MOVECO Toolbox

DRAFT Version

Schools of thoughts

Regenerative design

DATE, PLACE,COUNTRY

NAME OF PRESENTER, ORGANIZATION

Aims of this tool

To understand the importance of different schools of thoughts for new circular design, manufacture, use and end of life with the aim to keep materials, products and components within the technical or biological cycle for longer periods, at their highest potential, and evaluate strategical circular development of a company;

To learn how to apply circular design approaches that can be implemented within a company/product lifecycle and define measures to improve the company circularity.

To define steps in developing the company circularity through new ways of thinking

Content of this tool

- **Regenerative design**
  - *- introduction*
  - *- the path towards regenerative system development*
  - *- creating regenerative development*
  - *- basic design rules of regenerative systems*
  - *- supporting tools for regenerative design*

Introduction

Regenerative design is a theory about designing systems capable to restore, renew or revitalize their own sources of energy and materials via specific processes, thus creating sustainable systems that form synergies and symbiosis between natural and artificial ecosystems. The basis of regenerative design is system ecology by adding closed loops between inputs and outputs or creating models where all outputs are viable and all inputs are accounted and where **Σoutputs ≥ Σinputs**.

Regenerative design is the biomimicry of ecological systems to artificial systems that work as a closed viable eco-economic system for all industries. Regenerative design is about finding solutions in order to metamorphose organic (biotic) and synthetic (abiotic) materials into new viable materials, not just to metabolize them.

Introduction

The ultimate goal of regenerative design is to redevelop systems with 100% effectiveness for co-evolution of humans along with other species.

The concept **“regeneration”** includes the concept **“sustainable”** and moves a step forward in the sense it act such that a lost ecological system to be brought back to existence.

In simple words, regenerative design is about *believing that it is possible to regenerate lost ecosystems.*

Regenerative design and development is about architecture, urbanization, people and their activities.

The well-known **“butterfly effect”** is ubiquitous in such cases.

Introduction

The difference between a degenerative and regenerative system results by comparing the block schemes from ***Figure 1*** and ***Figure 2***.

Figure 1. Degenerative system

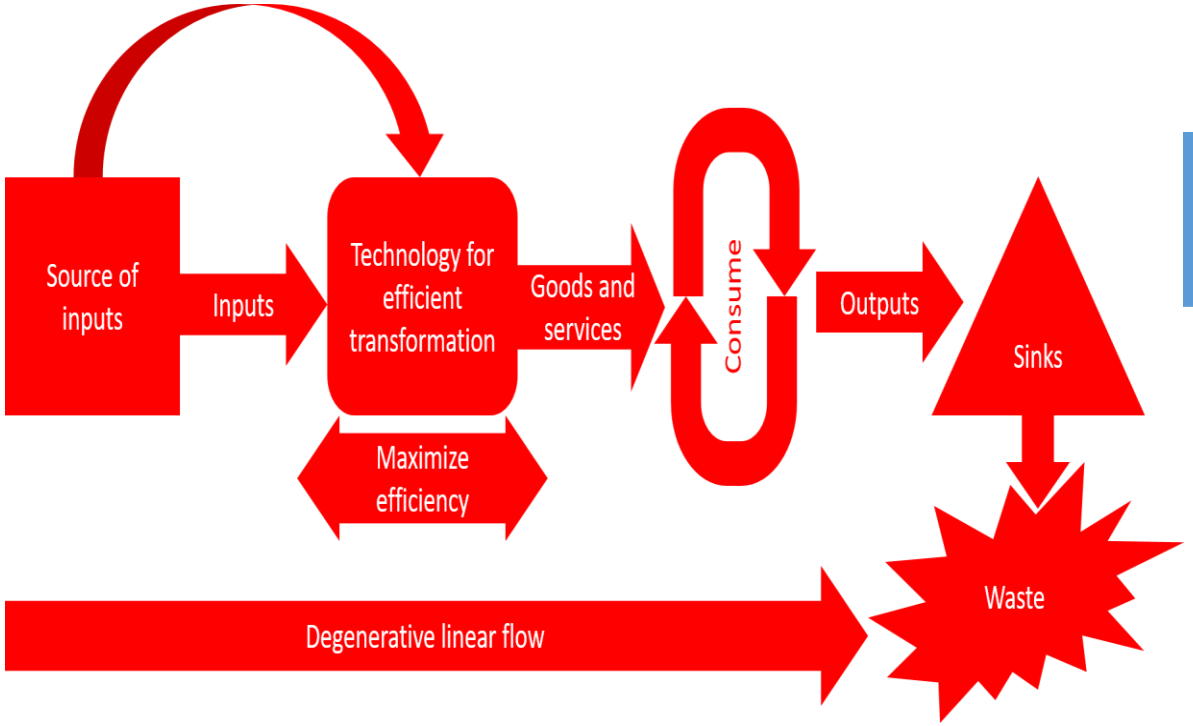
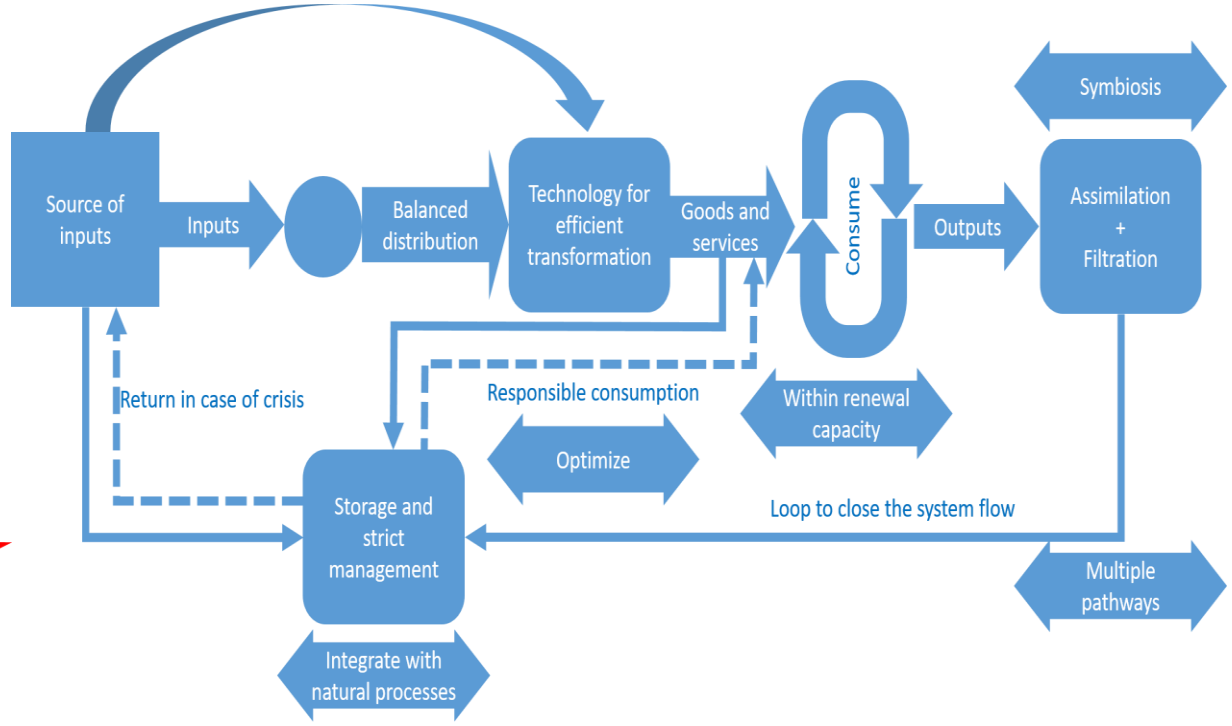


Figure 2. Regenerative system



Introduction

The paradigm shift between **degenerative** and **regenerative** design and development is to shift from *"output-driven thinking" (result) to "outcome-driven thinking" (result & impact of result).* This is suggestively illustrated in ***Figure 3.***

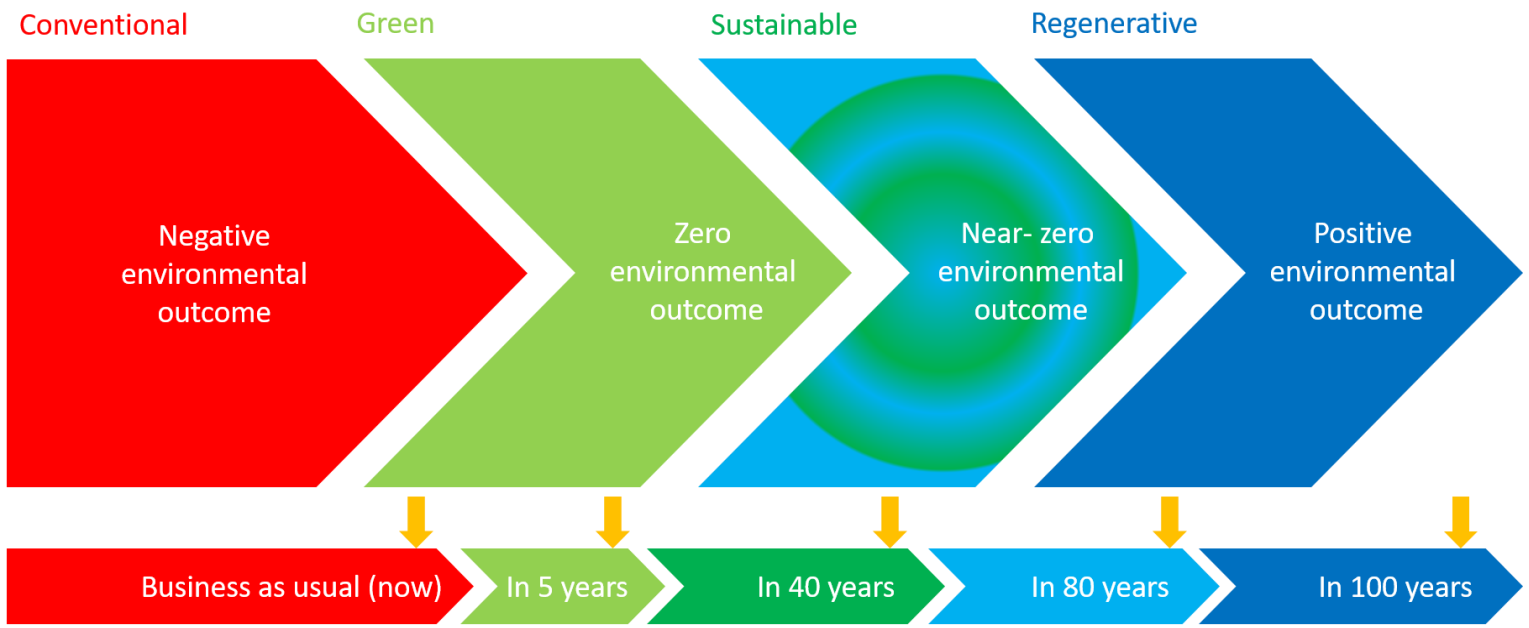


Figure 3.

Introduction

As ***Figure 3*** shows, it is not possible to jump from conventional ecosystems to regenerative ecosystems. We need to pass through some intermediary phases for learning lessons and optimizing solutions.

Regenerative design is not only about preservation of natural ecosystems, but also to improve natural ecosystem by human contribution.

Fauna and flora from a place try to keep in balance with nature.

Thus people must act such as to increase the capacity of natural environment to evolve in a positive way and to be resilient to various changes of the planet.

The path towards regenerative system development

Regenerative development starts when people realize that the place where they leave is a dynamic entity with its own unique past and future, continuously influenced by the larger system in which it is embedded. The second step is to turn to action. This requires a strategic partnership between all stakeholders in order to design and put in practice a plan to harmonize all ecosystems from a place such as create endogenic capabilities for regeneration. The last stage is the one of co-evolution to sustain the regenerative capabilities. These stages are suggestively illustrated in ***Figure 4.***

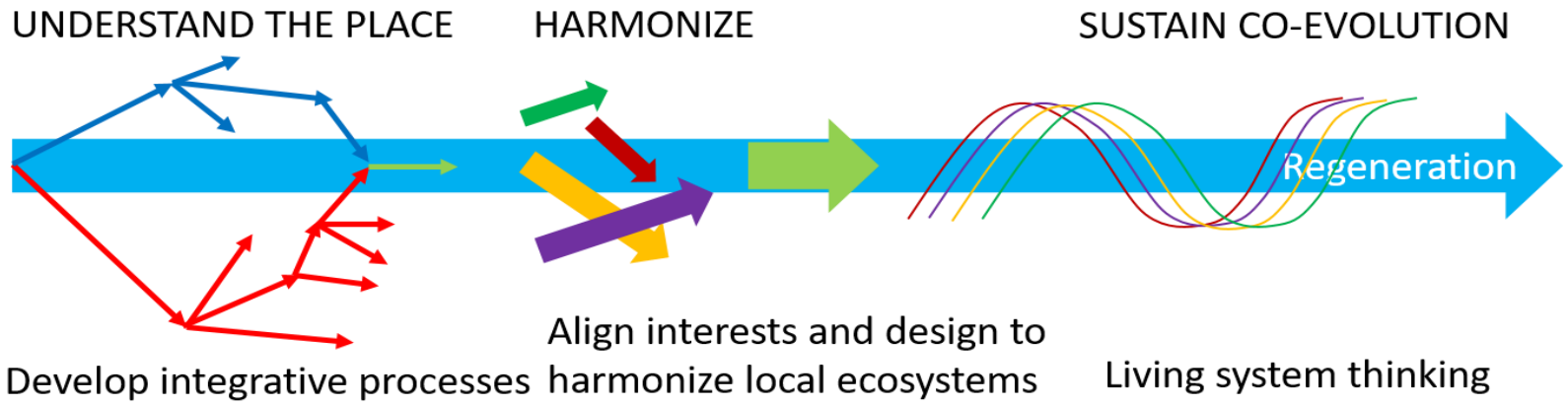


Figure 4.

The path towards regenerative system development

Regenerative design and development considers that construction of a system needs to serve the well-being of people, the planet and all living things. This implies a co-creative partnership with nature based on strategies of adaptation, resilience and regeneration. In regenerative design every system of the human habitat has to be designed such as to keep the harmony in the wider ecosystem. Without a harmonious integration within the natural ecosystem, an artificial system cannot possess such capabilities by itself. For example, considering the construction of a school in the paradigm of regenerative design, developers must take into account several key aspects.

The path towards regenerative system development

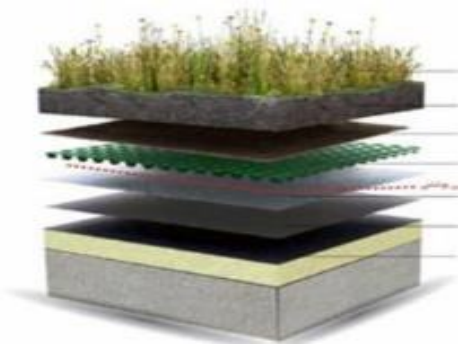


Figure 5. Natural insulation of a roof in regenerative design

First of all, the upper layer of the dislocated earth has to be stored and preserved (see ***Figure 2***) for later use on the roof, as natural insulation (see ***Figure 5***).

The path towards regenerative system development

If there are some trees on the site, they have to be replanted in the proximity (see ***Figure 6***). Another preoccupation is to design a passive building of the school such as its impact on local environment to be minimal and to ensure a symbiosis with the natural environment. An example is shown in ***Figure 6***. These actions are part of the so-called **“holistic design”** or **“system thinking design”**, sometimes known as **“whole living system design”.**

Figure 6.

The path towards regenerative system development

From the perspective of **“holistic design”** we have to see the effect of the new construction of the surrounding places, as well as of the whole habitat. This means, we do not have to see the network of streets and sites around the school as static elements. We have to see everything as dynamic processes. Maybe the wrong placement of the school can create traffic jams in the morning, meaning negative externalities in the ecosystem, more pollution, etc. To balance this effect, in regenerative design we have to plant additional trees in the area and along the flow of cars. In regenerative design we have to see the people interacting with the school as part of the nested, dynamic and complex natural ecosystem.

This means **co-evolution**.

The path towards regenerative system development

From the perspective of co-evolution, a practical approach in the case of school regenerative design, is the inclusion in the site of permaculture gardens where young students run practical activities and interact with nature. An example is shown in ***Figure 7.***

Figure 7.

The path towards regenerative system development

In addition, young students can be involved in practical activities to build wild habitats for insects, birds and small animals (e.g. squirrels) in the trees of the school and in some artificial constructions (see ***Figure 8***).

Figure 8.

The path towards regenerative system development

Regenerative design is also an opportunity of hope and positive direction in time of crises. People should see a crisis as an opportunity for innovation and renewal. In the case of school project, regenerative design could bring into equation the problem of global climate change. In this context, many activities can be included in the school's curricula on circular economy and in site application of this concept. This would include selective waste management, as well as entrepreneurial projects for the young students on circular economy (see ***Figure 9***).

Figure 9.

The path towards regenerative system development

Another characteristic of regenerative design is to consider the specificity of place in design. This imposes to integrate the artificial system in the natural place in a smart way. Beautiful examples are illustrated in ***Figures 10, 11 and 12***.

Figure 10.

The path towards regenerative system development

Figure 11.

Figure 11 introduces examples of designing residential units in harmony with the place. Design includes the unique story of the place and to optimize the presence of people and to engage them to preserve nature.

Figure 12.

The path towards regenerative system development

Another characteristic of regenerative design is to explore new patterns and boundaries, to scale and to nest systems. Illustrative examples in case of schools are shown in ***Figure 13***.

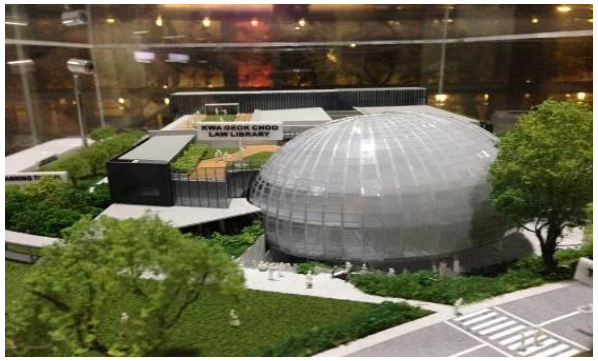
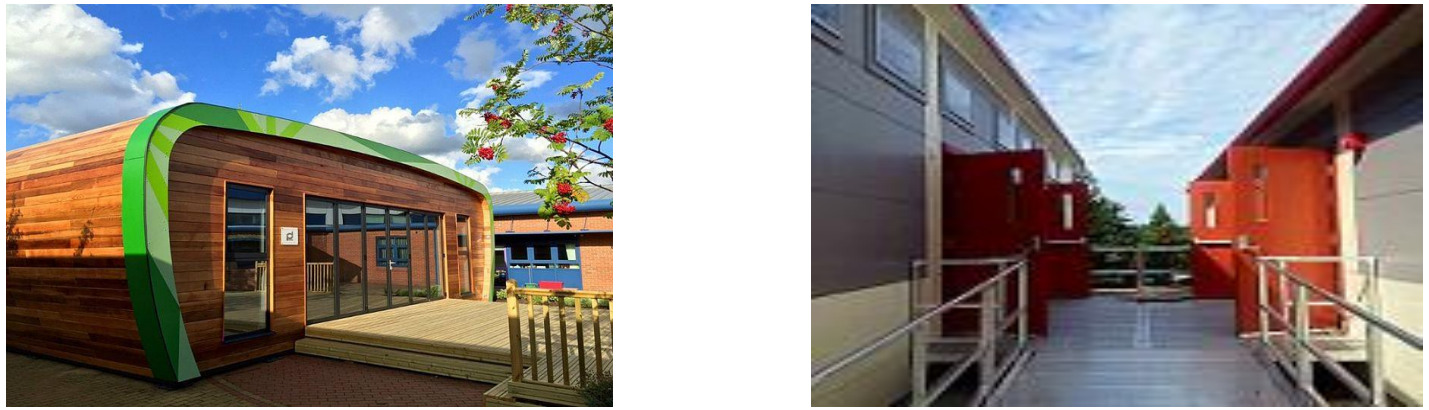


Figure 13.

The path towards regenerative system development

A last characteristic of regenerative design is about consideration of long-term perspective. Reconfigurable concepts fit very well with this requirement. Reconfigurable systems are systems that incorporates flexibility, modularity, convertibility, integrability, scalability and interoperability. Examples of green modular and easy scalable schools are shown in ***Figure 14***. The concept of portable classrooms can be also taken into account (see the left-bottom corner in ***Figure 14***). Regenerative design and development does not end with the delivery of project and approvals and construction.

Figure 14.



Creating regenerative development

To design and develop regenerative systems it is important to see the whole picture and how the system as a whole works and keeps the balance. From this perspective, any sectorial problem has to be approached by analysing its interactions with other parts of the overall system, and not in isolation. This requires a structured roadmap. A possible way to do this is the following:

- Identify all subsystems of the system and their links and flows
- Understand how the whole system works or master the pattern of the place beyond

  site boundaries
- Deploy system patterns into design specifications

Creating regenerative development

- Understand and base design in the local context, considering both ecological and socio-cultural issues
- Understand and align human aspirations to the project keeping in mind that diversity is crucial for sustainability (both ecological, cultural and social)
- Define the sense of the place
- Leverage and understand relationships between subsystems
- Use multi-disciplinary knowledge and design teams to solve problems
- Design for complexity and introduce feedback to support evolution over long time periods

Creating regenerative development

- Use integrated and participatory design and construction processes
- Conserve, restore and regenerate ecosystems; ensure capacity of functioning without the need of human management.

According to Brad S., in order to manage regenerative design, it is necessary to develop a comprehensive capability to:

- Handle an increased number of critical issues in a unit of time
- Take appropriate decisions in a very short time
- Select a reliable solution from many possible variants

Creating regenerative development

- Generate, in due time, feasible solutions to every unexpected, critical event
- Assess large amount of information to guarantee for the decision taken
- Forecast and understand the possible side effects of actions
- Develop and implement contingency plans if unpredictable events occur, as a result of various former actions taken
- Handle in a robust way incomplete and fake information
- Search continuously to discover “hidden” resources within the ecosystem
- Find ways to increase the productivity of limited resources and to increase the use of unlimited resources (e.g. creativity), rather than increasing the productivity of work.

Creating regenerative development

In **regenerative design** it is important to acknowledge that we deal with complex systems. From this perspective, the following **behaviours** have to be taken into account:

- Under certain circumstances, small inputs can lead to significantly large effects
- Very small variations of the input parameters are able to produce very different outputs
- Global effects are a consequence of the aggregated behaviour of individual entities of the system
- Changes in the external environment may cause the change of the system's structure altogether.

Basic design rules of regenerative systems

Because **regenerative design** deals with complex ecosystems, adequate rules have to be applied. Brad S. proposes **16 design rules** in this respect, which are further introduced:

Rule 1 : A system has to be seen as a group of many **"agents"** that interact continuously and mutually affect each other.

Rule 2 : A regenerative system must be developed considering several small-scale and interrelated **"experiments"** (increments, prototypes).

Rule 3 : The way in which requirements related to a certain regenerative system will evolve over the system life-cycle is very unpredictable. In this respect, it is more suitable to create conditions (via radical innovation) for constructing a certain predictable state of the future and to design intrinsic properties within the regenerative system such that changes to be done easily.

Basic design rules of regenerative systems

Rule 4 : Because adaptability of the regenerative system to external conditions over its life-cycle is required, heterogeneous (non-uniform) parts in the system are necessary both for enhancing and prolonging system's sustainability.

Rule 5 : Complex regenerative systems are both **"distinct"** and **"connected".** To fix this conflicting problem, innovative approaches are required. The following recommendations are considered here for designing regenerative systems: **(a)** apply the principle of **"universality"**, which asks to include parts capable to perform multiple functions; **(b)** apply the principle **"new physical states of the system"**, which asks to replace "solid" parts with other types of systems ("softer") or elements (e.g. "fields").

Rule 6 : Because in a complex world, "under certain circumstances, small inputs can lead to significantly large effects", regenerative systems must be designed not only to adapt to their external environments, but to contribute to the creation of external environments.

Basic design rules of regenerative systems

Rule 7 : The design process should see the conflicts within the regenerative system as driving forces of innovation.

Rule 8 : When designing a regenerative system, better results could be obtained when the solution is built from a self-reinforcing cycle, rather than from a very explicit **“vision”** of the system.

Rule 9 : Synergic solutions come up from novel ideas and they are not easily understandable from lower level perspective. Because of this, design approaches should encourage early trial-and-error experiments for learning (the concept of **“useful errors”**).

Rule 10 : Seeing a regenerative system as a hyper-system that integrate several complex systems, the design process should take into account that every decision affects multiple events. Also, effects in regenerative systems are connected back to causes (there is no isolated cause-effect chain), so the design process should consider a holistic view on the system. There are multiple reliable solutions to any problem. Thus, we cannot talk about the best solution in absolute terms, only in contextual ones.

Basic design rules of regenerative systems

Rule 11 : The design process should take into account the fact that regenerative systems are far-from-equilibrium. They need energy to persist. This energy comes from the hyper-system and should be renewable, otherwise the system will die. So, design of regenerative systems should follow the concept of **“design for excellence” .**

Rule 12 : Excessive individualisation of regenerative systems is a poor aim. The most effective solutions, are those designed in a modular way. System’s modules have to be relatively small; not too small to fail because of lack of diversity, not too large and too connected to fail because of lack of flexibility.

Rule 13 : Any innovation within a regenerative system creates a circular causality.

Basic design rules of regenerative systems

Rule 14 : The challenge during the design process of regenerative systems is to find the overall **"natural"** balance between stability and adaptability (this is actually the optimisation goal).

Rule 15 : Regenerative systems are emergent systems. In this respect, qualitative rather than quantitative methods have to be used during analysis and synthesis processes of regenerative systems.

Rule 16 : The multitude of possible combinations between the regenerative system and the complex external environment makes impossible an exhaustive testing before launching the system. This means that extra-design resources should be planned such as to react in a timely manner to any possible claim.

Supporting tools for regenerative design

In order to guide developers in regenerative design projects, several tools have been proposed. The most known ones are: **REGEN, LENSES, Eco-Balance, Perkins & Will Framework, and Living Building Challenge**. The **LENSES** framework is shown in ***Figure 15***.

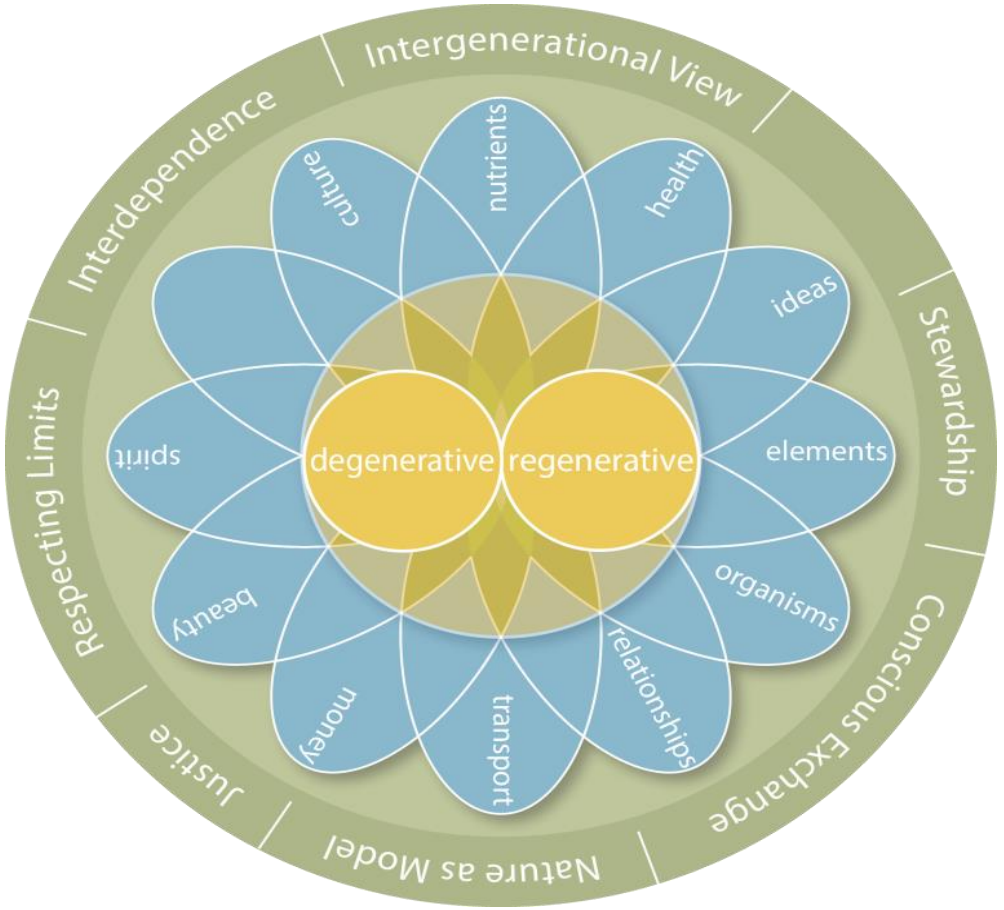


Figure 16.

Supporting tools for regenerative design

An adaptation of the **LENSES** framework is further presented. Adaptation is not from the perspective of content, but rather from the perspective of practical usability. LENSES framework was proposed in 2014 and considers three layers or three lenses through which we have to analyse a design. The first layer is the ***"Foundation Lens".*** The Foundation Lens includes ***eight*** guiding principles: **Stewardship, Respecting Limits, Interdependence, Justice, Intergenerational View, Partnership, Health, and Spirit**. These principles interact with natural, social and economic systems. Designers must follow all boxes presented in ***Table 1*** and propose positive correlated solutions that fit to the regeneration concept.

Supporting tools for regenerative design

Table 1. Foundation lens and regenerative design

Project								
Place								
	Stewardship	Respecting limits	Interdependence	Justice	Intergenerational view	Partnership	Health	Spirit
Natural system	Solution 1.1	Solution 1.2	Solution 1.3	Solution 1.4	Solution 1.5	Solution 1.6	Solution 1.7	Solution 1.8
Social system	Solution 2.1	Solution 2.2	Solution 2.3	Solution 2.4	Solution 2.5	Solution 2.6	Solution 2.7	Solution 2.8
Economic system	Solution 3.1	Solution 3.2	Solution 3.3	Solution 3.4	Solution 3.5	Solution 3.6	Solution 3.7	Solution 3.8

Supporting tools for regenerative design

The second layer is the ***"Flow Lens"***. This layer includes eleven categories and an open space that can flow into and through a project and define the project context. These categories are **Culture, Materials, Wellbeing, Education, Energy, Ecosystems, Land use, Transport, Money, Beauty, and Water.** By means of the Flow Lens project context is developed and relationships are discovered.

Table 2 illustrates a practical tool to analyse the project through the flow lens.

The last layer is the ***"Vitality Lens".*** Vitality Lens supports teams to understand the characteristics and qualities comprised in each flow from a regenerative state perspective. It uses a scale of impact from "degenerative" (-3), "degenerative-sustain" (-1), "sustain" (0), "sustain-regenerative" (+1), to "regenerative" (+3).

Supporting tools for regenerative design

Table 2. Flow lens and regenerative design

	Culture	Materials	Wellbeing	Education	Energy	Ecosystems	Land use	Transportation	Money	Beauty	Water
Culture		Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
Materials	Solution		Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
Wellbeing	Solution	Solution		Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
Education	Solution	Solution	Solution		Flow	Flow	Flow	Flow	Flow	Flow	Flow
Energy	Solution	Solution	Solution	Solution		Flow	Flow	Flow	Flow	Flow	Flow
Ecosystems	Solution	Solution	Solution	Solution	Solution		Flow	Flow	Flow	Flow	Flow
Land use	Solution	Solution	Solution	Solution	Solution	Solution		Flow	Flow	Flow	Flow
Transportation	Solution	Solution	Solution	Solution	Solution	Solution	Solution		Flow	Flow	Flow
Money	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution		Flow	Flow
Beauty	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution		Flow
Water	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution	Solution	

Supporting tools for regenerative design

Table 3. Vitality lens and regenerative design

	Rubric: Energy															***
	Focal point: Production					Focal point: Transmission					Focal point: Storage					****
	-3	-1	0	+1	+3	-3	-1	0	+1	+3	-3	-1	0	+1	+3	
Culture																
Materials																
Wellbeing																
Education																
Energy																
Ecosystems																
Land use																
Transportation																
Money																
Beauty																
Water																

Supporting tools for regenerative design

The Vitality Lens works in conjunction with the other lenses. While the Flows Lens works for understanding historic and current flows, the Vitality Lens guides teams in envisioning future or potential flows. The lenses of the tool overlap to display the interactions between the foundational attributes and the flows. The Vitality Lens helps teams to set regenerative goals and measure the impacts. It is associated with Rubrics to provide qualitative metrics.

SOURCES

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