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## Implementing strong sustainability in a design process

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## INTRODUCTION

Two major limitations from traditional sustainability assessment tools

- 1 They focus narrowly on environmental issues neglecting problems, they compartmentalize problems rather than adopting a systemic perspective.
- 2 The impact due to ever-increasing consumption proves too great compared to the associated efficiency gains; this is a technical perspective that pays only limited attention to human aspects (e.g. rebound effects).

Higher education institutions and companies are looking for new skills to link "awareness" and "skills" to promote the use of "skills" in the service of SoSy.

Companies also need to overcome strategies that compartmentalize environment, society and economy in their industrial strategy in order to evolve in their sustainable product development process.

The aim is to propose a design methodology to help designers integrate aspects of strong sustainability into design process. This is achieved by identifying specific SoSy elements, integrating them into a design framework and then testing them with several case studies.

## MATERIALS AND METHODS

The Design Research Methodology (DRM) proposed by Blessing and Chakrabarti (2009) has been chosen as the supporting framework for this research project. The DRM consists of four stages that are adapted to our purpose of implementing a design process in the SoSy paradigm.

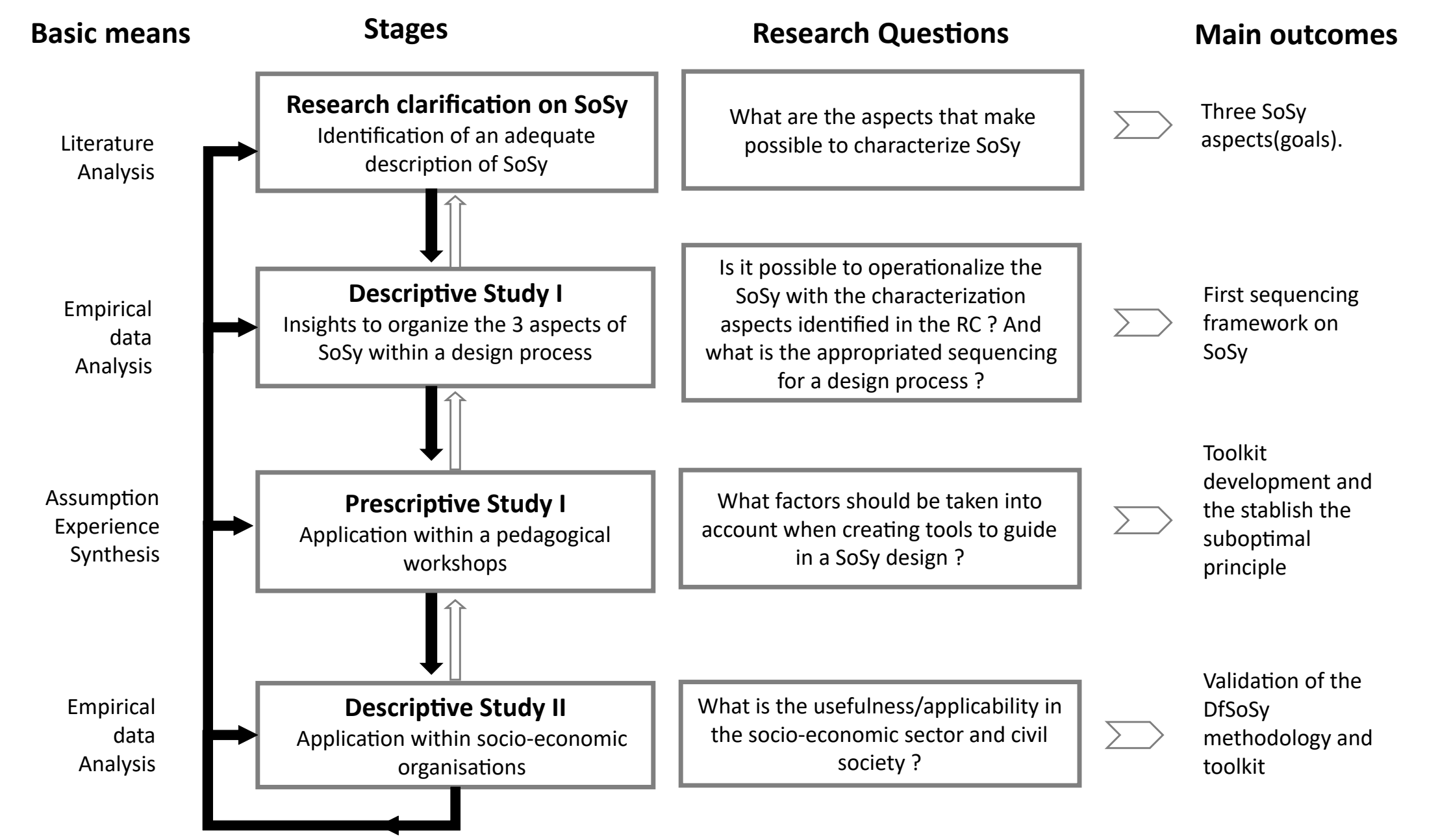


Figure 1 DRM Framework adapted for the development of the new DfSoSy methodology

## STRONG SUSTAINABILITY FRAMEWORK

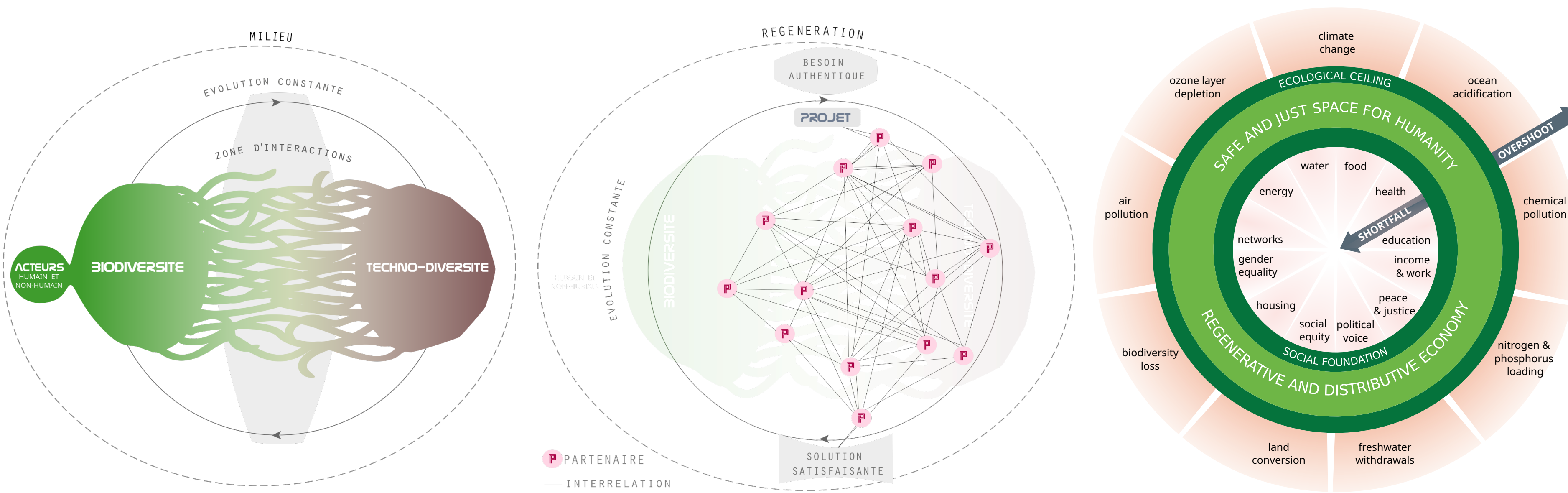


Figure 2 The Milieu, the Regeneration and Safe and just operating space concepts representations in a design for strong sustainability context.

The concept of Milieu it is related to the field of ethics, it help us understand that our choices become the choices of a multi-species community. We cannot live outside the environment, but we perceive it and act within it as a milieu charged with meanings and values.

Regeneration is associated to the description of the "Milieu" in order to take into account evolving events (increase, decrease and cycles) related to interactions between "Actors". It means taking into account different timeframes (short term, medium term and long term) and the ability to integrate the long timeframe of the living world. Including the cycles of the Earth system and the future generations of different species.

The concept of a safe and just operating space to satisfy the real needs of the living for good living together. In this way, the economy is seen as a means of achieving fulfilment within the constraints of local ecosystems and planetary self-regulation systems, taking into account the multiple parameters of planetary limits and these regulatory processes. Similarly to the Planet Boundaries approach (Steffen et al, 2015; Rockström et al., 2009) and the "Safe and Just operating space" (Raworth, 2012)

## DESIGN FOR STRONG SUSTAINABILITY METHODOLOGY

The Figure 3 present the steps in line with the double-diamond framework established. Each step is supported by key-factors specifically proposed for the DfSoSy methodology. A key-factor is "an influencing factor that seems to be the useful factor to address in order to improve an existing situation". (Blessing and Chakrabarti, 2009)

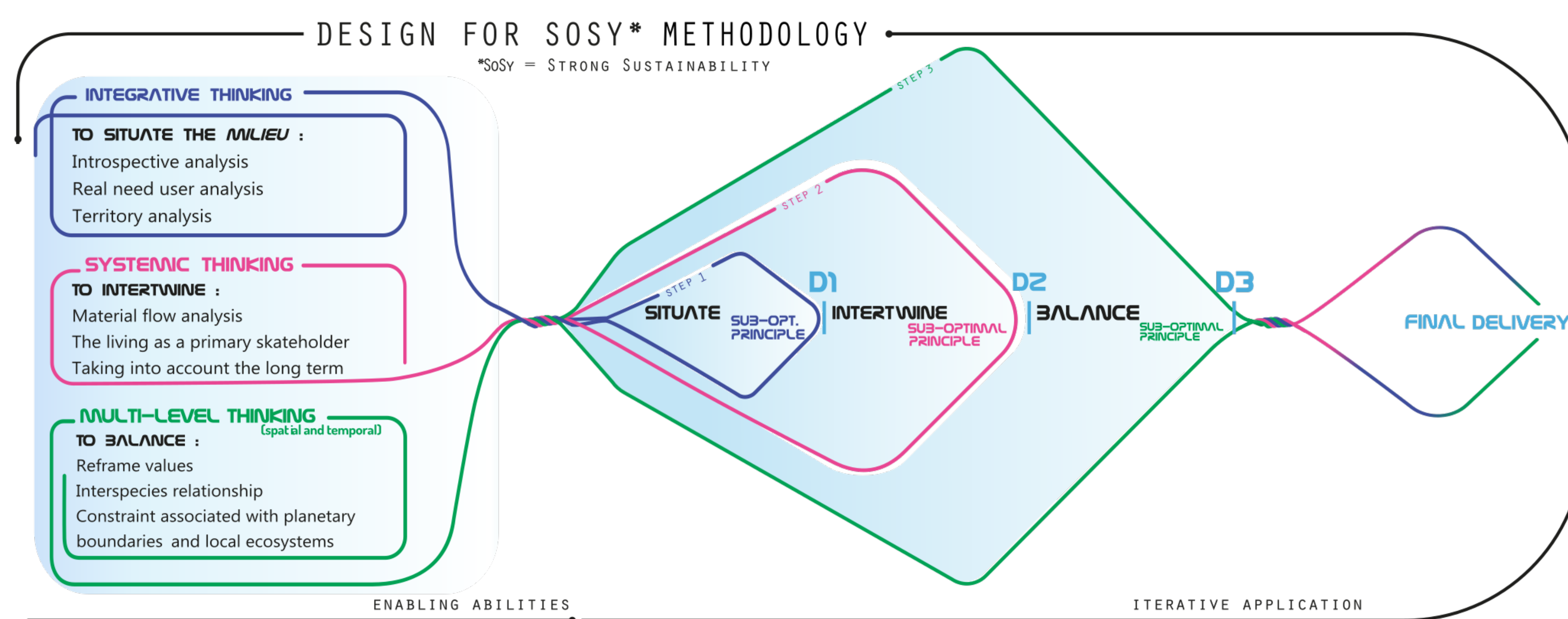


Figure 3 DfSoSy methodology by the positioning of each step according to the aspect of SoSy, its thinking approach, and key factors or abilities.

## CASE STUDY RESULTS

In the Prescriptive study I, a workshop application was performed. During 4 subsequent days (36 hours in total), twelve design students (L3) were enrolled in the workshop. The pedagogical objectives of the workshop were "Understanding and applying elements of strong sustainability" comprising:

- o Three aspects: Milieu, Regeneration, Safe and Just Operating Space
  - Real need analysis
  - Integrating living being
  - Economy taken as a means
- o The iterative stages of the creative process: situate, intertwine, balance
  - Sub-optimality selection principle
- o A new thinking framework

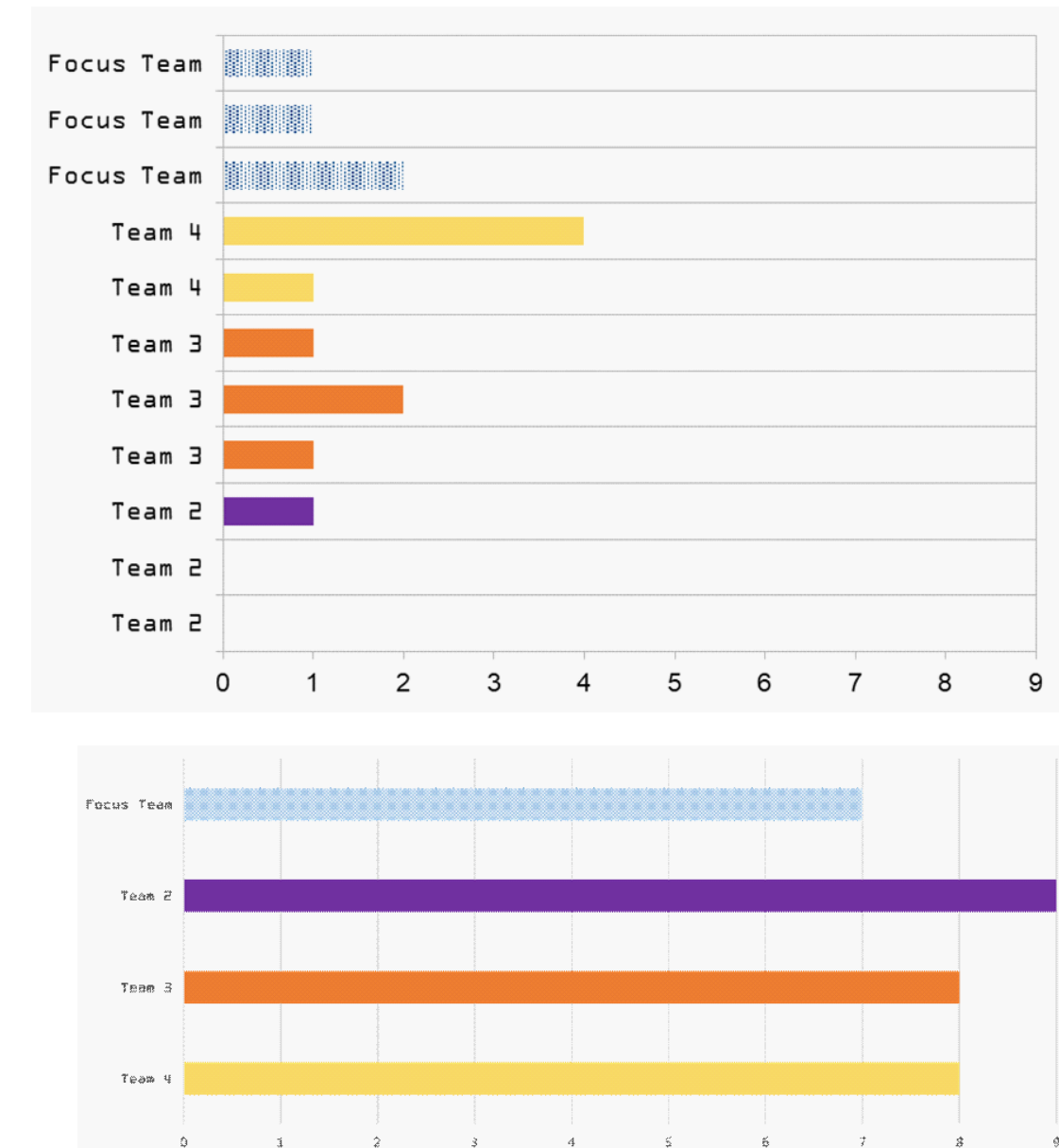


Figure 4 Expert's assessment of the individual proposals in the D0 (7a) and the teams' proposals in the final deliverables (7b)

Table 1 Criteria for the evaluation of the 3 SoSy aspects

Milieu	Regeneration	Safe and just operating space
real user need recognition	consideration of future and current human and non-human generations	awareness of social ceilings
local resources	link between actors	awareness of planetary boundaries
relation human and non-human/ecosystem	Material circularity	economy as a means

From all the feedback, self-assessment and deliverables, it can be concluded that the pedagogical objectives ("Understanding and applying elements of strong sustainability in a design process") have been achieved. In fact, the understanding and application of the elements of strong sustainability throughout: (1) the operationalization of the three aspects (Milieu, Regeneration, Safe and Just Operating Space), (2) the implementation of the iterative approach based on Situate, intertwine, balance steps (3) the application of a new thinking framework.

## CONCLUSION

In order to ensure a viable and deliverable future for all the living being in line with environmental issues and the planet's boundaries, a paradigm shift in design methodology has been demonstrated. An analysis of the literature revealed a gap in Design for Sustainability (DfS) approaches. Indeed, there are no clear indications of a methodological approach or a design method for SoSy. In order to move towards a design methodology that integrate the challenges of strong sustainability, a Design for Strong Sustainability (DfSoSy) methodology © (CC BY-NC-ND 4.0) had been proposed. The foundations of the proposed methodology are based on an analysis of the founding concepts of strong sustainability led to highlighting three aspects characterizing strong sustainability (SoSy): the "Milieu", the Regeneration and the Safe and Just Operating space.

The major scientific contributions are:

- To assist in the clarification and understanding of SoSy knowledge found in the literature review (Milieu, Regeneration, Safe and Just Operating Space).
- To assist in the application of the aspects that characterize SoSy, through the three actions to be taken at each step iteratively (to situate, to intertwine and to balance).
- To take into account living stakeholders (human and non-human) in design models by a decentralization approach.
- To integrate the properties of robustness rather than those of performances.