P/REFERENCES OF DESIGN

DESIGN RESEARCH LABS: A NEW PERSPECTIVE FOR PUBLIC SECTOR INNOVATION.

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ABSTRACT | The digital transformation of the public sector promotes collaboration and experimentation. Furthermore, it paves the way for design practices to enter new realms. Creative approaches, such as design thinking, service design, and system design, have surfaced, particularly within innovation laboratories. However, these organizational structures often face challenges related to achieving and executing changes, transferring knowledge, and gaining cultural acceptance. The structure of public sector innovation laboratories aligns with that of the private sector, where the phenomenon originated. Nevertheless, their primary missions differ: one focuses primarily on the common good, while the other prioritizes commercial interests. In contrast, the concept of Design Research Labs (DRL), rooted in the arts, shares a mission to serve the public interest, offering a different perspective on labs in the public sector. As authors, we explore what a DRL framework might offer to support public sector innovation labs. The paper serves a dual purpose: first, to develop a systematic understanding of the criteria for DRLs; second, to propose areas of tension and fields of action for what public innovation laboratories can learn from DRLs as a framework. By offering this new perspective, the article contributes to a better understanding of the characteristics of public labs, facilitating positive change.

1. The Rise of Public Innovation Laboratories

In the past decade, the landscape of innovation laboratories has flourished in various forms across different sectors (Bason, 2014; Mulgan, 2007). The rapid expansion in the public sector can be justified by the realization that traditional structures, practices, and approaches in politics and public administration may not adequately address contemporary challenges, including climate change, social justice, and shifting demographics (Ottenbacher & Dubé, 2018). This growth has also sparked a shift in the approach to strategy and implementation as well as an increased demand for cultivating creativity, collaboration, and prototyping (Graham & Milligan, 2019; Werneck et al., 2020; Wellstead et al., 2021; Pinder et al., 2017; Komatsu et al., 2021). Simultaneously, the term labification, as coined by Williamson (2015), underscores the temporary nature and the associated sense of a trend that brings high expectations and an element of the unknown.

This begs the question: do innovation labs hold more significance than merely being a passing trend?

1.1 Scattered Landscape of Forms, Missions, and Impact

The landscape above includes various forms named differently from policy labs, city labs, gov labs to social labs (Whicher 2021; Hinrichs-Krapels et al. 2020). Blazing an early trail was Denmark's MindLab, a cross-governmental innovation unit that involves both citizens and businesses, founded in 2002. It heralded a culture change in the Danish government, which labs around the world have attempted to replicate, but it was closed in 2018. While MindLab still serves as a great example, the BMZ digilab hardly operated for two years before the physical workspace space was converted into a modern meeting room. Reasons have been multiple, among them: first, a changing political party leading the ministry with different priorities. Second, the mission of the lab, to scale digital innovation, has not been easy to grasp for employees who were mostly new to digital transformation, and third, the team was built out of four institutions not equal in terms of resources, power structures, and mutual dependencies. These circumstances offer possible insights into success factors for public innovation labs. Another example is the Denkfabrik, an innovation laboratory founded in 2018 within a federal ministry in Germany, that transitioned to a department within the ministry in 2022. In addition, the CityLab is funded by the Berlin Senate Chancellery. It is designed as an open space and a point of contact for citizens and administrative employees interested in digitalization and combines elements of a digital workshop, coworking, exhibition, and event space to create a place where participation and innovation are conceptually combined. From a design perspective, the CityLab is clearly focusing on the first phase of ideation and prototyping; afterward, the city of Berlin should take over.

At first glance, those examples suggest the impression that setting up new organizational forms such as innovation labs is already perceived as a widely spread, and approved strategy to enhance change in the public sector. Nevertheless, forms, structures, missions, and expectations towards innovation labs are different and partly conflicting.

Most initiatives so far prioritize aspects such as new work methods, process design, digital tools, and workspaces, while elements like outcomes, key performance indicators, iterations, connections to innovation ecosystems, and competence models receive less attention. However, even though the number of innovation labs is increasing, a comprehensive theoretical foundation is still lacking. This scattered map might indicate the unknowns and one reason why labs often struggle to become a sustainable approach to contributing to changes.

1.2 Emerging Design Practices

The intersectoral expansion of design practices since the rise of design thinking has led to new roles for design as a discipline and new contexts for professional designers, particularly in the public sector and policy design (Villa Alvarez, 2022a & 2022b). Advancements in practical implementation suggest that the introduction and application of design practices often hinge on the expectations a methodological manual

provides to non-designers. Practical observations also reveal that its foundational principles, including problem orientation, user questioning or observation, and a prototyping approach (learning through trial and error), are novel for many workers in administration and often contrast with established performance characteristics such as predictability, the insistence on correctness, risk aversion, and the need to substantiate claims. Furthermore, the prescription of design (thinking) as a method comes along light-footed without emphasizing a systemic, holistic problem-solving approach. However, for newcomers, the toolboxes and method cards published during the emergence of design practices can create the impression that they can be applied without prior knowledge or adaptation to the specific context (Augsten, 2022).

Some design researchers proclaim that the application of design thinking as a method has split the role of professional designers from design practices and made it applicable to everyone through training. The final aspect has naturally faced criticism from professional designers who are concerned about its relevance and its place within the design community. Without ignoring these ongoing discourses about the transdisciplinary role of design (Hepburn, 2022; Peukert, 2021 & 2022), we as authors represent the position that the expansion and adoption of design thinking have been promoted by the toolisation approach of Stanford's design thinking version but have positively positioned design practices and professional designers in the context of innovation and facilitation (Augsten & Gekeler, 2017) as a predecessor for today's appearance in the public sector (see Schaminée, 2018).

1.3 The concept of labs in the design discipline

Scientific institutions, such as universities focused on art and design, often establish labs with names like Design Labs, or Design Research Labs (DLR). These labs have been recognized as agents of change and serve as spaces for experimentation and exploration in the context of organizational transformation. They attract individuals with foundational skills and experience in design practices and principles. Importantly, these labs existed long before the term labs gained popularity.

While these labs are hardly mentioned in design research discourses, they might offer new possibilities for the concept of public innovation labs. For instance, DRL holds promise in providing interdisciplinary knowledge transfer that supports impact-driven research, making it relevant for practitioners and multiple stakeholders. However, there is still a notable gap in design research when it comes to systematic investigations into the potential and criteria of DRLs.

In this paper, as authors, we aim to shed light on two key aspects. First, we seek to gain a better understanding of what a DRL entails, the role that design plays within these labs, and how it functions. Second, we aim to explore what lessons can be derived from DRLs for public innovation labs.

2. The Undefined Landscape of Design Research Labs

The number and significance of these labs have been on the rise, yet they have remained a relatively unexplored area in design research. The term and concept of DLRs first emerged in the UK during the 1960s, following the Design Method Movement (Alexander, 1977; Schön 1969; Jones 1970). However, it is in the early 2000s, particularly in the European context, especially in the Netherlands and Scandinavian countries, that DRLs have continued to evolve and gain prominence. The Helsinki Design Lab, closed in 2013, needs to be mentioned as a pioneer and still leading example. It accelerates the integration of design and government by establishing strategic design as a core discipline in supporting governmental decision-making and service delivery.

A current trend is the growing number of DRLs in German-speaking regions, with examples like Burg Labs at Burg Giebichenstein University of Art and Design Halle, Kind-Lab at the University of Applied Sciences Trier (among others), Hybrid Things Lab at the University of Applied Arts Augsburg, the Design Lab for Applied Research at Technical University Dresden (in collaboration with Fraunhofer-Institute). This growth is also mirrored on an international scale, with DRLs such as the DESIS Lab at the Parsons School of Design, MIT Media Lab at Massachusetts Institute of Technology in Cambridge, USA, Design Labs at Harvard University

Graduate School of Design, Diseno@QUT Design Lab at Queensland University of Technology in Brisbane, Australia in collaboration with universities from South America, or the Social Design Lab at Victoria University, School of Design Innovation in Wellington, NZ. The rise of labs can also be recognized in the global south. As one example among many, the Design Lab in Kigali, Rwanda, established in 2020 as CcHUB's Research and Development Unit, aims to bring design into the way public agencies and large corporations think about the implementation and use of technology to solve significant problems in society.

These labs share a focus on radical innovations to tackle complex social, political, ecological, and technological issues. They aim to generate new ideas that benefit the public, like DLRs and public sector innovation labs. With the growing urgency and complexity of these challenges, more DLRs in design schools and interdisciplinary settings, especially in the public sector, are likely to emerge in the future.

2.1 Theoretical Understanding and Characteristics

This evolution has been relatively unexamined in theoretical design discourse. While the potential and the role of design in interdisciplinary lab structures are increasingly recognized, there has been a lack of systematic research.

The first theoretical discussions can be traced back to Binder and Brandt (2008), who introduced the term in the context of design education. Their paper explores the concept of a design lab as a platform for conducting participatory design research, emphasizing the collaborative and interdisciplinary nature of design activities

within such a setting. It discusses the benefits of this approach for fostering creativity, innovation, and engagement among various stakeholders in design processes.

Since Binders' research in 2008, no further analysis, classification, or mapping of design labs has been published. Therefore, the purpose of this paper is to inquire about the role of design and design research labs, with the aim of developing a new perspective. This serves a dual purpose: it provides a framework for DLR to support the future impact of public innovation laboratories and sheds light on aspects overlooked in the field of design. Despite its potential to offer valuable insights not only for the public sector but also for design research itself, there is still a lack of updated and systematic investigation in this area. In the following paragraphs, we will propose four principles of the DLR framework before applying them to the public sector.

3. The DLR Framework for Public Innovation Laboratories

3.1 Theoretical Foundations of the Framework

The underlying definition of DLR in this paper is based on various sources: Binder and Brandt (2008), Binder (2007), Reynolds-Cuéllar (2020) or Boyer (2020). Binder and Brandt derived characteristics from a traditional lab as a metaphor, based on the practical example of the Malmö Design:Lab, defined in the paper as follows: "The Design:Lab is neither a particular set of methods and techniques nor a particular place or event; it is a platform for a collaborative inquiry that is based on design experiments" (2008, p. 121). We, as authors, use the term DRL in this paper as a comprehensive umbrella term that combines three fundamental characteristics: A DLR …

- is primarily affiliated with design schools and departments;
- explicitly applies design practices as a tool and method for inquiry; and
- is addressing emerging societal, technological, and ecological challenges.

3.2 Methodological Approach and Practical Use Cases

This definition laid the foundation for an investigation into existing DRLs associated with design schools. Our methodology involved a qualitative pattern analysis of four distinct design labs from various global

locations. This analysis was conducted by gathering information available online and visually mapping the data, which was a collaborative effort between both authors.

In the initial step of our methodology, we delved into the self-descriptions and profiles of the selected design labs to uncover shared traits and unique characteristics that define these entities. This allowed us to identify commonalities and distinctions among them.

Subsequently, the mapping process was enhanced through the utilization of guiding questions. They served as a framework for our analysis, enabling us to delve deeper into the structural aspects, functions, and purposes of each DRL. This comprehensive approach provided us with a holistic understanding of the design lab landscape, which we will further elucidate in the subsequent sections of this study:

Table 1. Guiding questions for mapping process.

What does the DRL?	Describing the aims, goals, and fields of actions of the DRL.	e.g.: aligning design practice with societal issues
Who is part of the DRL?	Describing the stakeholders involved directly and indirectly in the DRL.	e.g.: research partners, collaborators, and affected groups
Why is the DRL operating?	Describing the missions of the DRL.	e.g.: specific societal issues, and design research questions
How does the DRL operate?	Describing the structures, processes, and operating principles.	e.g.: theme-based organisational structure, research portfolio
Where does it operate?	Describing where the DRL is operating.	e.g.: local or international level, facilities of the lab

Through rigorous discussion and an iterative open coding process, we derived four fundamental principles from the dataset, which subsequently formed the basis of the framework (see figure 1). This framework represents a significant outcome of our research, serving as a conceptual structure for understanding and analysing DRLs and their impact.

It is important to note that this framework is not static; rather, it serves as a prototype that will be subjected to empirical testing and refinement, aligning with the dynamic and evolving nature of DRLs and design research.

Furthermore, to illustrate the practical utility of the framework, we present four case studies of DRLs that exemplify its application in real-world contexts. These case studies showcase how the framework can be employed to gain insights into the functioning and significance of DRLs, demonstrating its potential as a valuable tool for both researchers and practitioners in the field of design and innovation.

The Design Research Lab, affiliated with the Berlin University of the Arts (UdK) since 2010, is a collaborative network involving UdK, the Einstein Center Digital Future, the German Research Center for Artificial Intelligence, and the Weizenbaum Institute. This network defines itself as “a network of individuals, organizations, and non-human entities engaged at the intersection of technologies, materials, and social practices” (Design Research Lab, 2023). Their objective is to create socially and ecologically sustainable tools, spaces, and knowledge that promote people's participation in a digital society, with a foundation in inclusiveness and respect for the environment. Their mission is to democratize technology development by fostering collaboration across academia, industry, politics, art, design, activism, and the public, making “technology development a participatory social practice” (ibid.). They are structured around four theme-

based working groups (material interaction, smart textiles, social design, and digital sovereignty). Their interdisciplinary approach incorporates “critical human-centered design, technology hacks, prototyping, public interventions, and strategies for inclusive discourse” (ibid.) and aims to introduce innovative forms of transdisciplinary research.

The Parsons Design for Social Innovation and Sustainability Lab (DESIS Lab) was founded in 2009 at The New School in New York City and is part of the DESIS Network, a global group with around 50 design labs. It describes itself as an “action research laboratory” that “works at the intersection of design and social theory, applying interdisciplinary expertise to sustainable practices and social innovation” (The New School, 2023). The vision and mission of the lab revolve around the advancement of design-led social innovation, with the aim of creating more equitable and sustainable cities and practices. In response to the intricate and interrelated global challenges, the DESIS Lab concentrates on issues like indigenous sovereignty, planetary interdependence, diversity, natural systems, societal inequities, and the commons. To achieve these goals, the lab employs “integrated design practices,” placing a strong emphasis on “service design as a practice based on social justice principles” (ibid.). The lab actively seeks interdisciplinary collaborations, both with local partners in New York City and global partners within the global DESIS Network.

The Delft Design Labs (DDLs) were created in 2017 at the Faculty of Industrial Design Engineering (IDE) of TU Delft. They describe themselves as “platforms for design innovation and knowledge development in which staff members of IDE, students of TU Delft, and external partners work together” (TU Delft, 2023). Their main aim is to involve IDE students in research to contribute to design research while addressing a broad range of societal challenges.

These DDLs are organized in a flexible, open setting framed by four main themes: sustainability, health and well-being, mobility and urban living, and artificial intelligence, which form the basis of a total of 17 theme-

based labs. These labs “are driven by the passion of individual educators and researchers” and follow a practice-based understanding that “shows concrete examples of how issues are studied, insights are gathered, and challenges are addressed through design interventions” (ibid.). The open structure of the DDLs encourages collaboration across disciplines and allows adaptation to changing societal needs.

The Social Design Lab (SDL) was established at the School of Design Innovation Department at Victoria University of Wellington, NZ. The SDL is driven by the acknowledgment that “over the past decade, the role of design and designers has undergone a major shift as the discipline re-evaluates its contribution to society and the environment” (Victoria University of Wellington, 2023). SDL aims to promote the evolving role of design in contributing to more positive, equitable, and sustainable outcomes for society and the environment. Against this background, SDL focuses on enhancing students' critical and creative thinking, communication skills, and cross-disciplinary collaboration to prepare them as socially responsible designers and leaders. As a key characteristic, SDL integrates local and indigenous knowledge into its research and employs ethnographic and participatory approaches to develop design solutions for pressing social and cultural challenges. The SDL is organized around three “research pods”, defined as social design, social impact, and social innovation and form the basis of three different research projects.

Even though these four examples exemplify different approaches and thematic focuses of DRLs, they also serve as compelling illustrations of the fundamental commonalities that underpin the diverse landscape. In the ever-evolving field of DRL, where novel techniques and applications continue to emerge, it is essential to distill the core principles that guide and unite these endeavors. These principles, summarized in the following section, form the bedrock upon which the broader DRL framework is built. By recognizing and understanding these shared foundations, researchers and practitioners can not only appreciate the richness of DRL's possibilities, but also effectively contribute to its advancement and innovation.

3.3 Four Principles of Design Research Labs

The four principles that emerged from this approach should be viewed as coexisting and shedding light on various facets, rather than having a hierarchical relationship.

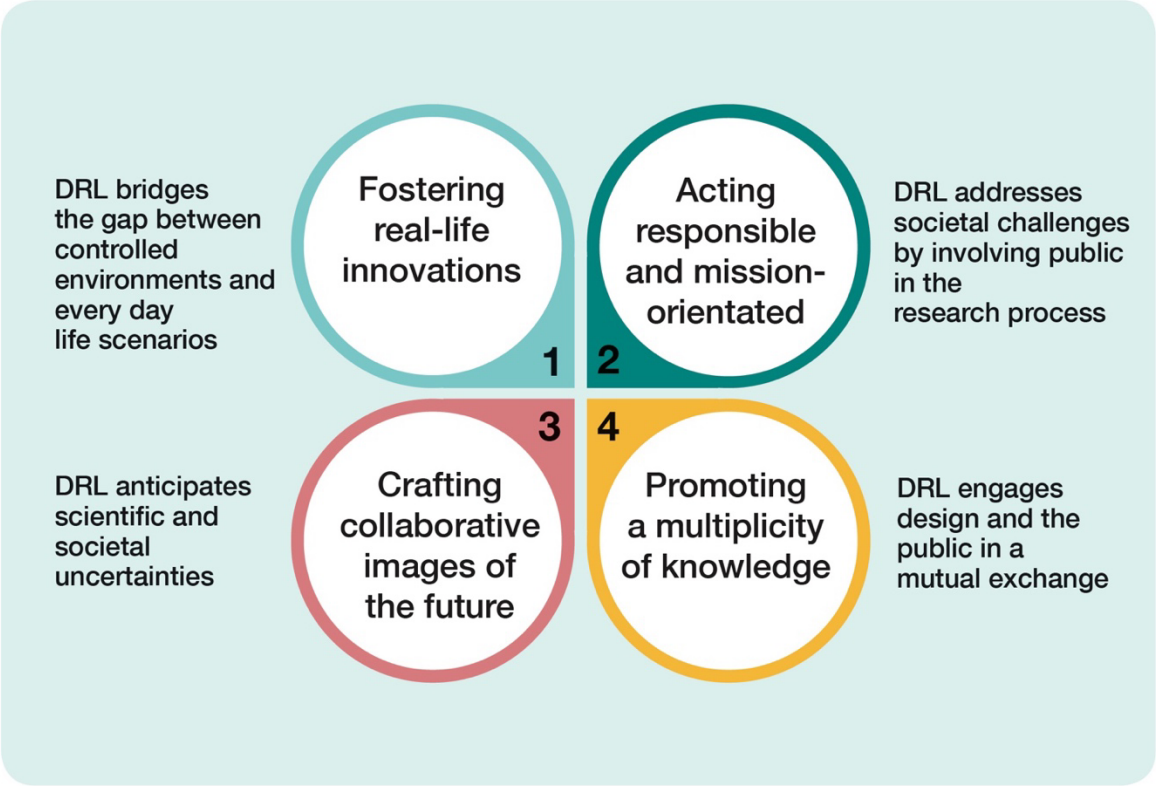

Figure 1. The DRL-framework by the authors (Harles & Augsten), 2023.

1. Principle 1: Fostering real-life innovations

   DRLs metaphorically embrace the concept of scientific labs, characterizing them as controlled environments where knowledge is generated through experimentation and measurement (Binder & Brandt, 2008). Unlike the traditional scientific notion of exclusive access for eligible researchers within an institution, DRLs are seen "as platforms for collaborative inquiry" (Binder & Brandt, 2008, p. 121). It is evident that case studies within DRLs often occur beyond the confines of design faculties' studios and lecture halls. Instead, they are situated where the interventions are intended to be applied. Consequently, the individuals and groups directly affected, as well as strategic relevant collaborators, actively participate in the knowledge production process. What is even more significant is that these activities occur directly in real-life, everyday environments. Prototypical solutions are developed, where they are needed. For instance, considering the case of the Malmö Design: Lab (Binder & Brandt, 2008), employees and managers from one company collaborated directly with external healthcare consultants during on-site sessions at the production factory. This approach ensured that everybody actively participated in the lab, where inquiries regarding healthcare for workers were addressed directly with the workers in their actual work environment.
   Another example by Reynolds-Cuéllar (2020) illustrates how coffee farms can become a DRL, framed as a design course, where design students are relocated geographically to rural Colombia, where they are immersed into the everyday life of coffee farmers to comprehend their routines, needs, and challenges. This served as an essential basis for a co-creation process between students and local communities.

The first principle extracted after analyses is to bridge the gap between controlled environments and everyday life scenarios through the sometimes unforeseen collaboration of various stakeholders. In addition, this exemplifies how DRLs blend the structured, controlled environment of a lab with the realities of the field, creating open and inclusive spaces for collaborative knowledge production.

2. Principle 2: Acting responsible and mission-orientated

DRLs focus on societal issues rather than theoretical aspects of the design discipline. They align their research agendas with specific socially relevant topics like healthcare, mobility, or sustainability (Delft Labs), indigenous sovereignty and human-nature interaction (DESIS Lab, Social Design Lab), digital sovereignty (Design Research Lab UdK) as well as the societal implications of technological innovations, interactions, and interfaces. The goal and motivation of the described examples are to address societal challenges by initiating new paths for knowledge production and socially oriented innovation processes through design. They can be described as mission-oriented, meaning they follow a consensus- and value-oriented research framework like Responsible Research and Innovation (RRI), as proposed by Von Schomburg (2013). The RRI framework encourages researchers, innovators, and organizations to consider the broader societal and ethical implications of their work, actively involving the public and stakeholders throughout the research and innovation process (see also Timmermans et al., 2020). DRLs are inherently aligned with this framework in several ways. First, they aim to foster interdisciplinary collaborations with organizations, governments, scientific institutions, and academia. Second, they aim to engage with diverse audiences, including the public, local communities, marginalized groups, and even non-human entities, incorporating them into the innovation process. Finally, they aim to promote non-academic modes of knowledge as well as methods of knowledge production that are not exclusive to academic research, such as everyday expertise and indigenous knowledge. As a result, DRLs promote a comprehensive and forward-thinking approach to research and innovation, with the objective of ensuring that the outcomes of these activities benefit society, adhere to ethical standards, and contribute to sustainable, long-term developments. As a second principle, we identified that a DRL addresses societal challenges by involving the public, as well as specific and marginalized target groups, in the research process.

3. Principles 3: Crafting collaborative images of the future

Drawing from their mission-oriented approaches, DRLs are notably characterized by their emphasis on uncertainties. These uncertainties stem from the fact that many technological advancements (ex.g. artificial intelligence), but also geopolitical and ecological developments (like wars, pandemics, or biodiversity loss)

often bring about unforeseen transitions or transformations and, consequently, unforeseeable social implications. To ensure that technological potentials are early aligned with societal needs, adapt quickly to an ever-changing world, and that probable long-term consequences are considered, DRLs must anticipate and intertwine technological, societal, and political with ecological trends and project them toward probable future agendas. This necessitates the creation of exploratory spaces where diverse stakeholders can examine future developments while anticipating desirable societal progress, all without immediately providing final short-term solutions.

Within this context, the design discipline holds immense potential in addressing uncertainties and managing “non-knowledge” within interdisciplinary knowledge production processes (Harles &

Heidingsfelder, 2022). These potentials are particularly evident in design-based approaches that evolve from Critical Design, including Design Fiction (Bleecker, 2022), Speculative Design (Auger, 2013; Dunne & Raby, 2013), and Design for Debate (Heidingsfelder et al., 2019). Their shared objective is to extrapolate societal, technological, and ecological developments within everyday scenarios, facilitating mutual knowledge transfer. Through the creation of fictional narratives and tangible "as-if" prototypes such as speculative objects, services, or systems (Wensveen & Matthews, 2014; Boer & Donovan, 2012), these approaches embody potential developments in tangible scenarios for a non-expert audience.

These interventions, often referred to as "speculative enactments" (Elsden et al., 2017), have the power to reveal ambiguities and immerse participants in "as-if" situations to provoke reactions and feedback. By initiating social discussions at an early stage of innovation, DRLs facilitate the negotiation of ideas, needs, and common visions among various stakeholders that are not experts in the field. These future visions are the starting ground for creating fields of action in the present. Consequently, DRLs represent a distinct understanding of design as a critical practice, detached from the market-oriented utility of design thinking. In this way, DRLs function as transition spaces or "hypothetical places" (Binder & Brandt, 2008), where the foundation of the innovation process is not ideas but needs, with results emerging gradually throughout the process.

4. Principle 4: Promoting a multiplicity of knowledge

DRLs enable a novel mode of knowledge production that extends beyond traditional academic knowledge generation, often referred to as "Modes 1 and 2" (Nowotny., 2006). "Mode 1" characterizes the traditional, discipline-specific approach with specialized research and academic discourse, while "Mode 2" represents an interdisciplinary, problem-oriented approach that emphasizes collaboration among diverse experts from different fields (Nowotny et al., 2006). However, design-based knowledge processes, as observed in DRLs, go even further, addressing what is also described in the literature as "Mode 3" (Carayannis et al., 2016; Sandstrom, 2014). This is characterised by highlighting the co-production of knowledge involving a diverse array of actors, including both experts and non-experts. This distinction is a central aspect of DRLs. DRLs serve a dual purpose in knowledge production. Firstly, they encourage knowledge production through design. By creating inclusive spaces for both experts and non-experts, DRLs simplify complex issues through visualizations, tangible experiences, and design-based methods. These methods engage multiple senses and encourage experimentation, allowing participants to transcend verbal and existing knowledge constraints (Heidingsfelder et al., 2019). Moreover, DRLs promote knowledge production by facilitating design-based public engagement. In this capacity, they empower the public and non-expert stakeholders to actively contribute to the innovation process, essentially becoming co-designers. This inclusive approach enables the transfer of various forms of expertise, including general, inclusive, and indigenous knowledge, thus broadening the scope of the innovation process. DRLs effectively extend design methods into areas traditionally outside the purview of designers (Binder, 2008). In this way, DRL introduces an essential peculiar characteristic in which they challenge conventional authorship structures in favor of shared authorship between the lab stakeholders (Binder 2008, p. 121).

In essence, DRLs redefine knowledge production by emphasizing collaboration, inclusivity, and the integration of diverse perspectives, ultimately reshaping traditional scientific outcomes. Thus, DRL engages design and the public in a mutual exchange.

4. Perspectives and Challenges from DRL to Public Innovation Labs

The given examples of DRLs demonstrate that, given various application scenarios, a uniform definition remains elusive. More intriguing than the question “What is a DRL?” is the query “What actually defines a DRL?”. In contrast to traditional scientific research laboratories, DRLs are not understood as static, hermetically sealed, non-public spaces. Instead, they are characterized by a distinctly human dimension in which they operate. In this regard, they represent a significant counter-design while simultaneously meeting the demands for interdisciplinary and socially oriented innovation processes (e.g., Open Science). The framework of DLR (see 3.2) introduces various aspects that may spark how public sector innovation labs can benefit from the DLR framework.

The DRL fosters real-life innovations to bridge the gap between controlled environments and everyday life scenarios. So far, most innovation labs in the public sector have been acting shielded. Opening up to a more human-centered reality would support them in becoming more relevant to the challenges of citizens. Observations highlight a different approach to innovation. DLRs prefer a bottom-up approach to innovation, while in the public sector a rather hierarchical, top-down innovation approach is still distributed. That goes along with the recommendation to open up the innovation process and collaborate with multiple stakeholders to focus on socially relevant issues serving the public interest.

DRL addresses societal challenges by involving the public in the research process to act responsibly and mission-orientated. Instead, most public innovation labs are oriented primarily on the political agenda. Involving multiple stakeholders, and taking their perspectives profoundly, might help to stabilize their contribution to a valuable transformation.

Many public innovation labs have been much closer to implementation than visioning due to governing time frames and horizons. DRLs, on the other hand, design speculative visions of the future that act as examples for discourse, as artefacts for a common understanding, and as spaces of possibility. Understanding this vision as a starting point for action is an offer that DLR can make to innovation labs in the public sector to broaden the degree of exploration and openness to include uncertainties.
The relevance of promoting a multiplicity of knowledge demands for integration of multiple stakeholders and the acceptance of the co-existence of multiple forms of knowledge (cf. Mode 3). This view would provide a new form of openness beyond individual expertise and responsibility.

5. Outlook

In conclusion, this paper presents a framework as a systematic approach for analyzing the potential aspects of structural development, responsible research approaches, and various modes of future-oriented knowledge transfer within the domain of DRLs. However, the gap between theoretical principles and practical implementation highlights the existence of blind spots and challenges that need to be addressed:

To the design discipline:

- Affiliation with Design Schools:
  Being associated with design schools provides structural freedom and political independence for a DRL. However, the accessibility to external stakeholders beyond the discipline should be questioned to involve external stakeholders in the process and recognize their added value.

- Beyond traditional scientific outcome:
  Design-based interventions produce implicit knowledge that is not measurable data in a traditional scientific sense. Furthermore, the data collected from such processes is often not evaluable as quantitative, representative datasets in the traditional sense. Thus, these different forms of knowledge generation also demand new types of research results, approaches to evaluation, and impact measurement.
- Knowledge transfer and science communication of Design Research:
  The need for knowledge transfer and science communication leads to the question of how the added value of design research and the knowledge production processes behind it can be conveyed and transferred to other disciplines. For instance, the natural sciences make their research widely accessible through science communication formats, whereas the specialized discourse in design research often remains confined to the design discipline itself, even when interdisciplinary collaboration occurs.

To the public sector:

- Stakeholder expectation management:
  The lack of knowledge transfer regarding design-based research processes and methodologies can lead to misguided expectations from external stakeholders. The aim of DRL often goes beyond quick ideation and prototypes. They foster societal debates to formulate questions, needs, and collaborative visions to define a strategic and ethical framework. They also take structural, cultural, and legal into question, which leads to more long-term processes that are crucial to upscale and implement outcomes.
- Openness towards implicit knowledge and exploration:
  The most enduring challenge innovation laboratories are facing is based on the inherent conjunction of implicit and explicit knowledge, which in processes of public administration serves as one aspect to determine. Innovation laboratories should take on the role of exploring different questions of measuring, judging, and planning need to be deferred so as not to destroy the innovation capacity before it arises.
- Diverse skill sets and new profiles:
  The public sector is driven by clear structures and linear logic that led to bureaucratic hurdles and a culture that is rarely open to new skill sets and multiple profiles. More flexible structures and higher diversity, as a DLR provides, would unfold the innovation capabilities, and help to overcome the upcoming shortage of skilled workers and the demands of younger generations entering the public sector.

Since the development and establishment of public sector labs is an ongoing process, we propose a two-fold approach: Firstly, it would be intriguing to test the framework by investigating more DRLs (see acknowledgments). Secondly, while in this paper we have approached the public sector from a design perspective, it is worth noting that within the public sector, a scattered pattern of labs has been identified, which would also be of interest for further investigation.

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P/REFERENCES OF DESIGN

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