The Doughnut framework: from theory to local applications in Switzerland — literature review & practical lessons

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Abstract

The Doughnut conceptual framework, developed by the economist Kate Raworth, is gaining considerable momentum. It is often framed as a representation of the normative objective that socio-ecological transitions are intended to achieve. This contribution sets out the main strengths and weaknesses of this framework, according to the increasingly prolific literature on the subject on the one hand, and on the other, according to our recent practical experiences of downscaling the Doughnut to a Swiss territory and a Swiss institution. It shows that, since its creation, the Doughnut has been used and remodelled along a continuum between conceptual and theoretical purity, inspired by the framework of planetary boundaries and theories of basic human needs, and a pragmatic tool aimed at guiding public action at local level. In this respect, the local reinterpretation of the Doughnut raises several practical questions, which in turn can lead to the local tool being distanced from the original framework. We suggest that, if the Doughnut is to remain a strong sustainability tool, some additional principles should be adopted by practitioners while downscaling it. Hence, we propose six guiding principles for maintaining the integrity of the Doughnut's conceptual framework in its local variations.

Keywords: doughnut, planetary boundaries, fundamental human needs, ecological transformation, safe and just space, strong sustainability

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Introduction

The Doughnut, originally developed by British economist Kate Raworth (Raworth, 2017)[i], is gaining traction. The Doughnut-shaped figure consists of the space between a social foundation and an ecological ceiling, which represents "*the safe and just space*" for the development of human activities. It is therefore often used as a visual representation of the normative objective that socio-ecological transitions are intended to achieve on a global scale. It is also increasingly used at the local level, as a tool to drive socio-economic transformations toward sustainability, guiding the design of local policies. The growing reputation of this global conceptual framework is however accompanied by numerous theoretical criticisms regarding its relevance, particularly its scientific validity. As for its adaptation to different geographical scales, many attempts have been made and documented (specific countries, regions, cities), but the process still poses significant challenges and questions which answers aren't straightforward (Gomès-Alvarez Diaz et al., 2024; Ferretto et al., 2022).

The authors of this paper have conducted two experimental applications of the Doughnut framework, by downscaling it to the regional or local context. A first application was conducted in 2020 for the Greater Geneva urban area, encompassing the city of Geneva and neighbouring Swiss and French territories (Gilloots et al., 2022). The Doughnut served as a framework for the area's ecological transition strategy, informing political discussions and leading to a quantified commitment, which was eventually endorsed by French and Swiss elected representatives in 2022 (GLCT Grand Genève, 2022). Subsequently, local authorities have been working on urban policies aligned with the political objectives inspired by the Doughnut. While no extensive participatory process was conducted, some consultation with the local population and economic stakeholders took place. Drawing from this initial experience and responding to the Rectorate's request, the Doughnut was then applied to the University of Lausanne (UNIL), a mid-size public university in Switzerland (Gilloots et al., 2023). The results were used to facilitate a participatory process for developing UNIL's transition strategy (*Assemblée de la transition*, n.d.). The Doughnut now also serves as general guiding framework for tackling ecological challenges at the university (CAP 2037, n. d.).

Based on our practical experiences as an interdisciplinary team and our work with various stakeholders in different territorial contexts, this article aims to highlight the strengths and challenges of the Doughnut as a tool for public action, thus contributing to the ongoing discussion regarding its use on a local scale. It also intends to contribute to the assessment of the scientific relevance of the Doughnut.

We start by presenting the historical and conceptual origins of the Doughnut to understand what is special about it and why it is sometimes referred to as the illustration of a new environmental paradigm towards *strong sustainability*. We then outline the main strengths and weaknesses of the Doughnut as discussed in the scientific literature. To contribute to the assessment of its usefulness when applied locally (in a Global North context) we continue by presenting the insights and challenges drawn from two of our practical experiences in Switzerland. Based on these findings, we discuss how to address theoretical critiques and the challenges arising from the real-world application of the Doughnut. Finally, we propose six guiding principles for maintaining the integrity of the conceptual framework in its local variations.

[i] The present article focuses on the conceptual framework and visual representation introduced by Raworth as the first proposition of her book *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*, independently of the rest of Raworth's propositions.

The Doughnut as a new conceptual framework for strong sustainability

This section aims to present the context in which the concept emerged, to describe how and on what basis it is constructed and to introduce its application at local level.

Emergence of the concept of environmental limits

The notion of limits, central to contemporary environmental movements, has gradually gained prominence since the 19th century (Kallis, 2019). In the mid-20th century, the notion of strict ecological limits has expanded, primarily through concerns about the alarming growth of the human population and consumption in relation to the planet's finite resources and waste assimilation capacity (Sayre, 2008; Bourg & Fragnière, 2014). In 1972, *The Limits to Growth*, a report commissioned by the Club of Rome, sparked controversy by asserting the existence of environmental limits to economic growth (Meadows et al., 1972). The understanding of environmental limitations was further advanced in the 1990s with the introduction of the well-known *Ecological Footprint* indicator, which compares human consumption and pollution with the Earth's biocapacity (Global Footprint Network, 2024; Wackernagel, 2006).

In the early 21st century, this same idea of fixed ecological limits to human endeavours was framed in a new way with the concept of planetary boundaries (PBs), nine interdependent processes crucial to the Earth system's functioning, each linked to a specific risk threshold. According to this approach, crossing these thresholds heightens the risk of significant and irreversible large-scale environmental changes, leading the planet toward an unstable and unpredictable state, while remaining within these PBs would "*allow Earth to remain in a 'Holocene-like' interglacial state*", i.e. the past ten thousand years (Richardson et al., 2023, p. 1). These boundaries therefore define a safe space for humanity, within which human activities can take place without major risks of destabilizing the Earth system. Their initial definition came forth in 2009, proposed by Johan Rockström and an international team of 28 scientists (Rockström et al., 2009a, 2009b). Subsequent refinements and improvements, notably through major revisions in 2015 and 2023 (Steffen et al., 2015; Richardson et al., 2023), have enabled the quantification of limits that were not yet precisely measured in 2009. According to the latest revision, six of the nine PBs are currently transgressed (Richardson et al., 2023)[ii].

This transition from a focus on resource depletion to a functional understanding of environmental limits rooted in Earth system sciences is considered by some authors as a genuine paradigm shift—or even a second Copernican revolution (Schellnhuber, 1999). According to this perspective, the concepts of the Anthropocene (Crutzen & Stoermer, 2000; Crutzen, 2002; Steffen et al., 2005, 2011, 2015) and PBs mark the beginning of a new historical stage, both in the influence of human activities on natural processes and our scientific understanding of it, by allowing us to take a macroscopic view of our own planet to understand its global functioning and changes (Steffen et al., 2005, 2011, 2015 ; Hamilton & Grinevald, 2015; Hamilton, 2016).

The Doughnut as a compass for the socio-ecological transformation

In her original article in 2012, Kate Raworth builds on the first version of the PBs (Rockström et al., 2009a, 2009b) to draw her now famous Doughnut-shaped conceptual framework, and combines it with a social foundation, to define a *safe and just operating space for humanity*. The model is visually

[ii] In 2023, a group of 51 scientists led by Johan Rockström proposed a significant evolution of the PBs model, renamed *Earth system boundaries*, by incorporating a justice dimension (Rockström et al., 2023). Nevertheless, in the remainder of the article, we refer to the original nine PBs, which at present remain the reference model for academic debate, and on which the Doughnut framework was built.

represented by two concentric circles, where the outer boundary outlines the space within which human activities must operate to avoid destabilising the Earth system. Meanwhile, the inner circle, representing its social foundation, delineates the minimum social standards necessary for individuals to escape severe deprivation and meet their essential needs. As emphasized by Raworth herself, the inner circle represents only the bare minimum required for the survival and dignified existence of the planet's populations (Raworth, 2012; Raworth et al. 2017). The aim is to eradicate extreme poverty and deprivation globally, but societies can and must aspire to more, that is enabling their people to thrive (Raworth, 2012). In her 2017 book, Raworth proposes 12 social dimensions, as illustrated in Figure 1 (Raworth, 2017).

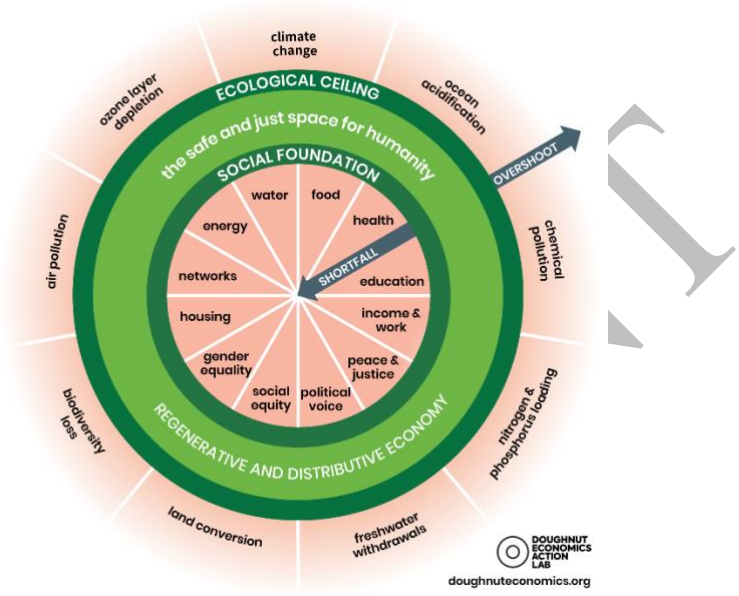

Figure 1: The Doughnut of social and planetary boundaries (Raworth, 2017)

With its distinctive shape, the Doughnut can be acknowledged as a popular representation of this new understanding of strict limits, coupled with the need to understand the systemic and dynamic nature of Earth systems equilibriums. Moreover, it brings social and ecological goals into a single figure. In this regard, it serves as a compass for the social-ecological transformation, i.e. a normative model that establishes goals without prescribing the best means of achieving them. Unlike the traditional perspective of sustainable development and its triple bottom line—environmental, social, and economic (World Commission on Environment and Development, 1987)—it assigns a purely instrumental role to the economy. Economic development is no longer an end, but a tool available to societies in the pursuit of social and environmental objectives (Raworth, 2017). Hence, by reaffirming the idea of limits, both environmental and social, the Doughnut aligns with theories of *strong sustainability* (Hediger, 1999; Norton, 2005).

From theory to practical application: downscaling the Doughnut

In order to put this conceptual framework into practice, the Doughnut Economics Action Lab (DEAL) published a detailed methodological guide, titled *Creating City Portraits* (Fanning et al., 2020), aimed at facilitating the adaptation of the Doughnut at the local scale. This first methodological guide was developed following pilot tests conducted in Amsterdam, Philadelphia and Portland, and provides valuable tools for adapting the global model to smaller units, mostly in urban contexts. Central to this guide is the *Four Lenses* of the City Portrait, a simple matrix that combines the ecological ceiling and the social foundation of the Doughnut on one side, and the global and the local levels on the other, as illustrated in Figure 2. This four lenses approach facilitates the alignment of local priorities and

aspirations with the broader responsibilities of highly consuming urban centres (Fanning et al., 2020). Each lens addresses the relevant dimensions of the ecological ceiling (e.g. climate change, biodiversity, etc.) and the social foundation (e.g. health, equity, etc.), both at the local or global scale. To draw up a City Portrait, practitioners are invited to select the most relevant dimensions for each lens in their local context. Next, the guide suggests choosing a few indicators for each dimension of each lens (e.g. greenhouse gas emissions per year, nitrogen footprint, modern slavery footprint). Two values must be calculated for each of these selected indicators: the current state and the target, representing either the social foundation or the ecological ceiling, to be achieved.

Figure 2 : The Four Lenses tool, also called the 'Unrolled Doughnut'
(derived from DEAL - doughnuteconomics.org, Doughnut Unrolled: Introducing the four lenses, Version 1.0 – April 2022)

Since its initial publication in 2020, this methodology was updated in 2022 (Fanning et al., 2022b) and has been implemented in over 70 locations across the world, including cities such as Barcelona, Leeds, Brussels, and Grenoble (Grcheva, 2023). Each of these entities has created its own City Portrait and is now, to varying degrees, striving to engage policymakers, the private sector, or civil society in advancing towards the *safe and just space*. Since 2022, the two Swiss territories on which we are basing our practical experiences (the Greater Geneva area and UNIL) can be added to the list.

The Doughnut as a conceptual framework: Strengths and limitations

This section briefly exposes the theorical strengths and limitations of the Doughnut's conceptual framework according to the scientific literature. We focused our search on the PBs, as it is the scientific framework used for ecological ceiling of the Doughnut. For the social foundation, multiple concepts as well as theories of universal human needs have been drawn from over the years (e.g. Doyal & Gough, 1991; Max-Neef, 1991; Nussbaum, 2013; Walker & Maesen, 2011). Therefore, we decided not to focus our search on a specific concept for the social foundation, but rather to look for articles offering a critique of the Doughnut in general. We thus reviewed articles published up to June 2023, examining combinations of the keywords "Doughnut model", "Doughnut Economics", "Planetary Boundaries" and "critic/critique" on Web of Science and Google Scholar. From the >1,000 results returned by this search, we identified about 80 relevant articles in English based on their abstracts (see Appendix). In-depth readings were conducted for half of them. Additionally, we thoroughly examined 10 articles written by the frameworks' authors.

Strengths

- **Visual simplicity for effective communication**: The visual frameworks and core messages of both models prove to be sufficiently simple for easy sharing and understanding, transforming them into powerful communication tools (Turner & Wills, 2022; Wahlund & Hansen, 2022; Brand et al., 2021; Bleby et al., 2021; Drees et al., 2021; Pasgaard & Dawson, 2019; Lewis, 2012).
- **Incorporating social imperative**: The Doughnut, as well as the latest instalment of the PBs (Earth system boundaries), integrate a social imperative. This convergence combines ecological limits with a commitment to social equity, answering previous criticism directed at the PBs and environmental sciences in general (Turner & Wills, 2022; Drees et al., 2021; Kim & Kotzé, 2021; Dearing, 2018).
- **Holistic paradigm based on scientific grounding**: The PBs present a powerful, scientifically grounded paradigm, offering a holistic vision of the issues at hand and emphasizing the imperative to live within the planet's limits. This broadens the popular debate around the ecological crisis, extending beyond the sole parameter of climate change and recognizing the existence of absolute limits. The Doughnut aims at building upon this (Turner & Wills, 2022; Brand et al., 2021; Bleby et al., 2021; Biermann & Kim, 2020; van Vuuren et al., 2016; Schmidt, 2013).
- **Stimulating debate and increasing scholarly contributions**: The PBs and, increasingly, the Doughnut have spurred a rich debate and a growing number of scientific articles over the past 15 years (Turner & Wills, 2022; Brand et al., 2021; Pickering & Persson, 2020).

Limitations

In examining the limitations mentioned in our selected articles about the PBs and the Doughnut, we organized the arguments into nine subgroups, consolidating them into three main categories.

The first category consists of arguments related to the **scientific robustness** of the PBs framework.

- **Uncertainty in threshold determination:** The determination of thresholds for the PBs presents a significant challenge as achieving scientific certainty is nearly impossible. These thresholds are approximations, at times appearing overly generous or lacking precision (Bleby et al., 2021; Brand et al., 2021; Biermann & Kim, 2020; Hillebrand et al., 2020 in Drees et al., 2021; Nordhaus et al., 2012 and Brook et al., 2013 in van Vuuren et al., 2016).
- **Oversimplification in model creation:** The simplification necessary for model creation tends to oversimplify the intricate nature of planetary processes and their interconnections, occasionally sidelining other crucial limits (Bleby et al., 2021; Brand et al., 2021; Biermann & Kim, 2020; Kim & Kotzé, 2021; Downing et al., 2019; van Vuuren et al., 2016; Lewis, 2012).
- **Diverse nature of PBs:** Some PBs are thresholds that can be surpassed *with consequences*, while others are *fixed limits*. Similarly, some boundaries are truly planetary (e.g. climate change), and others are aggregates of local limits (e.g. nitrogen flow). Yet all are quantified with numerical values that are put on a similar level. This juxtaposition may lead to confusion and imprecision (Kim & Kotzé, 2021; Lewis, 2012; Cole et al., 2014, Dao et al., 2015, Priyadarshini and Abhilash, 2020 in Ferreto et al., 2022).

The second category consists of **critiques stemming from social sciences**.

- **Inadequate attention to equity and social justice:** The PBs and Doughnut either do not address, or inadequately address, issues of equity and social justice. PBs, in particular, rely on normative judgments (e.g. risk tolerance in the face of extreme climate events) and entail impacts on human populations that are not thoroughly considered and discussed (Blüdhorn, 2022; Bleby et al., 2021; Brand et al., 2021; Drees et al., 2021; Gupta et al., 2021; Biermann & Kim, 2020; Kim & Kotzé, 2021; Pasgaard & Dawson, 2019; van Vuuren et al., 2016; Whyte, 2018 in Brand et al., 2021; Schmidt, 2013).
- **Limited diversity in framework development:** The PBs framework—and to a certain extent its updates—has been crafted by small groups of scientists primarily from Northern countries, excluding participation from civil society or politicians. Given the normative assumptions underpinning the boundaries, coupled with the risks associated with an expertocratic/technocratic approach, there is a call for moral and political deliberation (Turner & Wills, 2022; Brand et al., 2021; Biermann & Kim, 2020; Kim & Kotzé, 2021; Pickering & Persson, 2020; Boelens et al., 2018 in Gupta et al., 2021; D'Souza, 2015 in Kim & Kotzé, 2021; Pielke, 2013 & Stirling, 2015 in Pickering & Persson, 2020; Lam & Rousselot, 2024).
- **Universalist vision and anthropocentrism:** The PBs and the Doughnut are rooted in a universalist vision of the world, assuming a homogeneous humanity. This perspective fails to represent real diversities between and within countries and may potentially be biased in favour of a privileged segment of the global population. Additionally, both models are fundamentally anthropocentric, prioritizing the preservation of Earth's conditions for human beings, overlooking the broader implications for other species beyond the quantified prism of the biodiversity boundary (Brand et al., 2021; Drees et al., 2021; Kim & Kotzé, 2021; Hulme, 2020 in Gupta et al., 2021; Pasgaard & Dawson, 2019; Schmidt, 2013; Reischl, 2012 and Galaz et al., 2012 in Downing et al., 2019).

Limitations and challenges with local applications represents the third category.

- **Lack of unified methodology for downscaling:** Despite numerous attempts to apply the PBs and Doughnut on a local scale, there is currently no standardized methodology for downscaling them. Literature underlines that this poses challenges for consistent and comparable local applications (Ferreto et al., 2022; Bleby et al., 2021; Kim & Kotzé, 2021; Stockholm Resilience Center, 2018), whereas practitioners tend to see it as an opportunity to help capturing context-specific opportunities for transformative local action.
- **Global perspective vs. local adaptation:** Both the PBs and Doughnut are grounded in a global perspective. Plus, they were not initially designed for local implementation, a crucial need for many stakeholders. This makes it challenging to connect and customize them to local contexts and dynamics (Ferreto et al., 2022; Turner & Wills, 2022; Bleby et al., 2021; Biermann & Kim, 2020; Downing et al., 2019).
- **Legitimacy and adoption hurdles:** While the PBs framework and, increasingly, the Doughnut are gaining recognition among scholars, NGOs, and governments (Wahlund & Hansen, 2022; Drees et al., 2021; Bleby et al., 2021), they still face challenges in achieving widespread mainstream legitimacy, making their practical implementation more complex compared to government-led models such as the Sustainable Development Goals (Turner & Wills, 2022; Bleby et al., 2021; Kim & Kotzé, 2021; Linnér & Selin, 2013 and Schlosberg, 2016 in Pickering & Persson, 2020; Griggs et al., 2013 in Li et al., 2021).

The Doughnut as a public policy tool: Practical lessons

The article now dives into what unfolds in practical settings, exploring its capacity to guide local action based on our experiments in Switzerland and especially documenting the third category of critiques, on the downscaling of the Doughnut, identified in the literature review.

A first concern immediately emerging when considering dealing with the local application of the Doughnut is the very relevance of using this tool at the local level. Indeed, we might question the appropriateness of adapting the social foundation, which was designed as multiple universal minimal thresholds for the global context, to a local one. Moreover, downscaling and allocating the ecological ceiling to a specific territory is not straightforward and implies important normative decisions that must be taken by practitioners, while lacking democratic legitimacy to do so. We put these questions to rest and present the results of our two practical experiences, where we accepted, per design, to use the Doughnut as a tool for local action.

A powerful heuristic tool

Using the Doughnut as a conceptual framework for fostering ecological action in the Greater Geneva area and at UNIL revealed three primary strengths, consistent with findings identified in the literature:

- **Visual simplicity**: The visual clarity of the Doughnut proved to be an effective communication tool, easily grasped by elected officials, public service members, students, researchers, etc.
- **Holistic perspective**: The Doughnut facilitated a more comprehensive acceptance of environmental concerns by incorporating human social needs. Consequently, the model was perceived as more inclusive and complete, although some individuals accustomed to the sustainable development framework questioned its treatment of the economy. By placing human needs at the centre of the model, the anthropocentric approach of the Doughnut resonated with the expectations of most stakeholders in the Swiss context.
- **Enhanced understanding of ecological challenges**: Building on the PBs framework, the Doughnut fostered a nuanced understanding of ecological issues, transcending the prevalent carbon-centric perspective. Raworth's simplified representation rendered scientific PBs accessible to a wide audience, enabling people to engage with and grasp unfamiliar ecological concepts such as biodiversity loss or the nitrogen cycle. For instance, the inclusion of the *biodiversity footprint* as one of the four indicators chosen for the *global-ecological* lens of the UNIL's Doughnut proved instrumental in raising awareness about the environmental impacts of IT and research equipment.

Methodological challenges while downscaling the Doughnut

When creating the Doughnut Portrait of a local territory relying on the *Four Lenses* tool presented above, practitioners can expect to encounter several methodological challenges. The main ones encountered in selecting and quantifying the indicators for the Greater Geneva's and UNIL's Doughnuts are summarized in Table 1 below. To allow a brief overview, its content is deliberately non-exhaustive and simplified. Some of these challenges were also encountered, at least to some extent, in Brussels and Grenoble (Dethier et al., 2023; Dissaux et al., 2021; Ville de Grenoble, 2022). Up to 2023, the lack of mandatory, detailed and widely shared methodology for utilizing the Doughnut locally led each territory to address these challenges in its own way. We can expect future editions of the DEAL to provide guidance to address a number of these issues.

In addition to the lens-specific challenges outlined in Table 1, the (un)availability of local data represents a major methodological issue. Confronted with a lack of detailed data (e.g. about

consumption of goods, social indicators, etc.), two options arise: either immediate data availability is guiding the choice of the indicators, or ideal indicators are developed, even if the data to quantify them is not yet available. The first option offers a fully quantified local Doughnut that can be immediately used to trigger local action. However, the seemingly complete picture might not accurately represent the complexity of the situation. Authors from the alternative indicators movement suggest that indicators are never neutral and mostly follow dominant norms and values (e.g. Delahais et al., 2023, p. 3). Thus, building on existing statistics might increase the risk of perpetuating the current consumerist narratives (e.g. centred around increasingly higher revenues) that urgently need to be reimagined to align with the global Doughnut. The second option leverages the potential of the Doughnut to encourage discussions about what truly matters. In this case, indicators that cannot be quantified in a Doughnut are typically shaded in the drawing, intending to spark curiosity and stimulate the production of new transformative data about processes that were previously overlooked. However, creating data requires expertise, resources, and time—a path that may not align with the sense of urgency felt by decision-makers we have collaborated with. As immediate action is generally preferred over further studies, shaded areas of the Doughnut, that is dimensions that have not been quantified, may remain unaddressed for a while and even be neglected in the production of concrete plans.

From the Doughnut portrait toward public action: the role of governance

Using the Doughnut as a tool to guide public action towards sustainability also rises significant governance issues. Decision-makers commissioning the application of the Doughnut framework to the Greater Geneva and UNIL expressed concerns about the subsequent acceptance and engagement of stakeholders affected by the Doughnut-inspired policies. To address this concern, the determination of who participates in the normative decisions to downscale the Doughnut (e.g. selecting dimensions, indicators, target values), and how the process unfolds are important. Possible forms of governance range from versions mainly led by scientists, experts or politicians, to versions led by citizens, or at least involving a participatory process (Gilloots et al., 2023, p. 113; Fanning et al., 2022b, p. 12).

According to the numerous experiments reported by the DEAL, depending on the purpose of using this tool, the people involved in the process may vary (Grcheva, 2023). When using the Doughnut as a tool for public policy, the strong inclusion of social public services and local organisations in the process of creating the Portrait seems to be an important success factor of the overall transformation process. Based on the experience of the Greater Geneva Doughnut, it appears that the creation of a purely expert-led Doughnut might heighten the risk of rejection or indifference towards the findings. Moreover, the selected indicators and target values have a lasting impact on collective narratives and, therefore, on the effectiveness of the local Doughnut in guiding public action within the PBs framework. Once the local Doughnut is adopted by local actors, there remains a risk of rejection by elected representatives rather than its acceptance as the official guiding framework. In such cases, its transformative potential diminishes but does not entirely disappear, as grassroots local engagement remains possible.

If political backing is provided, the local Doughnut can become a guiding tool for developing strategies, plans and measures. However, the transition from the City Portrait to the design of public policies is not without methodological and human challenges. First, a translation may be necessary, as the indicators of the Doughnut can differ from those typically used by decision-makers. The latter often rely on indicators categorized as "*Drivers*" and "*Responses*" within the DPSIR (Driver-Pressure-State-Impact-Response) framework (Kristensen, 2004; Ness et al., 2010). In contrast, the indicators selected for the downscaled Doughnuts for the Greater Geneva and UNIL belong to the categories of "*Pressures*" and "*States*" of the ecosystem and human well-being. Hence, metrics such as the *kilometres of cycling paths* are more readily monitored and actionable by decision-makers than indicators related to *biodiversity* or *nitrogen footprints*. The relation between "*Responses*" indicators,

such as constructing cycling paths, and "*State*" indicators—reflecting the status of PBs for example—is not easily quantifiable, as these causal mechanisms are intricate and fraught with uncertainty. It remains challenging to ascertain if the political "*Responses*" will adequately mitigate the ecological and social impacts of the "*Drivers*". Thus, the Doughnut's absolute approach, rooted in the existence of quantified limits, faces the risk of gradually losing its edge as it is implemented into practice. Moreover, as for any model advocating for a significant transformation of Western lifestyles, crafting public policies to align with the *safe and just space* requires overcoming entrenched human, organizational, and normative obstacles within our European public institutions, such as siloed policies and responsibilities, strong hierarchies, and varying levels of expertise.

Table 1. Main challenges to address for quantifying each lens of the Unrolled Doughnut, according to recent experiments in Switzerland.

	Local	**Global**
Ecological	**Selecting dimensions and indicators.** The first guidance to use the Doughnut for cities recommended using the *Ecosystem Services* framework to select some natural processes to monitor in the *local-ecological* lens (Fanning et al., 2020, p. 17). This approach, and others based on "natural resources" (e.g. Gilloots et al., 2023, p. 23), may lead to selecting indicators inspired by an anthropocentric perspective that can be controversial (as it offers a partial view of the complexity of ecosystem health and might perpetuate Western narratives in a utilitarian approach to nature). **Setting target values for urban and semi-urban areas.** Setting a ceiling for an ecosystem requires a desirable reference state: the Holocene period is the reference state for the PBs framework, but does it make sense to target a "Holocene-like" state in cities that have been heavily influenced by human activity for centuries? Is it sufficient to target a "1950s-like" state to maintain the resilience and health of the local ecosystem? What are the respective roles of urban, semi-urban, and rural areas in ensuring the global health of biodiversity? These questions still rise debate among experts and need to be addressed in this lens. Since 2022 the guidance published by the DEAL is based on a method inspired by the Biomimicry approach which gives clear answers to these two points (Fanning et al., 2022b, pp. 18–24).	**Downscaling the PBs.** Setting targets to *global-ecological* indicators implies sharing and allocating global ecological thresholds to individuals, territories, and sectors, depending on their perceived past, present, and future responsibilities and rights and adding even more complexity, possibly according to the specific characteristics and resources of the area. This prominent challenge is increasingly addressed by scientific research (e.g. Bai et al., 2024; Birgisdottir et al., 2023; Fanning et al. 2022a; Ryberg et al., 2020; Lucas et al., 2020; Häyhä et al., 2016) and takes place within international climate negotiations for decades, but to date there is no allocation rule recommended for downscaling the Doughnut to cities and places, except for a few emerging paths in recent articles (e.g. Birgisdottir et al., 2023, Chapter 'Allocating shares of the global climate change boundary'; Schlesier et al., 2024). **Measuring the current footprint of the chosen entity.** It requires to produce a robust assessment of the ecological footprints of the entity in question that is scientifically comparable to the few control variables selected by the PBs framework. To date, this step is challenging for some PBs such as "Change in biosphere integrity" where existing indicators, databases and calculation methods still require consolidation (e.g. Gilloots et al., 2023, pp. 68–71).
Social	**Selecting satisfying social indicators and data.** The social foundation can encompass theoretical and complex human needs (such as 'connectivity') or rather practical and tangible material resources which help to meet human needs in a given place—and time—such as *number of cars per person*. Also, indicators and data can be extracted from conventional administrative available statistics (such as *unemployment rates* or *number of hospital beds per person*) or rather being subjective indicators, measuring people's self-reported feelings to truly reflect the state of well-being of a society. **Representing faithfully the complexity of a local social situation, particularly inequalities in the satisfaction of social needs.** How should the local performance of social indicators be depicted relative to the target: through an average or median value, a percentage of inhabitants falling short of a minimum threshold[iii], or through a range of values reflecting inequalities? Another option is to address equality as a main dimension of the local social lens. These choices become particularly important in contexts where basic needs are already well fulfilled on average (e.g. in industrialised countries). **Setting *sustainable* social target values.** There is a risk that locally chosen social target values could inadvertently lead to overshooting planetary boundaries, potentially jeopardizing the *safe and just space* of the Doughnut in regions accustomed to high living standards (i.e. regarding mobility, housing and leisure). Studies are increasingly improving on this topic (Schlesier et al., 2024; Gerten et al., 2020; Millward-Hopkins et al., 2020), but more work remains to be done.	**Illustrating the global-social impacts with examples.** The *global-social* lens can prove less intuitive to articulate for local actors, as the individuals indirectly affected by local consumption (i.e. those working abroad to produce the goods imported) are not typically involved in the discussions of local transformative initiatives, making their realities and difficulties more complicated to assess. **Selecting indicators and data to measure the global social impacts of the chosen entity.** Different methods have been tested for quantifying the *global-social* lens of cities and regions. For example, both Barcelona and the UNIL's Doughnuts use supply chain modelling to quantify some social impacts on individuals abroad (Gilloots et al., 2023, p. 129; Hanbury Lemos, 2022). The two methods differ in details and output indicators, with Barcelona producing results on 11 comprehensive social indicators (inspired from national Doughnuts produced by O'Neill et al., 2018) and UNIL focusing on a single indicator directly linked to working conditions (imported 'modern slavery', inspired from Shilling et al., 2021). **Setting just social target values for people abroad.** Who has the authority to establish a universally agreed-upon definition of 'modern slavery'? Various perspectives exist, but employing international targets supported by the United Nations or other international agreements appears to be the most common and practical approach (because of the perceived legitimacy of these organisations). However, even within these organisations, the minimum that seems acceptable may change over time and according to the socio-political context.

[iii] Which is the normative approach chosen by Raworth in her global and original framework.

Discussion, recommendations and conclusion

The Doughnut is no silver bullet for solving all socio-ecological problems, globally and locally. It has limitations that need to be kept in mind when using it.

- First, critiques related to the **scientific robustness** of the PBs—and of the Doughnut—highlight the normative assumptions, limitations and oversimplifications of the models. We do not view them as shortcomings that fundamentally question their validity or applicability. They should be considered as integral aspects of the thought process when utilizing such frameworks, serving as signposts of the scientific limits that accompany any simplifications. This should also motivate an effort of transparency regarding normative assumptions, hypotheses, controversies, margins of errors, etc, in conceptual frameworks and models (Lam & Rousselot, 2024).

- Second, while the authors of the PBs have taken steps to address some of the **criticisms stemming from social scientists** through the proposals of Earth system boundaries and their associated justice foundations (Rockström et al., 2023; Gupta et al., 2023), we believe a deeper engagement with (local) civil society, greater consideration for social justice, and the inclusion of other-than-human beings in the frameworks are pivotal elements for a more comprehensive and inclusive approach. As addressing these aspects at the conceptual level might lead to more complex models, potentially losing part of the current easy-to-grasp visual depiction, a solution could be to address them when operationalizing the Doughnut at the local level.

- Last, the translation of a conceptual framework into a **tool for local action** poses many methodological challenges and triggers questions related to legitimacy, governance and acceptability. These challenges were also documented in the two Swiss practical experiences presented.

This being reminded, the Doughnut has important specific qualities.

- As a *framework* and *compass* it represents a powerful visual synthesis of some crucial parameters to consider when engaging action towards a sustainable and just future for all. It might be argued that other similar propositions have emerged in the past fifty years, but we find that it serves today as the most concise yet comprehensive depiction at hand to engage stakeholders at all levels. Having to continuously consider a multiplicity of fundamental ecological and social parameters, while making sure the latter do not lead to an overshoot of the former, is the essential challenge that this framework pushes us to take on.

- As a *tool* for local action, the downscaled Doughnut can be understood as a diagnosis of the current state of a selected territory or entity, which can be compared to a theoretical safe and just state. Though this task might be achieved through other means, we find the Doughnut as striking a good balance between efficiency, pragmatism, understandability, and scientific consistency, providing results that can be leveraged by many types of stakeholders. This final quality could be likened to the "totemic" function identified for the notion of *climate*, being able to "*break down the barriers that traditionally separate science, the environment, politics and the economy*" (Foyer et al., 2017, p. 9).

Six propositions for using the Doughnut as a local tool

The Doughnut can potentially be used in different ways along a continuum between, on the one hand conceptual and theoretical purity, inspired by the PBs framework and theories of basic human needs, and on the other hand a pragmatic tool, adapted to the local context and aimed at guiding public action. When transforming the Doughnut *framework* into an operational local *tool*, there's a need to find the right balance between the risk of creating a tool that is too complex for practical use by public or private actors, potentially rendering it ineffective and the risk of diluting the Doughnut into a *weak sustainability* tool, susceptible to being repurposed and distorted to serve policies that fail to meet the challenges of reaching the *safe and just space*. To prevent any form of "Doughnut washing", we suggest six guiding principles that should contribute to safeguarding the integrity of the *framework.*

1. **Acknowledge adaptations to the original model and limitations**

When presenting the Doughnut, for example in the context of a participatory process, its theorical limitations and the critiques should be at least briefly mentioned (critiques on the *scientific robustness*, critiques from *social sciences*, and challenges related to *downscaling*). It should be clear early on how far from the theoretical *framework* the *tool* might stray, and the justifications for these decisions. Being transparent about the choices made helps in preserving the insights of the original Doughnut framework, while using the iteration. For example, it might make sense for a certain territory to exclude some of the PBs, if not relevant to its specific context. Nevertheless, justifying this choice allows for healthy discussions at all stages of the process, ensuring that no hidden impact has been missed. The lack of unified methodology was stressed as a limitation in the literature (e.g. Ferreto et al., 2022) but the need to develop a methodology tailored to a given territory can also be seen as an advantage, as it requires detailed consideration of the various components that make up the Doughnut, thus preventing the tool from becoming a "black box" and offering the opportunity for transformative thoughts inside the local community.

2. **Think in Subsequent Steps**

Using the Doughnut requires thinking in subsequent steps and avoid jumping straight into brainstorming actions that could be undertaken (e.g. public policies) : 1) research and understand the theories and frameworks that underpin the original Doughnut or that it calls upon (PBs, sustainable-development-inspired social indicators, theories of fundamental human needs, etc.); 2) decide how close to the original categories and indicators of the theoretical *framework* one should remain, depending on the practical objectives that the *tool* must aim for; 3) quantify the chosen version of the downscaled Doughnut, i.e. quantify the ideal values to be reached and the current level of (un)sustainability of the territory; 4) formulate policy objectives and actions to be taken in order to reach these chosen objectives and 5) acknowledge the distance of these policy objectives from the ideal state to be reached and from the original Doughnut.

3. **Implement participatory governance for the process**

As mentioned by social sciences scholars, any local reinterpretation and adaptation of the Doughnut should involve citizens, small businesses, associations, etc., in the decision-making process, to properly identify the most relevant aspects of the social foundation that need to be considered and to collectively decide "*what is enough… or too much*" (Ottaviani, 2023). Such involvement may help to construct a clear vision for the future of the territory or entity, informed by science, matching the local context and its social realities. It also has the advantage of increasing the democratic legitimacy of the approach, and to some extent facilitating the acceptability of the public policies resulting from the application of the Doughnut.

4. **Make sure to produce a *sustainable* social foundation**

As mentioned previously, while the indicators chosen by Raworth (Raworth, 2017) might be adequate on a global scale and align with existing international standards, they do not match the realities experienced by individuals in many parts of the world. Therefore, we advise using one of the *Fundamental Human Needs* frameworks (e.g. Doyal & Gough, 1991; Max-Neef, 1991) to inspire and adapt locally the l*ocal-social* lens. These theoretical propositions not only aim at capturing what matters most to the people, but also differentiate *needs* (e.g. subsistence) from *satisfiers* (i.e. how the needs are satisfied, which vary from one society to the other). Selecting local objectives based on the perceived levels of fulfilment of the *needs* allows to select *satisfiers* based on their impacts on the ecological ceiling and adapt them over time to the changes of technical means. If you set target values for *satisfiers*, make sure that targets are compatible with the respect of the ecological ceiling. The study by Schlesier et al. (2024) can help.

5. **Downscale the global ecological ceiling to your territory**

As the PBs framework was designed at *global* level, using it to downscale the ecological ceiling must be done with care to reflect pressures on the local environment, while retaining the global impacts analysis of the footprint approach. 1) From the nine current PBs, we recommend selecting those that are the most relevant and/or critical for the entity being studied, permitting a more in-depth and rigorous downscaling process. This selection should be made with local scientific experts and/or based on relevant scientific literature. As climate change and biosphere integrity are identified as "*core boundaries*" in the academic literature (Richardson et al., 2023) and politically, they should always remain included in the downscaled Doughnut; 2) following the DEAL methodology (Fanning et al., 2022b), define ideal values for the *global-ecological* lens with an allocation key (e.g. how much of the remaining global carbon budget can be allocated to the entity being studied, considering its size, current and past emissions, population, etc., ideally with the sufficiency approach of Birgisdottir et al., 2023), making sure the decision and thought process is scrupulously documented and transparent. Indeed, these choices are some of the most influential on the conclusions that might be drawn from the downscaled PBs.

6. **Distinguish clearly between scientific-based objectives and policy goals**

The local adaptation of the Doughnut implicitly translates a decision on the level of sustainability and justice that is to be targeted. Choose absolute ecological boundaries that constrain social targets to a fair and equal level for all (in line with principle 5), regardless of present wealth or privileges: your interpretation of the Doughnut will yield results that align with a *strong sustainability* approach and require tackling the hard questions, at the potential cost of losing support from part of your project's stakeholders. For example, in industrialized countries, applying the Doughnut shows that most of the work must be dedicated to a radical reduction of the ecological impacts and a redistribution of wealth. At the other end of the continuum, you opt for a flexible approach, where political targets dictate the levels of your ecological ceiling, and social goals are chosen regardless of their impacts on planetary boundaries ; your version of the Doughnut will then serve as a powerful diplomatic and educational tool, bringing almost anyone around the table to discuss both ecological and social challenges, but the results may align with a weak sustainability approach, at the additional risk of being co-opted for even less rigorous endeavours. We therefore urge for a clear distinction between *ecological limits*, which are the results of using the Doughnut framework and are pursuing scientific validity, and *policy goals*, which are the results of a political process and are pursuing democratic legitimacy. Thinking in subsequent steps helps this distinction.

Limitations and Research Perspectives

First, we stress that practical insights drawn in this article are based on just two local experiences, which provide interesting points of attention for other territories, but cannot be considered as

generalizable conclusions at this stage. Then, while this article was designed to take a broad approach of the topic, multiples elements could be developed further, in terms of scope and depth of analysis. Three limitations warrant mention, while representing interesting research perspectives. First, the literature review of the critiques of the Doughnut could be extended to include not only scientific articles but also texts from the grey literature, as well as interviews of practitioners and researchers currently working on that topic. Second, while this article has briefly mentioned existing frameworks on which the Doughnut builds, examining more related concepts from the past fifty years, for example Daly's pre-analytic vision of ecological economics or Theys' substantive approach of sustainable development (Daly, 1973; Theys et al., 2010) would not only enrich the understanding of the Doughnut's origins, but also shed light on why some previous models may have faltered, and anticipate potential pitfalls to avoid in the further development of the tool. Third, given that the Doughnut does not provide a roadmap for societal transformation, many critical questions remain regarding *how* to transform societies to operate within PBs while ensuring a decent life for all. An analysis of necessary actions, as well as the extent to which the Doughnut might contribute (or not) would be useful.

Conclusion

Constructed on the scientific basis of the Earth system science approach to global environmental issues and combining ecological and social concerns in a visually appealing fashion, the Doughnut can serve as a guiding tool for the assessment and design of public policies anchored in a strong sustainability approach. However, it is not without caveats and nuances. For example, it is essential to recognize the underlying normative assumptions of the PBs framework, as well as to emphasize that the choice of the inner dimensions of the Doughnut can be extensively debated. The article delved into these different critiques and discussions, first from a theoretical perspective concerning the framework at the global level and then from a practical perspective. In this regard, one of the main challenges lies in fostering local applicability while maintaining its scientific integrity, without losing the strong sustainability component that contributes to the framework's novelty and originality. We believe that the six guiding principles suggested in this article can be helpful in that matter.

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