Innovation Infrastructures 4.0

A Position Paper to Support Germany's Innovation Infrastructure with Respect to Networking, Development and Sustainability

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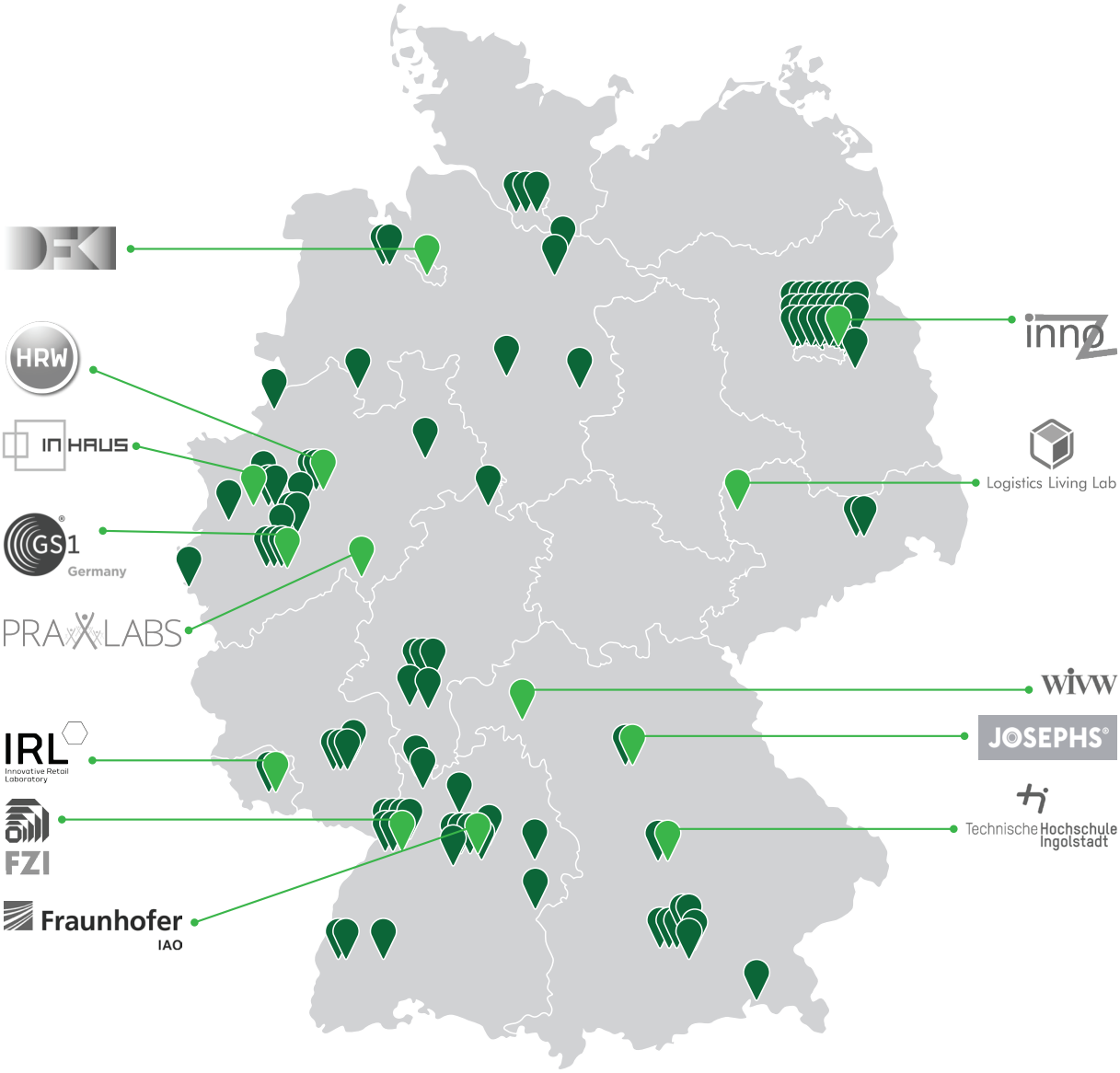

The German innovation infrastructure comprises more than 100 living labs, with more than 50 in the fields of housing, shopping and mobility, and a growing number of testbeds in Industry 4.0. The 13 living labs initiating this position paper belong to the Fraunhofer-Gesellschaft e.V., the German Research Center for Artificial Intelligence (DFKI), universities, foundations and private-sector institutions. Our more than 50,000 partners range from specialised start-ups and small businesses to major corporations. We are committed to serving the demands of the end user and our customers, maintaining the quality of our services, and fostering a sustainable economy and society.

Summary

German innovation infrastructure greatly contributes to overcoming major societal challenges, such as digitalisation, demographic change and sustainability. New products, services and business models are researched and developed in living labs; these innovations support Germany's ability to compete globally, and also contribute to building a sustainable society. Such innovations are based on the acceptance and active participation of the user and target groups involved in a real-world context. However, the scale of challenges as well as possibilities requires new incentives to strengthen flexible and user-oriented innovation infrastructure in Germany.

This position paper is addressed to decision makers on German innovation policy. The goal of the paper is to create a better understanding of the German infrastructure of living labs, to demonstrate the potential for innovation and market diffusion of new product and service systems, and to characterise the measures necessary for enhancing Germany's innovation capacity. As initiating research institutions and operators of institutionalized living labs, we see the following need for action in innovation policy.

1. **Support for the research and innovation system through the strategic positioning of living labs.** For this, a support programme with the following focus is necessary:
   - The networking of living labs and other key stakeholders
   - Harmonisation and professionalisation with respect to the methods used and the range of services offered, e.g. for start-ups and SMEs
   - The establishment and development of consumer and household panels
2. **The creation of new potential for innovation through sustainability and a user-oriented focus in innovation policy,** particularly by implementation of the following measures with respect to innovation policy:
   - Integration of the UN Sustainable Development Goals (SDGs) and user-centred innovation approaches (e.g. through living labs and laboratories of reality) as leading criteria in innovation funding and innovative public procurement
   - Expansion of the streamlined allocation of small levels of funding ("Fast Track to Experimentation") for start-ups and SMEs to support creative stages of development and experimentation
   - Significant enhancements of action programmes for socio-technical or non-technical innovations
3. **The establishment of integrated data and knowledge platforms for knowledge transfer on Smart Living and Smart Cities,** with the following emphasis:
   - The gathering and transfer of knowledge and experience with respect to user and stakeholder integration in open innovation processes
   - The preparation of knowledge and a data base for more effective innovation processes regarding future-oriented technologies (e.g. artificial intelligence, the bioeconomy, Industry 4.0, the Smart Home, an ageing society)
   - Development of educational and informational material on Smart Living

If you would like to support this call on policy makers to action, you can find additional information at the following link: **www.innolab-livinglabs.de/en/results/position-paper.html**
There you can also download the position paper as an electronic PDF document.

Thematic background of this position paper

Research and development (R&D) is key to bringing about a digital economy and a society seeking growth, competitiveness, prosperity and sustainability (BMBF 2016). Innovation actors in particular face a challenge in productively using the **increasing dynamism and complexity of societal changes as well as of innovation processes** (Erdmann et al. 2016). Driven by globalisation and digitalisation, future innovation will bring together activities in the domains of mobility, housing, energy, commerce, health and work to form the field of Smart Living. As a result, corresponding needs for innovation will no longer be industry-specific, but rather wide-ranging, integrated and lifestyle-specific. If actors can collaborate to define the challenges ahead, their solutions, and the processes needed to arrive at those solutions, new, long-lasting benefits may emerge. Such collaboration is encouraged by an "open-innovation" approach, which actively engages producers, network operators, and service and content providers, as well as users (BMWi 2015).

Against this backdrop, various applied testing environments, field-trial areas, living labs and other sites of **innovation infrastructure in Germany** have formed (e.g. initiatives addressing the Smart Home, Ambient Assisted Living (AAL), Smart Data or electric mobility). These infrastructures allow the **development of prototypes and service concepts in real living and working environments together with users**. Assessing user needs, context and practical knowledge in innovation processes early in the development cycle decreases development risks, and is therefore essential for the market success of new business models and the targeted sustainable use of products, services and infrastructures (Bódi et al. 2015, Baedeker et al. 2017).

However, the **specific innovation challenges posed by digitalisation** (e.g. the Smart City, integrated energy and mobility transitions, Industry 4.0, the Internet of Things and Services) **exceed the capacity of the current German innovation infrastructure, the boundaries of its focus, and its abilities**. Powerful innovation infrastructures are necessary to satisfy the dynamic requirements demanded by the economy and society at large as well as by international developments: real-world meeting points for innovation actors, knowledge centres for systemic innovations, the identification of real needs and innovation needs, the development of collaborative and iterative solutions and the testing of the resulting prototypes in real-world or application environments (INNOLAB 2017, Warnke et al. 2016).

Combining and strategically developing the strengths and capabilities of living labs and other applied innovation infrastructures in Germany represents a chance to create new, responsive and interconnected structures. This promotes the potential of developing disruptive, systemic innovation around Smart Living and an **open, sustainability-focused innovation culture** (Hightech Forum 2017). SMEs and start-ups in particular can increase their ability to innovate by using Innovation Infrastructure 4.0.

The need for action

We see specific need for action in three areas.

1. **Support for the research and innovation system through the strategic positioning of living labs**

The German research and innovation infrastructure makes a significant contribution to the added value of many products and services, which in turn has led to market success, as well as societal prosperity. Often, these contributions cannot be measured in financial terms, e.g. regarding their contribution to educational quality at universities. Innovation is becoming an increasingly complex and dynamic phenomenon; therefore, we recommend **a funding programme to support innovation infrastructure in Germany, which will allow it to continue to develop excellent solutions alongside key stakeholders from business, science, education and politics (Innovation Infrastructure 4.0)**. Living labs and other real-world infrastructures offer the experimental culture necessary to systematically develop and test unconventional, creative prototypes and service innovations, in protected but nevertheless public spaces. At the same time, living labs enable students and researchers to become familiar with advanced research methods and the applied development of future technologies. As such, living labs help to increase the appeal of STEM (Science, Technology, Engineering and Mathematics) research and careers as well as the development of interdisciplinary and transdisciplinary innovation abilities. Such infrastructures are especially hard to establish and maintain for SMEs and start-ups, and ensuring their access to living labs will serve to aid them in successfully bringing their products and services to the market.

We recommend measures to develop and raise the profile of national living labs: substantial support to **facilitate communication and exchange among key living lab stakeholders** (especially in industry, research, politics and society), a general strategy to improve the use of living labs in national research and innovation systems, the possibility to exchange experience, and develop the capabilities of living labs (among others in respect to Work 4.0, the Internet of Things and business model development) and support to establish specialisation, cooperation and communication platforms.

The use of harmonised methods in innovation processes, which facilitates learning generally and the upscaling of innovations specifically, help to **harness innovative energy within the innovation system. Furthermore, it is crucial to support living labs internally in improving their operations as well as externally in facilitating accessibility to living lab services** in order to permanently secure the initial investment in infrastructure, and fully utilise each lab's innovative potential to create financial and societal value in Germany. Such support would include incentives for public research projects (without their own infrastructure and test group) to use living lab facilities and services, programmes to improve SMEs' and start-ups' accessibility to living labs, and support during the conceptual, technical and organisational development of innovation infrastructure, e.g. through **establishing and supporting user and household panels**. Beyond that, living labs need room to contemplate ways to avoid path dependency. Therefore, oversight and a monitoring system should accompany infrastructure development.

2. The creation of new potential for innovation through sustainability and a user-oriented focus in innovation policy

Sustainable innovation supports the competitiveness of Germany while addressing societal needs. For example, industry itself benefits from modernisation measures regarding energy and resource efficiency. The potential of living labs and other applied innovation infrastructures in leading German markets and key technologies are not yet fully utilised with respect to sustainability.

Therefore, we recommend **integrating the UN Sustainable Development Goals (SDGs) and integrating users into the main criteria for innovation funding and innovative public procurement**. The sustainability of R&D should be evaluated to facilitate innovation processes and find solutions for important key tasks, which are especially relevant for economic growth and societal prosperity in Germany: a digital economy and society, sustainable development and energy, innovative work, healthy living, intelligent mobility and civil security. Civil society must be widely and consistently engaged in order to make citizens a part of a culture of experts in everyday R&D and in order to develop a high level of citizen competence. **Public procurement should function as a catalyst for new – not only technical – innovation potential**.

Streamlined allocation of small levels of funding ("Fast Track to Experimentation") for start-ups and SMEs are necessary for unexpected, short-term problems as well as for the short, creative stages of development and experimentation. SMEs and start-ups especially benefit from the excellent networking relationships with potential clients living labs offer, and therefore they add value directly. An **action programme for socio-technical or non-technical innovations** could be expanded to support additional, highly valuable business solutions, e.g. for innovative marketing and consulting services, design concepts and business models.

3. The establishment of integrated data and knowledge platforms on smart living

To support the innovative capacity of socio-technical R&D in Germany and to secure qualified labour, the knowledge from laboratories of reality and living lab projects needs to be captured and disseminated.

Therefore, we recommend **establishing and supporting integrated online platforms for Smart Living and Smart Cities data and knowledge** to consolidate user and stakeholder-integration experiences from multiple R&D processes as well as the necessary data sets (e.g. the environmental impact of single activities or behaviours in the fields of mobility, housing, energy, commerce, health and work). This platform could **provide knowledge and a database for more effective innovation processes in future-oriented technologies** (e.g. artificial intelligence, the bioeconomy, the Internet of Things, the Internet of Services, the Smart Home). Additionally, it is necessary to support **education and raising awareness about smart living** (through educational and press material, etc.) to facilitate the dissemination of goal, system and transformation knowledge. Such action should be complemented with the development of concepts outlining knowledge generation and transfer (with universities, educational and business associations, etc.) which in turn can be further disseminated among other German businesses, research institutions, sectors and regions, as well as in educational processes nationally and internationally.

Initiating organisations

The following organisations have initiated the this position paper:

Organisation	Responsible bodies	Location	Contact
Bremen Ambient Assisted Living Lab (BAALL)	German Research Center for Artificial Intelligence (DFKI)	Bremen	Dr. Serge Autexier
EUREF-Campus/ Innovationszentrum für Mobilität und gesellschaftlichen Wandel (InnoZ) GmbH	InnoZ GmbH	Berlin	Dr. Helga Jonuschat
Fraunhofer Institute for Microelectronic Circuits and Systems	Fraunhofer Institute for Microelectronic Circuits and Systems	Duisburg	Dr. Gerd vom Bögel
FZI House of Living Labs	FZI Forschungszentrum Informatik	Karlsruhe	Tanja Zylowski
GS1 Germany Knowledge Center	GS1 Germany GmbH	Köln	Regina Haas-Hamannt
Innovative Retail Laboratory (IRL)	German Research Center for Artificial Intelligence (DFKI)	St. Wendel	Dr. Gerrit Kahl
JOSEPHS	Fraunhofer Institute for Integrated Circuits IIS	Nürnberg	Dr. Frank Danzinger
Logistics Living Lab	Leipzig University	Leipzig	Dr. Martin Roth
PRAXLABS	University of Siegen	Siegen	Corinna Ogonowski
Retail Lab Technische Hochschule Ingolstadt	Technische Hochschule Ingolstadt	Ingolstadt	Prof. Dr. Marc Knoppe
Science Box	Ruhr West University of Applied Sciences	Bottrop	Prof. Dr. Viktor Grinewitschus
SILAB/Würzburger Institut für Verkehrswissenschaften GmbH	Würzburg Institute for Traffic Sciences	Veitshöchheim	Dr. Armin Kaussner
Urban Living Lab/ Fraunhofer IAO	Fraunhofer Institute for Industrial Engineering IAO	Stuttgart	Udo-Ernst Haner

More information on these and other living labs can be found at:
www.innolab-livinglabs.de/en/living-labs-map.html

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