

May 2020

Author:  
**Youssef Diab**  
*UIA Expert*



The Urban Lab of Europe !

# The Earth Cycle project Journal N° 2

*Project led by the City of Sevran*



**CIRCULAR  
ECONOMY**



# The Earth Cycle project

The **EARTH CYCLE** project seeks to foster a new urban planning development model based on the use of locally excavated soil from major construction sites. Project partners will develop a full industrial process and ecosystem to produce certified earth construction materials from the reuse of soil extracted as part of two major subway stations' construction works. The project will design an experimental mobile production plant which will produce four different pilot building materials (bricks, panel of clay, wall coating and earth with fibers) to be tested in local urban development projects. Partners will set up an Earth Cycle Observatory to assess the materials flow and provide evidence to foster the replication and upscaling of the industrial process. Along with technical and engineering works, Earth Cycle partners will closely involve citizens throughout the project and train local companies and entrepreneurs to create further circular economic opportunities.

## Partnership

- City of Sevran
- Great Paris Developer
- Greater Paris Transportation
- QUARTUS Ensemblier Urbain
- Antea Group
- Joly&Loiret
- Gustave Eiffel University
- Sciences-Po Paris
- ENSAG (Architecture, Environment and Building Cultures)
- Amàco
- CRATERRE
- Skills for Employment
- ECT Group

# Table of Contents

- 1. EXECUTIVE SUMMARY 4**
  
- 2. CONTEXT OF THE PROJECT AND LEGAL ISSUES 5**
  - 2.1 A bit of history 5
  - 2.2 Metropolitan development and the earth management story: the example of Paris and the Parisian Region 6
  - 2.3 New legal context 7
  
- 3. THE CURRENT SITUATION: A SPATIAL AND FUNCTIONAL ISSUE FOR THE PARISIAN REGION 9**
  
- 4. RECENT EVOLUTION OF THE PROJECT: NEW CHALLENGES AND NEW PERSPECTIVES 10**
  - 4.1 Major elements of Earth Cycle 10
  - 4.2 The project evolution and the current situation 10
  
- 5. NECESSARY INTERDISCIPLINARY APPROACHES FOR THE EARTH MANAGEMENT: FROM THE EXCAVATION TO THE VALORISATION 14**
  - 5.1 Complementarities on local scale 14
  - 5.2 A new ecosystem vision 14
  - 5.3 Decpartmentalization and Urban Nexus 15
  
- 6. SUMMARIZING THE LESSONS LEARNED 17**
  
- 7. IMPLEMENTATION CHALLENGES 18**
  
- 8. CONCLUSION 21**

# 1. EXECUTIVE SUMMARY

The *Cycle Terre*: Earth Cycle project, supported by Urban Innovative Actions, started in March 2018. It seeks to foster a new urban planning development model based on the use of excavated soil from major construction sites to produce construction materials.

In this second journal, we will present the legal and historical context of earth management in the Parisian Region and its relations with the project by placing it in the perspective of a circular economy approach.

Then we will describe and comment the major recent evolution of the project, regarding the new implementation site and the business model (partnership and production). These changes make the project more realistic and will offer an easier integration of this process in the management of excavated earth in the Parisian region.

The third part allows a positioning of the Earth Cycle process in a more global approach to land management, urban development and urban regeneration at the scale of the Paris region as a complement to other more conventional approaches.

This journal presents the evolution of the situation and the management concept of excavated earth in the Parisian region. We will try to demonstrate the crucial role that these inert soils can play as a valorisation sector. Transforming a waste into a natural construction material is an interesting element of a territorial circular economy.

The major conclusions of this analysis is that Earth Cycle innovations regarding local economic development, sustainability and governance will certainly contribute to the elaboration of an integrated model of earth management in the Parisian region and probably in other European cities.

## 2. CONTEXT OF THE PROJECT AND LEGAL ISSUES

Raw earth, used for eleven millennia, remains today the most widespread building material around the world. A third of humanity lives in an earthen habitat, or more than two billion people in 150 countries. Earthen architectures, simple or monumental, are present in various contexts and meet very diverse needs. The use of this material is limited in Europe, despite the quality it can offer

### 2.1 A bit of history

All constructions, whether buildings, secondary or major infrastructures require earthworks!

The earthwork actions have taken various forms since the first sedentary societies: honoring the gods, burying the dead people, developing the agriculture, building dikes, levees, canals and reservoirs, protecting fortifications, so many tasks that require massively earth handling...

This was the case in ancient Egypt, 3200 B.C. or a thousand years later in the city-states of the first Mesopotamian empires, between the Tigris and the Euphrates in Syria and Iraq.

We could also cite military works, such as the Great Wall of China (6 to 7 meters high and 4 to 5 meters wide) built up with 57 million cubic meters of earth and masonry. This major construction began in the 4th century BC. It was extended and regularly restored until the 12th century, over a length of about 6,700 kilometers to protect the empire and stop the invaders.

With few exceptions, from high antiquity until a relatively recent period, the communities privileged the local re-use of excavated soil. Very

as a resource and an efficient construction and insulation material. The Carbon balance of this material is more positive in comparison with other materials used in construction, especially concrete.

Regenerating the use of this material in France and in the Parisian region in particular has significant potential in terms of circular economy and environmentally friendly construction techniques.

often, especially in clay regions, where the land is easily used for making bricks, a natural cycle of “circular economy” would allow to rebuild the city on itself, the ruins of old cities becoming the quarries of new cities.

A rough assessment of urban excavated earth since the end of the 17th century gives 0.1 m<sup>3</sup> / inhabitant / year in the 18th century. It grows to 1 m<sup>3</sup> / inhabitant / year in the 19th century and 10 m<sup>3</sup> / inhabitant / year in the 20th century. The volume increases tenfold every century: will the 21st century follow? It is not an easy question especially in an unstable economic context. We can say that the urban sprawl and the infrastructure development is the key element for a realistic answer! (*Fernandez (2014) [www.theses.fr/2014CNAM0982](http://www.theses.fr/2014CNAM0982)*)

In European cities, urban public soil rose by a few millimeters per year during the second millennium. Then the city councillors, urban planners and engineers like Haussmann and Belgrand in Paris, strongly influenced by hygienist needs and mechanics, implemented pipelines for drinkable water and sewage system.

The need to cover these infrastructures with selected soils was a key element for the city design. Relief disappeared from city planning, as the target was to allow the fluidity of the networks by insuring sufficiently gradual slopes.

The city lost its relief; its ravines were filled, its local altitudes buried or levelled in favour of uniform, slightly sloping, crawling roof spaces. This issue required important quantities of soils and earthworks.

## 2.2 Metropolitan development and the earth management story: the example of Paris and the Parisian Region

In this paragraph, we will show that the question of earth management isn't new and has already impacted the urban development and the utilities implementation in Paris metropolitan area, in the past. Different strategies were implemented over time but it is important to observe that the policy of transferring the excavated soil outside the city is recent. We analyse this scheme following three periods:

a- Big cities, and especially Paris, "capital of France and the Empire: Napoleon III", underwent radical changes between the end of the 18th century and the First World War. The planners must adapt the old city to the needs of modernization dictated by the industrial revolution and welcome an unprecedented rural exodus. It is the time of "urban development" and the birth of pre-town planning.

From 1800 to 1919, Paris not only almost doubled in size, but its population increased from 500,000 to almost 2,900,000 inhabitants. The urban ground was largely levelled, reshaped and backfilled in order to bring and drain the drinking water which the city so badly needs: along 97 kilometers, the Canal de l'Ourcq was built between 1802 and 1822; the water supply network was designed by Eugène Belgrand between 1854 and 1874.

It was also necessary to channel the river Seine, which became navigable from downstream to upstream with steamers, and build in 1832 the

landing stages of stations at the city limits - their location was chosen near the wall of the General Farmers. The works included widening and making the streets suitable for motor vehicles, with slopes suitable for the first teams of urban horse-drawn carriage of travellers and the systematic installation of sewers under the new tracks. From 1848, equipped sidewalks became mandatory. These important works required important quantities of soil.

The construction sector takes on its full extent with the arrival of Haussmann at the head of the Seine prefecture in 1853. It continues under the authority of Adolphe Alphand, director general of Works in Paris from 1871 until his death in 1891. Faithful to the teachings of the ancients, including Le Nôtre and Vauban, reshaped the city by practicing the principle of global cut and cover model, according to a holistic vision of the area to be readapted. In fact, they tried to reuse the maximum of excavated earth directly on site.

b- With the Thirty Glorious Years (from 1946 to 1975), the invisible revolution and the urban renewal which continued to transform Paris, the earthwork becomes a construction business. For the creation of the peripheral boulevard, the *Georges-Pompidou route along the Seine, the RER, Les Halles and La Défense* worksites, the *Georges Pompidou Center or the Maison de la Radio*, the excavations were carried out mechanically and the evacuation of the land was carried out with trucks outside the city.

From the *Montparnasse tower* to the *La Défense* district, modernity, at this time was expressed by the great height. The invasion of cities by the automobile requires the massive creation of parking lots under public squares as under all new constructions – offices, equipment and housing. The volume of excavations during this period progressed very quickly and the excavated earth was transported outside the city to the rural areas of the Parisian region. Some exceptions are relevant. The excavated earth of the “Trou des Halles” in the city center of Paris, those of the ring road then those of the works of the A86 motorway (second ring road) were used for the development of the Georges-Valbon departmental park in La Courneuve near Paris. A circular economy approach existed already!

c- Paris area today is only 105 km<sup>2</sup> while the Parisian Region (Ile-de-France) is around 12 010 km<sup>2</sup>. The rhythm of development and

## 2.3 New legal context

The French government regulates the treatment and management of polluted or inert excavated earth since 1975. For this management of polluted sites and soils, there are four legal technical documents, but no ministerial decree. These documents prescribe the carrying out of risk studies and diagnosis of land pollution. They also define the rehabilitation objectives for polluted sites and the methods of management and redevelopment of these sites.

A ministerial decree dated March 15, 2006 gives the list of waste categories acceptable in these inert waste storage facilities (ISDI), as well as the conditions of operation of these facilities. This text was modified twice, in 2010 and then in 2014, when the ISDI supervisory administration passed from the Departmental Directorates of the Territories (DDT) to the Regional Directorates

sprawling is important and generates important earthworks. The excavated earth managed as waste in the Parisian region represented 18.5 million tons in 2013 (11.7 million tons in 2001). Within them, 0.9 million tons were reused (0.6 million tons in 2001) and 9.1 million tons were allocated to the rehabilitation of quarries (5.6 million tons in 2001). The Inert Waste Storage Facilities (*ISDI; Installations de Stockage des Dechets Inertes*) allowed the storage of 8.2 million tons (5.0 million tons in 2001). Finally, the management of polluted soils concerned 0.3 million tons (0.5 million tons in 2001).

Given the numerous urban projects in the different cities of the region, another more circular approach is necessary. The Innovative Urban Action Earth Cycle clearly fits into this logic, especially with the presence of Grand Paris Aménagement, which has more than 100 urban development projects in the region.

of the Environment, Planning and Housing (DREAL) and to Regional and Interdepartmental Departments of the Environment (DRIEE).

The ISDIs became classified installations for the protection of the environment (ICPE) in 2006. This decree was modified and amended twice in 2010 and 2014. Also, the Planning permits for land elevations over 2 meters were created in 2005; these planning authorizations are managed directly by the municipalities under specific classifications and rules.

All these decrees, rules and recommendations aim at establishing a chain of responsibility, from the producer of the excavated earth to the site for the management of this earth and also for the future user. This is an essential fact for the implementation of a traceability methodology for excavated materials.

The project Earth Cycle falls perfectly within this precise regulatory and operational context. This urban innovative action responds to the components of the complete value chain of earth valorization because it involves all the players concerned in a transversal manner. The

new partnership includes an owner of an ISDI whose presence allows for a greater variety of excavated soil and allows the system to be clearly integrated into a comprehensive land management approach.



### 3. THE CURRENT SITUATION: A SPATIAL AND FUNCTIONAL ISSUE FOR THE PARISIAN REGION

The Paris Region produces around 30 million tons of DCW (Demolition and Construction Waste) per year ([www.iledefrance.fr/observatoire-regional-des-dechets-dile-de-france-ordif](http://www.iledefrance.fr/observatoire-regional-des-dechets-dile-de-france-ordif)), including 25 million tons of inert waste, including 18 million tons of excavated earth per year. The creation of the infrastructures of the Grand Paris Express (GPE) and the town planning operations linked to it will generate even greater production in the coming years: it is expected that 60 million tons will be generated by the Société du Grand Paris (SGP) by 2030. In the next 20 years, 400 million tons of earth will therefore be excavated and will have the status of waste, including 40 million tons from the Grand Paris Express metro network alone (Project partner of Earth cycle). These volumes demonstrate the need for the development of research and innovation actions on a regional scale.

This huge quantity of earth (i.e. four Pyramids of Khufu), must be extracted, transported and valued in a smart and sustainable way. This topic seems to have been completely neglected in urban planning and urban development for the past 30 years, with some exceptions, while it used to be a part of the spontaneous regeneration of urban spaces in the previous periods, as mentioned before.

The presentation of the situation in the Paris region and the evolution of public policies accompanied today by the effects of the digging of the Grand Paris Express tunnels testify to the complexity of the subject. Earth Cycle is an active contributor in an attempt to implement circular

economy logic in urban planning. The actors mobilized around this Action offer this possibility.

Ultimately, if this development risks saturating the region's waste storage facilities (ISDI), it also constitutes an opportunity to set up recovery systems at the local level – at the metropolitan and regional scale – whose interest is both economic and environmental. Earth Cycle is one of the major research and innovation actions in the Region and will offer important potential by developing construction materials for urban development and regeneration. This action integrates also a component related to LED (Local Economic Development) by creating jobs for local population.

This theme of earth management was part of the reflections of the Estates General of the circular economy of Greater Paris organized in 2015, and gave rise to one of the 65 proposals for action in the White Paper on circular economy ([www.economiecirculaire.org/library/h/livre-blanc-de-leconomie-circulaire-du-grand-paris.html](http://www.economiecirculaire.org/library/h/livre-blanc-de-leconomie-circulaire-du-grand-paris.html)).

This evolution of the perception and the need to manage the excavated earth in a sustainable way is shared by the major stakeholders of the Parisian Region. The political involvement is important and the topic is considered seriously as it is a possible source of income and a development of job opportunities. This circular economy vision might be an important factor to evolve the political policies in matter of urban and regional planning. Transporting excavated earth has to be limited and the local use has to be encouraged.

# 4. RECENT EVOLUTION OF THE PROJECT: NEW CHALLENGES AND NEW PERSPECTIVES

## 4.1 Major elements of Earth Cycle

The Earth Cycle project, supported by Urban Innovative Actions, started in March 2018. The project partners will develop a full industrial process and ecosystem to produce certified earth construction materials.

The major component of the project is the creation and the development of a factory to transform the soil excavated from construction sites of the territory into raw earth construction materials with a very low carbon footprint. The “Earth Cycle” factory must allow:

- receiving the excavated earth, which will have been prepared (dried, crushed, screened) on excavation sites or on an intermediate platform,
- transforming it into building materials, to be used on building sites.

The Earth Cycle factory will be a mechanized production unit which aims at a medium-term objective of around 6 500 tons of earth recycled each year. It will produce in a local short circuit a range of slightly transformed georesourced materials. Along with technical and engineering works, Earth Cycle partners will closely involve

citizens throughout the project and train local companies and entrepreneurs to create further circular economic opportunities.

The deadline for launching the raw materials factory and the marketing of its products is fixed at February 28th, 2021. Recently, the building permit was filed and accepted, the production lines designed, the machines chosen and the operating company set up. Earth Cycle is now focusing on the technical certifications that are essential for this new material sector and has launched the first custom-made training for Sevrans residents who plan to enter the job market.

Building with this georesourced, natural or recycled and local construction material does not require energy-consuming transformations. This will allow to alleviate the pressure on natural resources (sand in particular), to decrease the grey energy necessary for the production, transport and implementation of materials, and to favour the reversibility of the buildings (no new creation of waste in the event of demolition in the future).

## 4.2 The project evolution and the current situation

Earth Cycle is an innovative approach combining specificities of urban development projects and industrial development. All major territorial

projects evolve during the process of design and implementation. This iterative process allows for an optimization regarding environmental,

technical and economical performances. The major evolutions of the Earth Cycle project since the design phase are:

a. Change of site: Following an unfavourable regulatory procedure, a new site had to be chosen to implement the factory, in summer 2019. The activities of the factory are considered as an industrial activity under the French Urbanism Code. For this reason the Local City Planning Plan has been modified to allow the implementation of the factory.

The transfer of the project site made it necessary to downsize its programming and capacity. Thus, the current project occupies an area approximately four times smaller than what was initially planned. In addition, the earth preparation activity, which would have generated noise, cannot be carried out on site due to lack of space and will therefore be outsourced (preparation on excavation sites or on intermediate platforms).

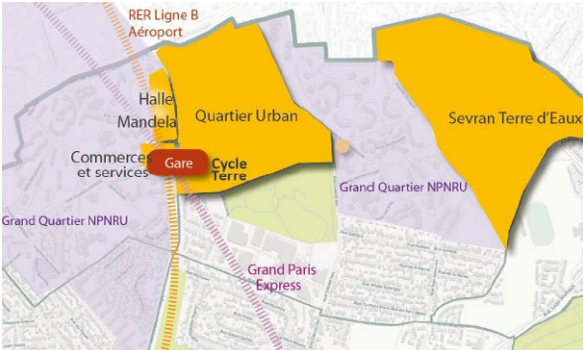


Figure 1: the location of the factory

The Environmental Impact Assessment (EIA) of the project and its factory in the new configuration shows a very low level of environmental and

health impacts. This work was necessary for the construction permit elaboration.

b. The building construction permit: The building permit application was submitted in November 2019 by Quartus (urban developer and partner of Earth Cycle): the project owner, and Joly & Loiret (Architect and partner of Earth Cycle): the project designer.

The planned building is a wooden structure, 13 meters high at the ridge. This optimizes the available height of the unloading area. The design, based on the use of natural materials, was guided by the idea to promote the image of the factory, avoiding architectural representations related to industry (shed) or offices (glass façades, steel). The opening ceremony is scheduled for February, 2021.

c. The partnership evolution: An agreement with the ECT group has been finalized in order to welcome the group into Earth Cycle partnership. ECT is specialized in earth management and land reclamation, the group reuses inert soil from public works sites in the Paris region for sustainable development projects together with local authorities. This complementary partner's presence is in line with the project's circular economy strategy of proximity.

d. The factory management and operating: A SCIC (Cooperative Society of Collective Interest) is being created to pilot the factory. Innovative governance is proposed for the factory. The company's charter has already been written and in order to anticipate the management of the Earth Cycle plant. The SCIC promotes collective values and has a double objective: economic efficiency and a social and democratic dimension. These characteristics fit perfectly with the spirit of the project.

In this type of structure, most of the profits can be reinvested in the factory or used to develop new actions, which perfectly matches the needs

of a newly created sector of activity. ECT, the new member of the consortium is also a part of the SCIC. Other members include the City, Quartus, Joly&Loiret, Amàco and an architect from CRAterre, as well as a brick producer from Toulouse who is not part of the UIA partnership but is engaged in the development of the raw-earth value chain.

e. The production: The business plan of the factory has been outlined. The activity is expected to become profitable in about 3 years. Today, price assumptions have been defined in order for the products to be competitive in the market. The turnover in an average year (year 3 in the business plan) is thus estimated at € 1.1m (for a level of expenses of around € 1m, including € 400k in personnel expenses, i.e. 8 Full Time Person).

The volumes produced in a current year are as follows:

- 300,000 bricks (2500 T per year)
- 35,000 extruded panels (700 T per year)
- 1,700 tons of plaster and mortar.

f. First clients and potential projects: In the summer of 2019, a first agreement was signed between Earth Cycle and In'li, the subsidiary of the Action Logement group (social and intermediate housing company). In'li ([www.inli.fr](http://www.inli.fr)) has agreed to use raw earth products from the factory in its new housing programs carried out under direct project management. In'li wishes to experiment this process on a small scale, and then in February 2021, to launch a pilot operation of 50 housing units. In addition, a R&D agreement was signed in which In'li contributes up to €165,000 to finance research on construction materials in order to promote their use in housing projects.

If the tests are positive and conclusive, In'li would go from 50 homes in 2020 to 100 in 2021, then 150/200 homes per year, if successful. With these volumes, the majority of Earth Cycle production would be consumed by In'li. This scenario will allow future development of the project with other territories:

- Meanwhile, Quartus will start an urban development project in Ivry sur Seine district in 2022. The development program strongly includes raw earth.
- Grand Paris Aménagement will strongly encourage the use of organic and geosourced materials with the implementation of its

strategic plan. Linkcity, a major French urban developer is involved in the construction of a building called Terre d'Eaux ([www.linkcity.com/projets/ile-de-france-sevrان-terre-deaux/](http://www.linkcity.com/projets/ile-de-france-sevrان-terre-deaux/)) in Sevrان inside the Terre d'Avenir urban development project. A few earthen buildings are also included in its housing program.

Other potential clients include municipalities close to Sevrان (Paris, Rosny-sous-Bois and Montfermeil have already launched the design of public building using raw earth materials) and other developers / entities such as Nexity, I3F, Toit et joie, to name just a few, are also concerned.

# 5. NECESSARY INTERDISCIPLINARY APPROACHES FOR THE EARTH MANAGEMENT: FROM THE EXCAVATION TO THE VALORISATION

In this chapter we present preliminary analysis and thoughts to integrate Earth Cycle project in a circular economy vision allowing an optimized management of excavated earth in Paris Region.

Many potential uses of this earth are possible and could be complementary following different spatial scales.

## 5.1 Complementarities on local scale

The problems of earth management and their valuation as a building material for construction and potentially urban regeneration, urban backfilling, Technosol<sup>1</sup> or landscape enhancement in the service of territories induce a need for a real creativity associating regulatory evolutions with technical, sanitary, urban, landscaping innovations and artistic approaches.

This theme of earth management is an important vector that mobilizes historians, elected officials, state and community officials, administrative officials, lawyers, economists, engineers, consulting firms, researchers, urban planners, landscapers, biochemists, architects and artists

and of course private companies in charge of the excavations works and storage.

Very often, the excavated inert soil in urban areas contains little organic matter (<0.1%). The possibility of transforming these so-called “sterile” lands into functional soils could represent a new outlet for this sector. This component of Technosol and Earth Cycle are complementary. Both will allow an integrated approach for urban development and regeneration even on small scales.

This closed loop, by integrating the maximum of excavated earths in urban development projects, will reduce the impact of cities on the environment.

## 5.2 A new ecosystem vision

The excavated earth is today participating in the flow of an urban metabolism at the scale of large metropolitan areas. The engineers, developers,

and land owners in charge of the urban and metropolitan development must integrate environmental issues, from biodiversity to

---

<sup>55</sup> A **Technosol** in the [World Reference Base for Soil Resources](#) is a Reference Soil Group that combines soils whose properties and **pedogenesis** are dominated by their technical origin like excavations. They contain either a significant amount of **artefacts** (something in the soil recognizably made or extracted from the earth by humans).

landscaping. They must remain attentive to the future of these lands and their development.

The possibilities for the valorisation of excavated earth are, in fact, very varied – landscaped parks, reforestation areas, urban farms, leisure or sports equipment, photovoltaic fields or filling and securing of quarries but above all, the use as a building material offers a structuring element for urban projects. This implies a new ecosystem vision that is pragmatically adapted to the realities of the regions. The different uses of earth will contribute in this reduction of ecological footprint of our territories. Land remains a precious commodity and an essential natural resource.

Soils are materials whose traceability remains an essential guarantee for their vocation as a resource. This is an important issue for human settlements, whatever their administrative status or size.

To promote the territorialized circular economy, it is necessary to build a collaborative ecosystem. Land and its management are often viewed as negative externalities.

Until recently, few architects, planners or even engineers have wondered about the future of

excavated earth. It was a problem only of earth workers. However, it is a sector of economic development that respects the environment. But beyond the specific interest at the scale of projects, the national stake is important. Earth management in France represents 150 million tons, 5 times more than the production of household waste.

Also, providing technical information through guidelines can help stakeholders to think about earth management in a different way while respecting an appropriate regulatory and insurance framework. This is also one of the major outputs and will be discussed in the next UIA journal.

We also need new political models. Valuing earth as a building material is an important starting point. But it is not a sufficient solution for this integrated management of earth on a regional scale. The whole set of private and public stakeholders around this urban innovative action should be emphasized and valued. The partnership model is preferred and its implementation is probably complex but with European, national and regional support, this can be very innovative.

### 5.3 Decomartmentalization and Urban Nexus

The previous analysis clearly demonstrates that Earth Cycle, through its organization around an Urban Innovative Action and the mobilization of many stakeholders, foreshadows an increased transversality which is essential for earth management on local or regional scales. This link between the innovation and Earth cycle process and the needs of local authorities to implement circular economy strategies, demonstrates the needs of decomartmentalization and to limit silo approaches.

This transversality is already present in many urban services like the combined management of waste water or solid waste and energy conservation and management. The Urban Nexus approach, first proposed by the German government and the German cooperation to achieve an integrated management of resources in 2011, seems particularly relevant here. No well-developed conceptual approaches are available yet but many tentative researches are undergoing. Applying them to urban management of earth could be very innovative.

The Urban Nexus is an approach to the design of sustainable urban development solutions. The approach guides stakeholders to identify and pursue possible synergies between sectors, jurisdictions, and technical domains. It counters traditional sectorial thinking, and divided responsibilities that often result in poorly coordinated investments, increased costs, and underutilized infrastructures and facilities.

This decompartmentalization is now essential in conventional urban services such as water, energy, waste and transport. Earth is a new urban service which must be assumed by elected officials to balance the territories. The earth can become by its quality, and the sensitivity of its treatment and management an important territorial service.

Beyond the specific questions related to the earth mentioned earlier, the methodological reflection carried out clearly fits into the reflections carried out around urban complexity. This system, and the sub-systems which compose it, are clearly in perpetual interdependence and this will oblige, sooner or later, the territorial managers to get out of their sectorial and compartmentalized approaches to urban and territorial questions. This important issue of interdependencies and integrated management will be discussed in other journals and probably in more research papers.

The ultimate goal of the Urban Nexus approach is to accelerate access to services, and to increase service quality and quality of life within our planetary boundaries.



## 6. SUMMARIZING THE LESSONS LEARNED

At this stage of the project development, two lessons are highlighted. The first is the important role that earth can play in implementing a circular economy policy for a territory. Indeed, the economic development potential is important; it creates jobs and allows a better ecological image of the territory.

The second lesson is the need to involve many competences and stakeholders to insure the

success of the project. This technology is new and the best way to optimize the project management and implementation is to involve the stakeholders from the early stage of the design to reduce the uncertainties. Earth Cycle will be an important knowledge management resource for the development of earth construction in France and probably in Europe.

# 7. IMPLEMENTATION CHALLENGES

An overview of the basic UIA challenges as well as project specific challenges is presented in Table 1. Besides the established UIA challenges, three more challenges are identified for the Earth Cycle project: Financial sustainability, Technical readiness, and Legislative readiness.

These three challenges are crucial for the success of the project due to the high level of technology and service innovation in the project. Earth Cycle project is piloting a new technology for a new urban service with new business models and partnerships.

In the table, the levels are classified as follows:

- High: important issues that are necessary for the project to focus on during the coming six to twelve months. If not resolved, they may impact the project result.
- Medium: the project has a plan or they are potential showstoppers later in the project.
- Low: the project has a plan or solution to mitigate or reduce them.

For Earth Cycle, no challenge was considered with a risky profile. The implementation process is undergoing and the time schedule is realistic.

Challenge	Level	Observations
<b>Leadership for innovation</b>	<b>Low</b>	The project arouses major interest in the Paris region. The Ile de France region will be associated to the project. A financial contribution of 200 000 Euro is proposed and it will insure the project development. The municipality facilitated the administrative procedures for the project to come out by accelerating the process for urban planning and construction permit for the new implementation site. This simplification of the procedures will allow the respect of the UIA schedule. The collective spirit characterizes the project and its partnership.
<b>Public Procurement</b>	<b>Medium</b>	As for the factory operation and the sale of products, public procurement might be an obstacle as public entities that would like to encourage the use of locally-produced geo-resourced materials will still have to guarantee market competition. The prices of the materials will probably be slightly higher than heavily industrialized, less environmental-friendly processes. Criteria of carbon and ecological footprint must be taken into consideration, for our materials to become competitive.
<b>Integrated cross departmental working</b>	<b>Low</b>	Earth Cycle has taken the role of uniting many actors of earth management in the Parisian Region and even France. This integrated approach allowed an involvement of all the departments in the city and even the Region Ile de France. The project is offering a shared vision. The departments of sustainable development, infrastructures, public command and urban development are involved in the consultation and decision process and the project is highly supported by the Mayor and his team. This interdepartmental involvement accelerates the rhythm of the project modifications and will facilitate the factory construction.

Challenge	Level	Observations
<b>Adopting participative approach</b>	<b>Low</b>	<p>The project is close to the city center and the inhabitants are very motivated for the project as it is going to increase jobs opportunities. A SCIC (Cooperative Society of Collective Interest) is being created to pilot the factory. Innovative governance is proposed for the factory. The company's charter has already been written in order to anticipate the management of the Earth Cycle plant. The SCIC promotes collective values and has a double objective: economic efficiency and a social and democratic dimension.</p> <p>ECT, the new member of the consortium is also a part of the SCIC. Other members include the City of Sevran, Quartus, Joly&amp;Loiret, Amàco and an architect from CRAterre, as well as a brick producer from Toulouse who is not part of the UIA partnership is also engaged. All these members are highly motivated and very committed.</p> <p>Earth Cycle's new location is an industrial zone: the project is expected to improve its image of the area and the job creation generated by Earth Cycle is highly appreciated by the population.</p>
<b>Monitoring and evaluation</b>	<b>Low</b>	<p>The objectives and the indicators were adapted for the new factory and are now realistic. The data collection process is well established. The data collection is supervised by the local authority. Each partner is in charge of a specific component.</p> <p>The architect and the technical team are in charge of the earth material quality and use and the investor of the factory cost and operating management. No specific problem is encountered except the realization delay related to the COVID-19.</p>
<b>Communication with target beneficiaries</b>	<b>Low</b>	<p>Earth Cycle is having high expectations from all the stakeholders and even on a large number of stakeholders not directly involved. It is one of the major urban innovations in the Parisian region.</p> <p>A steering committee is organized every 6 weeks and all the stakeholders are participating. Also specific meetings are organized by the local authority to sensitize the target beneficiaries on the importance of the project.</p>
<b>Upscaling</b>	<b>Medium</b>	<p>It isn't sure that without the financial participation of UIA, the project is viable. The cost of the factory is hardly sustainable, given the fact that the market is not developed yet. Another alternative could be the development of mobile lines with a lower cost. This upscaling question will be discussed in the next journal when the project budget is stabilized and the market demand is more precise.</p> <p>Many possible upscaling scenarios are possible: number of production lines, locations of other factories, size...</p>

## Project specific challenges

Challenge	Level	Observations
<b>Financial sustainability</b>	<b>Medium</b>	<p>The project has planned to identify more potential clients and more use cases, the operational costs and how to integrate this new concept in urban projects from the early stages of the design is a major issue. Earth Cycle is a demand driven project.</p> <p>This identification of new clients is realized by the SCIC and also by GPA to create a sustainable market for the project products. The demand regarding extruded panels is still limited.</p>
<b>Technical readiness</b>	<b>Medium</b>	<p>The technical process for compressed bricks and coating is mastered. The produced construction materials will be easily used by construction companies. As for the extruded panels, the research activities have not yet allowed to define a formula that passes the resistance tests. More R&amp;D activity needs to be done. In the meantime, the business plan of the factory must not rely too heavily on the extruded panels.</p>
<b>Legislative readiness</b>	<b>Medium</b>	<p>The legal status of collected earth in France is waste. Thanks to an implicit exit procedure, the produced construction material will not be considered as waste. In fact, this collected earth is directly used on the project site and not stored in inert waste storage facilities.</p> <p>Changing this status might impact the valorisation approach related to the project. This instable national legal context might impact the image of the project.</p> <p>This issue is, unfortunately, national and it is one of the major obstacle of a sustainable strategy for earth management in France.</p>

## 8. CONCLUSION

It is important as a conclusion to observe that our analyses presented in this journal concern only controlled, monitored and traced earth, but lightly polluted soils can also be the subject of rich and enriching research. A methodological transfer of charters and legal issues can complement these procedures for an exhaustive implementing earth management guides.

We believe that the concept of urban engineering through its interdisciplinarity and the consideration of complexity and

interdependencies can provide technical, regulatory, sustainable and above all innovative responses such as the Earth Cycle Urban Innovative Action.

Earth management is a subject that has been forgotten for a long time by the territorial authorities (municipalities, metropolitan authorities and regions), it is now an important element of an urban policy oriented towards a territorial integrated circular economy. Earth Cycle is a major player in this transition.

Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. Based on article 8 of ERDF, the Initiative has a total ERDF budget of EUR 372 million for 2014-2020.

UIA projects will produce a wealth of knowledge stemming from the implementation of the innovative solutions for sustainable urban development that are of interest for city practitioners and stakeholders across the EU. This journal is a paper written by a UIA Expert that captures and disseminates the lessons learnt from the project implementation and the good practices identified. The journals will be structured around the main challenges of implementation identified and faced at local level by UIA projects. They will be published on a regular basis on the UIA website.



### Urban Innovative Actions

Les Arcuriales  
45D rue de Tournai  
F- 59000 Lille

**+33 (0)3 61 76 59 34**  
info@uia-initiative.eu  
**www.uia-initiative.eu**

Follow us on **twitter**  
@UIA\_Initiative  
and on **Facebook**.