trade organisations and individuals. The debate was crucial in shaping the strategy to raise awareness towards environmental objectives.

There are two key elements in Scotland’s Economic Strategy:

- To develop a sustainable approach by setting up a single framework for all product types that drives choices for reuse, repair and remanufacture
- To reduce food waste by 33% by 2025.

The Strategy also focalised in four main areas: food, drink and broader bio-economy, remanufacture, construction and built environment and energy infrastructure. “With the strategy now in place, the Scottish Government and its delivery partners are working on the priorities identified to move Scotland towards a more circular economy.”

**Key Outcomes**

Since January 2016, the Scottish Government have been achieving their food waste reduction target, adapting to the 5kg threshold for separate food waste collection. This goal is better described in The Scottish Household Recycling Charter introduced to promote a consistent approach to household recycling of food, glass, paper/card and cans/plastic. Half of the Scottish councils have signed the Charter since July 2016.

The Scottish Manufacturing Plan developed in 2016, encourages manufacturing firms to adopt circular practices, of which one of most important is to remanufacture and promote educational programme on product design and resource reuse as a further opportunity to improve circular economy practices.

**Belgium**

A shared vision and awareness on the necessity of a different approach to limit the use of natural resources is the key element of the Programme in Belgium. Reusing, remanufacturing and recycling materials and products as the promotion of Flanders as a recycling hub for all of Europe, is the main issue of the policy.

**Flander Public Waste, Materials & Soil Agency**

**Belgium: Flanders Materials Programme**

In 2011 Belgium developed the Flanders’ Materials Programme that is a successful example of cooperation among business sectors, research institutions, public administrations and environmental organisations, based on three main concepts:

- Enforcing a change in mindset from waste to resource in a long-term vision.
- Policy-relevant scientific research to share knowledge and rise trust and awareness;
- Concrete actions and projects planned with active partners and a clear time schedule.

To incentive the implementation of the circular strategies, the Flanders’ Materials Programme focuses on materials with attention to closed loop productions, as we say, “cradle to cradle”. To pursue the programme, strategic projects were developed. They were based on the vision of reusing, remanufacturing and recycling materials and products as the promotion of Flanders as a recycling hub for all of Europe, or encouraging innovation in product design.
Key Outcomes

A shared vision and awareness on the necessity of a different approach to limit the use of natural resources is the key of the Programme. The programme also includes concrete actions that show how to reach the goals and overcome barriers. On the other hand, the main obstacles are lack of knowledge and skills and the behaviour of the public administration. The public administration should not choose the lowest cost alternative when making investments and purchases, but rather look at the total lifetime cost.

Netherlands

The new role of the Government is to provide advisory support for new green initiatives to arise and to monitor the results reached every two or three years.

Netherlands Ministry of Infrastructure and Environment

Netherlands: Green Deal

The Dutch Government realised that many circular economy opportunities were lost because of non-financial barriers, such as the “lack of experience among companies and policymakers to detect and capture” new circular economy business. The Government took on a new role by providing advisory support for new green initiatives to arise.

The Dutch Government developed a new programme where the Ministries of Economic Affairs, Infrastructure and the Environment and the Interior and Kingdom Relations with the cooperation of a board of businesses, non-governmental organisations (NGOs) and the government helped to recognize green projects. Any organisation could present its own business idea, showing hurdles and potential solutions to overcome them and how to successfully reach the results. If the proposal is in line with the policy aim and is profitable, the Government signs a voluntary agreement to support the initiative for two or three years monitoring the results.

Key Outcomes

The quantity of the applications was unexpectedly very high. The companies increased confidence in the new business model due to the possibility of opening a dialogue with the government and other companies. "By the end of 2015, after four years of numerous applications and 185 successful projects", the Green Deal Programme shows that profitability is not the real hurdle towards a circular future, what we need is a responsive and collaborative approach.

Final Considerations

The study on the circular economy actions set by different European countries shows that the help of a government office is essential to provide guidance and tools and to also build skills and improve education at all levels. The network among stakeholders is strategic to amplify policy measures because it allows for sharing the best practices, exchanging knowledge and more importantly, growing trust in the new way of thinking towards the economy strategy.

The stakeholders’ involvement at an early stage is crucial to set out a solid and well-balanced framework and a common understanding to improve the circular economy.

Profitability is not the real hurdle when moving towards a circular economy, one of the main obstacles is rather the lack of knowledge, skills and a shared economy-wide vision.
Circularity in the built environment: Case Studies

The construction and real estate sectors are responsible for approximately 40% of the total energy consumption, 30% of the CO2 emissions and 40% of the waste generated. To reduce the consumption of resources and the impact on the climate, it is not only necessary to reduce energy consumption in the buildings but also to transfer the energy demand to renewable energy resources.

It is also relevant to understand what circularity in the built environment looks like. “The ReSOLVE framework for the built environment was introduced in Growth Within: a circular economy vision for a competitive Europe, a report by the Ellen MacArthur Foundation, McKinsey % Co., and SUN. The framework identifies six different ways that organisations and governments can think about applying circularity: Regenerate, Share, Optimise, Loop, Virtualise, and Exchange.”

We can try to apply these six characteristics to recognise actions related to the circular economy vision.

**Villa Welpeloo, the Netherlands**

Superuse Studios “Finding and utilising “waste” materials for construction purposes”.

http://www.archiportale.com
http://www.superuse-studios.com

![Figure 1. Villa Welpeloo.](image)

The core of this project was the overall use of recycled materials amounting to 60% of the total that comes from the immediate surroundings within 15 km from the site. Also, nearly 90% of the interior is composed of reused and repurposed materials.

✓ Use of recycled materials (close the loop)
✓ Energy efficiency (optimise action)
✓ New design (virtualise)
Built in 2009, the project was based on the findings that there is a continuous stream of new incentives to develop the design further from the waste materials. New shapes and innovative construction methods were needed to incorporate the found materials.

TFK, a factory that produces cables, has a large number of redundant cable reels, too damaged for further original use. However, the inner parts of cable reels are generally undamaged and of a standard size to provide enough material for the façade, instead of using them for particleboard or for burning.

The load bearing construction is made of steel beams from a “paternoster” textile factory machine.

The same elevator that was used during construction was left in the building itself, hidden from sight. The insulation was provided by leftover polystyrene panels from a caravan manufacturer; old billboards were turned into cabinets and broken umbrella stretchers into low-voltage lighting.

The creators of Welpeloo made sure that the project clearly states the meaning of utility and sustainability and decreases the carbon footprint. Waste material, especially in the surroundings, can provide inspiration in the development of a new design.
Rehafutur Engineer’s House, France

Isabelle Cari, Development Advisory, cd2e
http://www.rehafutur.fr/
http://www.cd2e.com

Renovation of an existing ancient building to one with high energy efficient standards with a sustainable approach, shows that applying a circular economy model is possible with the use of natural materials and materials dismantled from the building itself.

✓ Insulation with natural material (regenerate action)
✓ Reuse of dismantled materials (close the loop)
✓ Energy efficiency (optimise action)

This case demonstrates that renovating existing, ancient buildings to high energy efficient standards with a sustainable approach and applying a circular economy model is possible.

The old building is located in the North of France, Loos-en-Gohelle, in the Unesco listed mining area. The whole budget cost was a total of € 1,580,000 of which € 720,000 was dedicated for the re-construction and refurbishment. Rehafutur has used 8 different eco-materials to demonstrate the effectiveness of renewable insulation materials labelled CAPEM (Cycle Assessment Procedure for Eco-impact of Materials).

Insulation was made from natural materials: Wood fibre, flax fibre, hemp bricks, expanded cork; Made of animals: sheep wool; and from recycled production: loose-filled cellulose, recycled textile, recycled cellular glass.

The natural materials used for the insulation (regenerate action) have a good thermal resistance. Thanks to them, Rehafutur is becoming an energy efficient building that requires only 34 kWh.m² annually for heating and therefore it is going to be less expensive in the consumption (Optimise action). They also enable comfort and health for the building’s users and for the worker at the construction site.

Relevant is the focus on the use of a lot of existing materials dismantled from the building itself and materials originated from renewable resources (Loop action):

The reuse of the original tiles or the old spruce floorboards had allowed to keep the high value of the building and move the budget towards labour costs rather than to the purchase of new materials. On the other hand, there were some technical difficulties using non-standard materials due to a lack of knowledge and it was also difficult using dismantled materials and being vigilant on the chaining of single operational steps.
Rehafutur : In situ instrumentation for a comprehensive building analysis

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Objectives – Context: Rehafutur I - Demonstration site – Renovation and Instrumentation of a North France traditional building

Method & Data:

Model & Results:

Applied inverse heat transfer estimation results

Conclusion and Perspectives:
Instrumented Hemp Concrete insulating the South-East wall is analysed. An inverse heat transfer method is applied to monitor its thermophysical properties.
Indoor comfort is monitored thanks to Mollier diagram
Condensation risk at the Insulation/bricks interfaces is monitored thanks to Dew point estimation.
Recorded data and Laboratory developed methods will allow estimation of other parameters like walls’ thermal effusivities.

Acknowledgment:
LGCgE and University of Artois thank Rehafutur partners: Ca2e, Ekwation and EU project Cap’em partners.

Figure 4. Rehafutur Engineer’s House.
This is an example of an energy saving large building built almost entirely out of wood and a system energy service, providing energy for a big part of the city.

✓ Energy efficiency (optimise)
✓ Use of natural material (close the loop)
✓ Energy management (optimise)

Energy Efficient Buildings:

In 2008, two large eight-storey apartment buildings constructed almost entirely of wood with highly efficient heating systems were built in Växjö, Sweden, by a municipality owned company.

These buildings are part of a research programme focusing on timber construction practices to reduce the embodied energy of building materials. (regenerate action)

The high energy efficiency is mainly due to:

- Air heat recycling system with the efficiency of 85%
- Thick insulation
- Air tightness
- Individual metering system which promotes more aware behaviour in saving energy.
Hot water and some additional heating required in extreme-cold conditions is provided by a biomass based district heating plant. The annual consumption is estimated at 50 Kw/mq, significantly below the Swedish norm of 110 Kwh/mq/year.

The wooden construction is promoted not only to improve the use of natural resources in built environment but also to develop the local economy.

District electricity and heat plant (**optimise action**). A big part of Växjö’s high renewable energy fraction comes from a large wood-chip-fuelled combined heat and power plant. Four boilers in the plant produce heat distributed via a 220-mile network of insulated hot water pipes and they are powered by wood chips that are sourced from 50-mile radius of the plant.

The system energy service in Växjö is an infrastructure system solution that improves resource efficiency using renewable energy, minimises extraction of raw materials and use natural materials (**loop action**) that come from the surroundings of the town, improving the local economy as well.
Refurbishment of School Gym - Pesaro, Italy


The renovation of an existing school gym to high energy efficient standards with a sustainable approach using a dry construction method, shows that building can be a store of future materials.

✓ Use of natural materials (regenerate action)
✓ Possibility of dismantled and reusing of the materials in another building (close the loop)
✓ New design developed (Better performing materials: exchange)

The requalification of public buildings, especially schools, represents an important task for the Italian Government. Not only for their educational function, but also for the important social role they play. These schools were usually constructions built during the ’60s or ’70s with old technical characteristics and expensive maintenance costs that cause a serious waste of energy. Due to the large number of schools scattered nationwide and the limited space for new buildings, it is better to refurbish them using design choices that improve their architectural quality and structural and functional efficiency. This study focuses on the sustainable restoration and energy building improvement of a school gym located in the seaside of the town Pesaro, located in the centre of Italy.

The design concept achieves high performance in energy saving and lower production of CO2. This was achieved by careful design based on the analysis of the Mediterranean climate, data of the site and the microclimates related to the precise position of the building. The biggest difficulty was to achieve different kinds of goals at the same time, because public buildings must satisfy a lot of mandatory specifications and sports buildings have much more variables such as noise control, dissipation of moisture generated by sport and wall resistance to damage.

The natural materials used for the insulation (regenerate action) have a good thermal resistance. Thanks to them, this school gym has become an energy efficient building that requires only 35 kWh.m² annually for heating and therefore it is become less expensive in the consumption. (Optimise action).

The design concept used a dry construction method that make the building flexible and functional as material banks: the building envelope is designed with a dry assembly construction process that can be reversed so the envelope materials can be dismantled and reuse in another building.

The use of natural materials creates a healthy environment in which to live and have also permitted a fast construction and a clean site to reduce CO2 emissions and waste.
Efficient sustainable friendly cities with recycled materials

This case shows how urban problems can be solved using the waste generated by cities themselves improving a new and innovative design to limit resources and move towards a zero emissions strategy.

✓ Recycling materials (Close the loop)
✓ New process of production (Optimise action)
✓ Reducing CO2 emissions (Optimise action)

The project has been developed in Barcelona since 2009 but the BUS BOARDER PLATFORMS have been installed not only in Barcelona but also in other Spanish cities and in France. The aim of the study was to improve the accessibility at bus stops. The platform is made by several prefabricated elements using recycled materials from PVC plastic waste and they can be easily assembled and disassembled like a puzzle.

The project shows that waste materials could be used in the fabrication of products that improve quality of life in the urban environment. In this specific case, the platform improves accessibility and safety at the bus stops.

The use of recycled plastic PVC allows reducing CO2 emissions up to 124 kg of CO2 eq/m2 compared with the use of virgin PVC material and a lower impact than a precast concrete platform with the same surface. (Optimise Action). The BUS BOARDER PLATFORM is reusable, it is made of recycled materials and the materials itself can be recycled again. This kind of process enables closing the loop.

The production process had to start with the research of finding recycled material with high characteristics and suitable for the production itself because some types of plastic waste were not
successful and study a properly mixed in different proportions allow to obtain enough mechanical characteristics. It was also desirable to minimize the previous treatment of different types of plastic PVC waste to reduce to a minimum the environmental impact. (close the loop)

The platform is subjected to a continuous process of improvement as it needs to adapt to different regulations depending on the country where it is installed.

**Selective Demolition Method (SMD)**

http://www.egap.it

![Figure 8](image)

**Deconstruction means a planned selective demolition in which salvage, reuse and recycling of the demolished structure is maximized.**

Disposal and Requalification Center of Inert Waste coming from construction and deconstruction.

The Selective Demolition Method (SMD) is an alternative to conventional methods. It is not just a process of recycling waste building materials but it is a solution for environmental impact reducing through improving the reuse and recycling of construction debris.

 ✓ New business model (optimise action)
 ✓ reuse and recycle materials (close the loop)
 ✓ reduce raw materials (optimise action)

Especially in refurbishment projects, a great deal of waste from the existing building is generated at the demolition stage. By maximizing the amount of waste that is recycled or reused, the environmental impact from the refurbishing works can be minimized. A solution for environmental impact reducing through improving the reuse and recycling of construction debris can be the Selective Demolition Method (SMD) as an alternative to conventional methods.

However, to apply the SMD method an in-depth analysis in term of productivity, costs and environmental impact is needed and to quantify the merit or demerit of the SMD method in a renovation project.

The SMD method is particularly interesting for the aggregates market to increase the use of recycled concrete which benefits are:

- reducing construction waste and extend the life of landfills for additional years
- recycling concrete can substitute virgin aggregates and reduce the use of raw materials and environmental costs of natural resources
- reduce transportation costs: concrete can often be recycled close to urban areas where it would be reused
- avoiding landfill costs and tip fees
• using as excellent aggregates for road bases, slope protection and earth retention structures
• arising employment opportunity in the concrete recycling industry that would not otherwise exist in other sectors.

The Dutch Government offers contractors the opportunity to earn bonuses if they use secondary (C&D derived) aggregates instead of natural gravel in public works.

EGAP srl is manufacturing industry located in the centre of Italy near Vicenza and Padova. It is an excellent example of how the traditional building waste business can change into a sustainable new one.

The achieved results of 15,000 m³ per year recycled materials allow to save 15,000 m³ of gravel as raw material and to save 50,000 m² territory as gravel site.
In the process of recycling waste building materials, they use 600,000 litre rainwater collected for the washing process of gravel.

The global system is supported by photovoltaic panels for the production of electricity to make the industrial process energy needs not only more economic and functional, but allow to achieve a high level of sustainable action. The photovoltaic plant produces 200,000 Kwh/year reducing the CO₂ emissions of about 100 tons/year and save 45 tons/year of oil such as traditional raw material to produce aggregates.

Case Studies on Services

Car sharing – Milan - Italy

http://www.comune.milano.it

Figure 9
A new way of thinking when it comes to mobility is using shared cars instead of owning them. It's really very easy to use a shared car with a simple mobile-app.

✓ Mobility management (optimise action)
✓ Car sharing (share action)

The Milan Council provides a fleet of 330,000 different types of cars available with the car-sharing service. You can pay an annual fee, a fee based on the time of use or based on the kilometres driven. Using shared cars, you can even travel around the city centre, while other cars need a permit. Parking is also free.

Bike sharing - Pesaro – Italy

http://www.centroinbici.it
http://www.citylab.com

“The global bike share boom”

The use of the bicycle in Italy is very traditional. Nowadays the opportunity to have bikes spread all over the city, available for everybody, is embraced. You don’t have to own a bicycle to get to enjoy riding one.

✓ Mobility management (optimise action)
✓ Bike sharing (share action)

In 2015, it was estimated that there are nearly 900 bike-sharing services in operation worldwide. Research and data on their performance and usage patterns are becoming very important to measure the city footprint.

Since 2006, all through the year in Pesaro 58 bikes are available in 5 bikes stations around the city centre for those arriving by train, bus or own car. The bike stations are well connected by public transport. Nearby is also the main parking area, where you can leave your car and pick up a bike and move in the city centre. The bikes are available from 7:30 a.m. to 12 p.m.

The car parking and use of the bikes are free. People have to register by filling up a form which is available online. Then the form has to be taken to the office and there you pay a fee of 10 €. Then they receive an electronic key to use the bike. The bike has to be returned to the same place where it was taken from.

This bike-sharing system is working in 102 Italian cities since the year 2000. Now there is an app that allows to see the bikes available and book one, register the user and receive information, too.
Tool libraries: Spirit of a Global Movement

Less consumption - less waste. But not only less waste. The Tool Library can make affordable tools for repairing or for maintenance of things in general to increase their life span. The library is becoming a social place where people can help each other and exchange knowledge.

✓ Tool sharing (share action)
✓ Repairing things (optimise action)
✓ Sharing knowledge (exchange)

Tool Libraries are rapidly emerging and becoming an important branch of self-made culture, enabling people who could not otherwise afford the expensive tools needed for their projects. Tool Libraries are accessed at a low cost by paying an annual membership fee instead of buying tools. Unsurprisingly, tool library locations are popping up across the globe, particularly in North America.

A tool library is not only simply a convenient means to access tools for self-made or repairing projects around the home but these spaces represent the concept of sharing things and helping one another. This system is able to sustain the communities’ environmental health, economic stability and social inclusion.

Energy Service - Gruppo Hera - Italy

An example of an energy service, providing 367 municipalities with very efficient energy waste management with a selective collection in order to reach a very high score of recycled materials.
Efficient organization for energy and water supply and drainage (optimise)
Waste management with selective collection (optimise)

Set up in 2002, Gruppo Hera SPA is an energy service company made up of a large number of companies that provide the energy services such as distribution and sale of electricity and gas, waste management as waste collection and treatment and water services such as waterworks and sewer maintenance and distribution in 357 municipalities spread wide in the centre of Italy.

The model of the energy service arises from constant innovation of its business, in order to improve social and environmental responsibility.

This system allows very efficient management of waste disposal, improving the collection of the paper, plastic, glass, metal, waste domestic oil and furniture finalized to the recycle.

To increase energy efficiency, Gruppo HERA developed the Heat District System that provides efficient use of renewable energy resources, increases energy efficiency, promotes innovative technological supply chain and saves the environment by reducing polluting emissions. It is also developing the light district to save energy with light control of the public lighting and traffic lights.
Sell service instead of selling products is the aim of the new business at Michelin and improving the performance of the tires themselves with an efficient maintenance service.

- New business model based on recycled raw materials (optimise)
- Reduce of CO2 emissions (optimise)
- Share things instead of owing them (share)

At Michelin, round tires are becoming circular: This will provide an opportunity to find the solutions to develop the tire production towards the circular economy strategy they called 4R:

- Reduce the weight of tires so the CO2 emissions related to their use optimizing the performance of the tires themselves;
- Reuse by harnessing tire repair regrooving and rethreading operations in order to extend fire lifespan;
- Recycle tires at the end of their cycle life by continuing to recycle materials;
- Renew using non-fossil materials in tires.

The Michelin strategy is not only involved in the production of tires. Most importantly, the company offers an affordable fleet tire lease program which consists of selling the service of the use rather than selling the tires themselves.
Hathigaon (Elephant Village) – Jaipur, Rajasthan, India

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The project approaches against land degradation, preservation of landscape; sustainable use and management of the water and improving natural process to save biodiversity.

Saving water allows joining people and animals together with the ancient ritual of bathing.

✓ Water efficiency system (optimise)
✓ Smart urban design (optimise)
✓ Flexibility in building (close the loop)

A housing project for Mahouts (care-takers) and their elephants, Hathigaon (or Elephant Village) is situated at the foothill of the Amber Palace and Fort near Jaipur.

The design strategy first involved structuring the landscape that had been devastated by its use as a sand quarry by local sand suppliers. To create a series of water bodies to harvest the rain runoff, as it is the most crucial resource in place, an extensive plantation program was carried out together with seeding the site to save and improve local species.

The water body was a critical component of the design, as it also facilitated the bonding between the mahout and elephant, through the ritual of bathing, important for the elephants’ health and their relationship with the keepers too. The housing units are organized in a system of clusters, courtyards and pavilions to create shared community space and to build a sense of community.

The challenge in this project was working through the bureaucracy, as the project was sponsored by the Indian Government and executed by the Public Works Department. These challenges were overcome by focusing on the landscape and using water as the central instrument. Minimal architecture investments were made so the buildings would be suitable for their inhabitants and permit them transformations over time.