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a taxonomy of ORGANISED INNOVATION SPACES

Authors

Sanz, L.
Klofsten, M.
Van Dinteren, J.
Jansen, P.

Editors

Battiston, A
Fazio, A.

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Joint Research Centre

Contact information
Competence Centre on Technology Transfer
European Commission, Joint Research Centre, Brussels - Belgium
Email: EC-CC-TT@ec.europa.eu

EU Science Hub
https://joint-research-centre.ec.europa.eu

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a taxonomy of

ORGANISED INNOVATION SPACES

Authors

Luis Sanz, IASP – International Association of Science Parks and Areas of Innovation

Magnus Klofsten, Linköping University

Jacques Van Dinteren, IADP - Innovation Area Development Partnership

Paul Jansen, IADP - Innovation Area Development Partnership

EC Competence Centre for Technology Transfer

Coordination and editing

Anna Battiston, European Commission, Joint Research Centre (JRC)

Alessandro Fazio, European Commission, Joint Research Centre (JRC)

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EXECUTIVE SUMMARY

The role of innovation in the economic growth of territories has long been recognised in both economic literature and policy. Successful innovation entities and intermediary actors are ideally positioned at the crossroad between these two processes. They attract a critical mass of businesses and early-stage entrepreneurs, researchers, investors, and other institutions, catalysing a multi-directional transfer of knowledge, collaborative innovation and co-creation activities, ultimately materialising into what are commonly known as innovation ecosystems.

Besides providing a physical setting for research, experimentation and business development, the added value of such spaces for their users lies, *inter alia*, in the wide and varied set of services and amenities they provide, the opportunities for interactions and networking deriving from close spatial proximity, the access to specialised knowledge and support, access to finance, as well as reputational benefits.

In this context, this study aims to identify the major physical entities fulfilling this role, and describe their key characteristics to better position them in the innovation ecosystem spectrum.

The report targets practitioners, investors, and stakeholders wanting to better identify opportunities that Organised Innovation Spaces (OISs) provide in their innovation ecosystems. The study intends to support policymakers in better aligning relevant policies and initiatives, by taking stock of extant innovation entities, their assets and added value-services, and exploiting potential synergies.

The report identifies six physical Organised Innovation Spaces – namely Science and Technology Parks (STPs), Innovation Districts (IDs), Industrial Innovation Campuses, Areas of Innovation (AOIs), Incubators, and Living Labs (LLs) - and analyses their scale and location; organisational and management structure; and main target users and services provided.

The study summarises the specific findings for each OIS, and provides a comparative analysis. In particular, it highlights how each OIS operates in different physical perimeters and with various levels of spatial concentration, with incubators and STPs presenting easily identifiable premises, and AOIs and LLs tending to be more scattered geographies.

The organisational configuration can also vary considerably, with Industrial Innovation Campuses and Incubators having a more prominently formalised structure. OISs with less comprehensive management, such as LLs and IDs, seem also to adopt softer governance models.

Even though all OISs follow an open innovation paradigm and embody the shift from a technology-push model to a market- and society-pull one, the extent to which quadruple-helix stakeholders are involved varies considerably. Traditional innovation actors such as businesses and startups benefit from high-added value services across all OISs. In some cases, residents, students and employees can also benefit from ancillary services (e.g. STPs, IDs, AOIs); in others, they can be involved in testing, development, or even active creation of new products and services, such as in the case of LLs.

Finally, we conclude by proposing complementary areas of research that remain to be explored, namely non-physical dimensions of (open) innovation as well as co-creation and synergies with Organised Innovation Spaces.

1. INTRODUCTION AND BACKGROUND

In both literature and practice, the use of the terminology revolving around the complex notion of innovation ecosystem has been often discretional or inconsistent, particularly when referring to innovation actors and entities.[1] This can make it difficult for prospective users and investors to discern key features, assets, and added-value services of such entities, and hinder the identification of opportunities they might hold.

According to the Horizon Europe Regulation, an innovation ecosystem brings together

> actors or entities whose functional goal is to enable technology development and innovation; it encompasses relations between material resources (such as funds, equipment, and facilities), institutional entities (such as higher education institutions and support services, research and technology organisations, companies, venture capitalists and financial intermediaries) and national, regional and local policy-making and funding entities.[2]

Embedded in a local or regional territorial dimension, often with national and transnational reach, Organised Innovation Spaces (OISs) are the physical manifestations of innovation ecosystems. Acting as aggregating entities and/or intermediaries, they bring together a critical mass of innovation actors, offer targeted services, and provide a physical space for experimentation, interaction and networking – enabling the whole to become more than the sum of its parts.

Based on an open innovation paradigm, OISs are known for often hosting stakeholders that would be in direct competition on the market, such as early stage entrepreneurs and businesses operating in the same sector, or distinct startup incubators and accelerators (Nikina-Ruohonen, 2021).

The purpose of this study is thus to help support the development and sustainability of innovation ecosystems by providing a straightforward taxonomy enabling practitioners, policymakers, investors, and stakeholders to discern between different Organised Innovation Spaces within the wide spectrum of the notion of "innovation ecosystem".

In particular, at market level the identification of a clear taxonomy would facilitate the segmentation of the market on the demand side, enabling the matching between actors of innovation ecosystems and prospective investors.

The importance of intermediaries such as OISs in fostering innovation and thus knowledge-driven economic growth, job creation, and social development, is reflected in the longstanding EU commitment to innovation, ever more renewed under the current programming period (2021-2027).

EU Cohesion Policy has long acknowledged the importance of, and invested in, innovation, increasingly shifting the focus to a place-based approach to innovation and the role played by actors such as Science and Technology Parks in the framework of Smart Specialisation Strategies (S3) – now constituting a precondition for ERDF funding. A further step in this direction has been taken with the launch of a pilot for Partnerships for Regional Innovation, which incorporates environmental sustainability in the systemic approach to innovation introduced by S3,

[1] On the multiple interpretations and uses of the notion of innovation ecosystem in literature, see Vasconcelos Gomes, (2018). An insightful contribution on the adoption of institutional vs strategic postures by organisations in choosing their name is provided in Hirtenkauf, et al. (2022).

[2] Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe, OJ L 170, 12.5.2021, p. 1–68, art. 2 (47). In literature, Granstrand and Holgersson describe the innovation ecosystem as "the evolving set of actors, activities, and artefacts" - e.g., products, services, tangible and intangible resources, technological and non-technological resources - "and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors" (Granstrand and Holgersson, 2020).

promoting the circulation of best practices among innovation ecosystems across Europe to tackle the innovation divide.

Furthermore, the European Innovation Ecosystems actions envisaged under the Horizon Europe programme aim at creating more connected, inclusive and efficient innovation ecosystems, specifically targeting innovation actors and organisations – such as policymakers, investors, companies, higher education institutions (HEIs), and research and technology organisations (RTOs).[3]

Lastly, the New European Innovation Agenda sets out a clear commitment towards supporting deep-tech innovations that are also aimed at answering to global challenges, by creating a fertile environment for experimentation – e.g. testbeds, Living Labs, regulatory sandboxes – mobilising private investments, and improving the overall policy framework.[4] In this respect, the present work is fully consistent with the need acknowledged in the New European Innovation Agenda for developing a clearer and common terminology related to innovation.

Indeed, a common conceptual framework could better guide policymaking to ensure alignment between policies, as well as at different governance levels, and exploit synergies between OISs and other R&I actors and infrastructures, the services they provide, and initiatives building upon them.

Specifically, at Union level, the EIT KICs Innovation Hubs and co-location centres bring together knowledge triangle actors in close proximity, providing access to partners' infrastructures, and working on knowledge exchange, development of innovative products and services, and other initiatives.[5] Similarly, the Digital Innovation Hubs, regional one-stop shops supporting the digital transformation of businesses, are based on the cooperation between RTOs, universities, industry associations, chambers of commerce, incubators/accelerators, regional development agencies, and governments, and provide access to knowledge and support in e.g. piloting, testing, and experimentation with digital innovations.[6] Most recently, the Digital Europe Programme is supporting the creation of a network of around 200 European Digital Innovation Hubs all over Europe, to increase the capacity of the regional hubs and foster transnational collaboration and knowledge exchange.[7]

In addition, shedding light on the complexities of innovation spaces and highlighting the value-added of different OISs, can also prove useful to practitioners, investors, and users, and facilitate the matching of demand and supply of innovation.

With this in mind, the methodology described in Chapter 2 circumscribed the scope of the study to six physical Organised Innovation Spaces – namely Science and Technology Parks (STPs), Innovation Districts (IDs), Industrial Innovation Campuses, Areas of Innovation (AOIs), Incubators, and Living Labs (LLs). Three key dimensions are covered for each of these typologies of OISs, in particular:

- their scale and location;
- their organisational and management structure;
- main target users and services provided.

On this basis, Chapter 3 develops an OISs taxonomy by exploring in detail each conceptual category, through literature review and desk research. For each OIS, an illustrative array of concrete examples is then provided.

The conclusions summarise the specific findings for each OIS, providing a comparative analysis, and identify complementary areas of research still to be explored.

Finally, the present work follows on from previous research carried out by the JRC Centre of Competence on Technology Transfer (CCTT).

Specifically, in Lund et al. (2020), the CCTT and IASP (International Association of Science

[3] https://eismea.ec.europa.eu/programmes/european-innovation-ecosystems_en - regional-innovation-valleys
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0332
[5] https://publications.jrc.ec.europa.eu/repository/handle/JRC116904
[6] https://digital-strategy.ec.europa.eu/en/library/digital-innovation-hubs-helping-companies-across-economy-make-most-digital-opportunities-brochure
[7] https://digital-strategy.ec.europa.eu/en/activities/edihs

Parks and Areas of Innovation) examined how Public-Private Partnerships (PPPs) and similar partnering modalities (e.g. concessions) can serve as models for the construction and operation of sustainable Science and Technology Parks (STPs) and Innovation Districts (IDs). The consultation of relevant stakeholders and case studies analysis showed the relevance of private sector involvement, both in the development/operation of STPs and IDs, and in supporting the whole innovation ecosystem. PPPs can indeed generate project-related efficiencies, attract new investors and users, and ensure long-term financial sustainability. The study also highlighted the risks that such endeavours entail for public partners – concerning the alignment of public-private interests, legal obstacles, and financial arrangements.

Building upon these findings, a recent JRC study on new investment models for urban innovation ecosystems looked into the risks and opportunities of leveraging private investments through public funding for attracting resources to support urban regeneration projects, such as the creation and operation of Innovation Districts. It also explored new funding mechanisms acknowledging the economic, social, and environmental dimension of such endeavours, recommending a set of key criteria for new social and environmental value indicators in innovative funding frameworks targeting IDs (Fiorentino, 2022).

The present study also takes stock of the findings of other JRC works, such as the categorisation of geographies of innovation in Galán-Muros (2021) – i.e., "planned and actively managed spatial clustering of a wide range of innovative organizations and intermediaries to undertake collaborative innovation activities". The work identified five models, namely industrial parks, business parks, science parks, technology parks, and innovation districts. The present study attempts to expand on said categories of innovation spaces, and in particular covering also those where linkages among actors and the organisational and governance dimensions are more flexible, and boundaries are blurred, such as Areas of Innovation and Living Labs. In doing so, it also draws on the evidence provided in Rissola (2020; 2017), which presents five case studies on place-based innovation ecosystems, and Raposo (2021), for the part providing an overview of the Living Labs conceptual framework.

2. METHODOLOGY

The first step in the drafting of the present work consisted of an exploratory analysis of innovation ecosystems aimed at scoping the object of the study. Based on literature and their extensive experience in the field, the authors identified a broad set of initiatives, entities, and tools supporting or hosting innovation activities and actors. Following this analysis, we decided to focus only on physical spaces, under the umbrella label Organised Innovation Spaces (OISs). Non-physical entities – such as clusters, associations, other networks, or digital initiatives – are therefore outside the scope of this exercise.

On this basis, distinguishing features of Organised Innovation Spaces have been selected according to three sets of criteria.

Different typologies of OISs have been identified according to their location – meaning urban, peri-urban, or (occasionally) rural. The location analysis covered also the scale of innovation spaces, which can span from building level, passing through campus, district and neighbourhood, to the whole city. The presence of, alternatively, defined or indistinct boundaries delimiting the OIS has also been taken into consideration.

The organisation and management structure has been identified as another crucial feature of OISs.

To qualify the different OISs according to the organisation type, the dichotomy of formal versus informal organizational structure has been proposed. For the purpose of the present study, a formal organisation presents a legally constituted body in charge of managing the OIS in question. It usually presents a full-time management team, devoted exclusively to the management of that particular OIS. Occasionally, in early stages of development the managing body might not be in charge of exclusively one OIS, but have broader responsibilities. When the OIS grows and becomes more mature, an exclusive management body is usually set up. Conversely, informal organisations lack any formal/legal/ad hoc set-up for the management of the OIS, which is rather "coordinated" or "curated" by more or less flexible groups of people belonging to different stakeholders. Although formally established organisations are usually behind these coordinating committees, they lack legal authority and have no responsibility over the OIS and its activities – except for extemporary events, projects, or initiatives they might co-organize (e.g., conferences, networking events).

Concerning the scope of management, a distinction was made between comprehensive and non-comprehensive management. In OISs with comprehensive management, the managing body has authority and responsibility on a very large number of aspects of the OIS operations and management. For instance, in OISs with clearly defined premises, such as STPs, managers usually have very ample powers, albeit some remain in the hands of the shareholders and the Boards of representatives. In this scenario, managers have the prerogative to limit or provide access to prospective users and tenants, and to select what services will be provided and how their delivery should be organised. They are also in charge of the maintenance of common areas, the organisation of activities, and the development of new premises, at times entailing considerable investments. On the other hand, in a non-comprehensive management model, managers have limited mandate in decision-making – regardless of the formal or informal nature or the organisation. Usually, their cover the role of conveners, network managers, coordinators, or "inspirators" – acting more as curators than proper managers. Important strategic decisions, investments, and real estate operations usually do not fall under their purview.

Finally, OISs' target users and related services are identified, providing an additional layer of differentiation between innovation spaces. Typical users go from startups, SMEs and companies, to researchers, research organisations and public administrations. They can also be students, professionals, customers

and end-users, even citizens and residents. Among the trademark services offered by innovation spaces there are business acceleration, entrepreneurial support, funding and financing advice, technology transfer and IP support, experimentation and testing facilities, training and educational activities, networking, and leisure and working facilities.

Based on our findings, a provisional taxonomy was elaborated. The interim results were subsequently presented at the 39th IASP world conference in September 2022. The feedback received in that occasion from experts, managers, and practitioners informed the finalisation of the taxonomy, which is now proposed in the present report.

3. ORGANISED INNOVATION SPACES

3.1 Science and Technology Parks

3.1.1 Description

According to the definition provided by the International Association of Science Parks and Areas of Innovation[8], a Science Park is:

> An organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities. The expressions "technology park", "technopole", "research park" and "science park" encompass a broad concept and are interchangeable within this definition. The acronym STP (science and technology park) is used to refer to all of these expressions.

According to Ng et al. (2019), the variable use of the terminology tends to be country-specific.

As physical realities, STPs include land, infrastructure and real estate facilities available for their residents/users. A distinguishing feature is the existence of clear and well-defined boundaries, which can, however, delimit one or multiple sites.

In terms of available space, the offer to the market varies: businesses can either buy long-term lease land to build their own premises, or rent space (office, labs, workshops…) with or without further purchasing options. Nowadays, the most common model observed is, by far, space rental in premises mostly owned by the STP, while sale/lease of plots of land was more common in the first generation of STPs, in the '80s, and is now quite rare.

In terms of sectors, technologies, and specialisations, STPs can have three main strategies[9]:

- Generalists: they will host companies and institutions from any technology sector, without any particular preference. They require their residents to be innovation-driven/focused, regardless of the sector they operate in.
- Semi-specialists: they will take in innovation-based companies and institutions from any sector, but privilege some specific sectors/technologies, which tend to eventually become dominant and guide the full specialisation of the STP. IASP recent statistics show that more and more STPs seem to favour a certain degree of semi-specialisation.
- Specialists: they only host companies and institutions belonging to a very narrow array of designated sectors (or only one in stricter cases), bringing about Life Sciences Parks, Bioparks, Agroparks, Aerospace Parks, etc.

Although STPs were initially often developed to support the commercialisation of universities' research results, they have increasingly been recognised as a policy tool for regional and national development (OECD, 2011). In literature, this evolution is generally expressed in generations of STPs (typically first, second, and third). If earlier generations of STPs are based on a linear model of innovation, either "science push" (academia-to-business) or "demand-pull" (business-to-academia), later generations of STPs tend to adopt a multidirectional ("open") approach to innovation, involving triple helix actors (academia-industry-government) and acting as orchestrators of the ecosystem and

[8] IASP. What is a science park? and other definitions from IASP. https://www.iasp.ws/our-industry/definitions/science-park
[9] A similar classification based on level of specialisation can be found in Liberati et al. (2016): the study, based on a 2012 survey administered to 25 Italian Science Parks, identified three levels of specialisation, i.e. general, mixed, and specialised.

catalysing regional development and growth (European Commission, 2014; Romano et al., 2014).

Box 1 Representative Examples

Launched in 1992, Malaga TechPark (known as PTA) is now a 2 million m^2 park located in Malaga, Spain, offering natural surroundings to large multinationals, university institutions, SMEs and innovative startups. Overall, it hosts more than 600 companies and employs over 20,000 people. Main sectors are ICT, which represents 60% of jobs, as well as engineering, consultancy & advisory services, industry, medicine & health, and energy & environment.
A public-private endeavour, Malaga TechPark counts among its shareholders the Regional Council of Andalusia, the Malaga City Council, Unicaja bank, and the University of Malaga (UMA) – a key actor in the ecosystem.
Malaga TechPark runs two pre-incubators to help entrepreneurs with innovative ideas set up companies. For existing companies, the park boasts several incubators to help them through the first years of life. All entrepreneurs at the Malaga TechPark can obtain free legal, business, accounting and tax advice for a year. These centres offer a training area, a business area, and an incubation area, with laboratories and warehouses ready for research and business activities.
Among its incubation activities, the park counts also "The Green Ray", a joint Malaga TechPark-UMA initiative located in a building on the Teatinos campus of the University of Málaga. "The Green Ray" houses companies and entrepreneurs coming from the university and national and international research groups. The park also provides soft-landing services for international companies that wish to set ups their activities in its premises.

The Tehnopol – Tallinn Technology Park is a technology park based in Tallinn, Estonia. It is the largest science park in the Baltic States with over 55 000 m^2 of office and laboratory space available for rent. It was designed as a research and business campus with a mission of helping startups and SMEs to grow more quickly; alongside this, Tehnopol Tallinn's objective is the provision of both modern office spaces and the highest possible quality of consulting for businesses aiming to develop and enter into export markets. They offer a smart research campus facility that forms one big campus area with Tallinn University of Technology.
The Park has over 200 companies operating in its premises, active across various technology sectors, as well as 230 companies using its business services, and over 35 startups currently in its Startup Incubator. Overall, it counts more than 4000 employees. The campus has been developed over time to provide the best benefits to clients – including free parking, a wide range of conference and meeting rooms, restaurants, sporting opportunities, and many other services.

BioSquare is Boston's biomedical research and business address. Located in a city with a vocation for innovation and commerce, it combines state-of-the-art research facilities with comprehensive tenant amenities and services in its campus dedicated to innovation. BioSquare covers 14 acres and offers over 2.5 million square feet of new laboratory and office space. It is situated next to the Boston University Medical Campus and Boston Medical Center, providing corporate tenants access to an outstanding scientific and research community.
Positioned within one mile of the city's central business district, BioSquare is easily accessible via major interstate highways, public transportation, and Logan International Airport. With over 700,000 gross square feet of space now built, BioSquare offers leading life sciences companies an environment designed to foster and support discovery, innovation, and commerce. Infrastructures consist of office space, lab space equipped with cold rooms, centrifuge, autoclave, glass washer, and freezer, and a state-of-the-art life sciences lab. Biomedical research support services are also provided, as well as flexible, all-inclusive arrangements available from 6 months to 2 years, and a number of other ancillary services.

Kilometro Rosso is located in the Lombardy region, Italy. Kilometro Rosso aims to bring together business and research in the same innovative space through the combination of companies, universities and research centres, following the Open Innovation paradigm. Its aim is to develop synergies between different skills and allow accelerated development thereby introducing innovative solutions on the market.
On its premises, Kilometro Rosso has 75 resident companies and over 40 laboratories. It provides a variety of business support services in the varied sectors in which its residents companies operate, both directly and through its community of Resident Partners (i.e. public and private bodies established within the campus). Specifically, organises education and trainings in the field of new technologies and advanced manufacturing, workshops, and other events. It also provides networking opportunities, support to access to funding and financing instruments, as well as promotion and marketing of its resident companies. As a Technology Transfer

Agent, Kilometro Rosso is also committed to create collaborations amongst academic and research institutions and its Resident Partners.
As an example of the terminological heterogeneity related to branding choices of OISs, it is worth mentioning that, albeit presenting all the key characteristics of an STP, Kilometro Rosso is also known as an Innovation District.

Thailand Science Park (TSP) - Bangkok is Thailand's first science and technology park, established in 2002 with the mission to promote innovation development and R&D activities in the private sector. TSP builds the ecosystem to promote and support R&D linkage between government and private sector, and stimulate the creation of new technology businesses. The park has a sectoral focus, namely on Food, Life Science, and Electronics.
The park is located next to Thammasat University (Rangsit campus) and the Asian Institute of Technology. The 140 000 m^2 of space where the park was first established are occupied by the National Science and Technology Development Agency (NSTDA), its four sectoral national research centres (specialising in Genetic Engineering and Biotechnology; Metal and Materials Technology; Electronics and Computer Technology; and Nanotechnology), and over 90 corporate tenants, of which around one third are international companies. Corporate tenants have thus access to highly-skilled personnel, including 2 000 full-time NSTDA researchers, with around 700 being PhD scientists. The park was subsequently expanded to accommodate the so called Innovation Cluster 2, an area of 125 000 m^2 housing new state of the art infrastructures.
Among the wide array of infrastructures offered, there are wet and dry labs, office space, a mechanical & electrical building, heavy equipment lab and a sensitive lab, as well as meeting and recreational areas. The services provided span across contract research and research services, business support (IP, business matching services), financial services, and trainings. The park also set up a Business Incubation Centre for tech-based startups.

3.1.2 Scale and location

Recent data show that 75% of STPs have an area from 100 000 to 1 000 000 m^2, although aa significant 18% of STPs present an area over 1 000 000 m^2.

Location wise, STPs are markedly of an urban character, being mainly in cities or in areas adjacent to cities. Regardless, they always have a clearly delimited area.

3.1.3 Governance and management

STPs have legally constituted managing organizations. There are different juridical constructs that are used, but all are fully established, including bylaws and well-defined governance bodies. They also commonly have an on-site, full-time management team (Ng et al., 2019).

In terms of ownership, most STPs throughout the world are owned and launched by the public sector, mainly regional and city governments. However, more and more mixed ownership schemes (PPPs) and, to a lesser extent, fully private STPs are being created. For instance, around 30% of STPs in the EU are under mixed public-private ownership.[10]

Next to governments, Universities are also at times owners of their own STPs, or co-owners under mixed-ownership arrangements.

STPs are characterised by being management intensive, with full time management teams. The management body has a legal entity and it may or may not be the owner of the land and/or of some of the facilities in the STP. In any case, STPs management organisations have ample powers and authority over the life and activities of the park. For example, they can decide which companies or activities can take up residence in the park and which not; under their remits are oftentimes the common activities that can take place in the park, and the services to be implemented; they can decide about building new facilities and refurbishing old ones, as well as on the commercial offer of the park, including the type of offer to be made – e.g. rental, sales…- and the price list.

STP management organisations have a degree of authority and decision-making capacity over the STP as a whole significantly bigger that the one that managers of other

[10] IASP. Statistics. https://www.iasp.ws/our-industry/statistics

innovation spaces usually have. This is one of the main differentiating traits amongst the various Organised Innovation Spaces.

STP management can therefore be described as:

- Intensive, as it entails a permanent and full time management team;
- Comprehensive, i.e. it covers a very wide range of aspect, such as infrastructures, maintenance, commercial, services, networking, institutional relations etc.

3.1.4 Target users and services

Target users in a STP typically are:

- Technology- and innovation-based firms across all stages of maturity, from startups to multinationals (NG et al., 2019). Nevertheless, statistics prove that startups and SMEs are the main STPs residents/users.
- Knowledge- technology related institutions and organisations: university labs and facilities, research institutes, etc.
- Knowledge-based added value professional services providers.

STPs usually provide or make available a large array of services for their residents/users. The presence of sophisticated services is one of the distinctive features of STPs.

Such services can be better visualised using a matrix along two axes:

- type of service:
  - ancillary services (low value added)
  - value added services
- service provider:
  - provided by the STP management team itself
  - externalized services (the STP ensures that certain services are made available to its residents and supervises their).

Using such a matrix, we list now some of the most common facilities and services provided in/by STPs:

Table 1 Services provided by STPs

	Ancillary services	Mid–high value added services
Provided by the STP	Security, surveillance Parking space Maintenance of common areas Meeting rooms, conference rooms	Equipped lab facilities Entrepreneurs' assistance (consulting, monitoring…) Access to networks Patenting and licensing guidance Quality IT connectivity Internationalisation support
Externalized	Restaurants, cafeterias Gym, sports centres	Training Consulting Patenting & licensing consulting

Source: IASP Statistics.

The number and type of services to be found in STPs can depend on a number of factors, including the country/region of the STP and the type of residents it focusses on. A concise literature review of a broader range of services provided in STPs is offered by Ng et al. (2019).

Box 2 Additional Readings

European Commission, Directorate General for Regional and Urban Policy (2014). Setting up, Managing and Evaluating EU Science and Technology Parks: An Advice and Guidance Report on Good Practice. LU: Publications Office. https://data.europa.eu/doi/10.2776/73401

Lund, E., et al. (2020). Public-Private Partnerships for Science and Technology Parks: utilising PPPs and related models for the development and operation of STPs and innovation districts. European Commission, Joint Research Centre, Publications Office, 2020. https://data.europa.eu/doi/10.2760/3057

IASP Global Survey, 2022. https://www.iasp.ws/our-industry/knowledge-room/iasp-global-survey-2022--science-and-technology-parks-and-areas-of-innovation-throughout-the-world

Lund, E. (2019). The Strategic Choices That Science and Technology Parks Must Make. In: Amoroso, S., Link, A., Wright, M. (eds) Science and Technology Parks and Regional Economic Development, *Palgrave Advances in the Economics of Innovation and Technology*, Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-30963-3_2

Ng, W., et. al. (2019). Towards a segmentation of science parks: A typology study on science parks in Europe. *Research Policy*, 48(3): 719-732. https://doi.org/10.1016/j.respol.2018.11.004

Romano, M., et al. (2014). Science Parks and Intellectual Capital: An Integrated Model for Intangibles' Representation, Evaluation and Control. Schiavone, F., and Romano, M. (eds), *Journal of Intellectual Capital*, 15(4): 537–53. https://doi.org/10.1108/JIC-06-2014-0070.

Vásquez-Urriago, A. R., et al. (2016). Science and technology parks and cooperation for innovation: Empirical evidence from Spain. *Research Policy*, 45(1): 137-147. https://doi.org/10.1016/j.respol.2015.07.006

3.2 Industrial Co-innovation Campuses

3.2.1 Description

A few decades ago, it became increasingly clear to companies that innovating on their own did not always produce the best results. In addition, many successful large companies lose their power of action and innovative capacity over time and become trapped in procedures and control – avoiding risks and seeing their innovative ability decline. To overcome this, companies might at times place small units outside the company and let them function as a startup. These are independent teams with their own responsibilities and budgets, comparatively less risk- and failure-averse. These independent but company-specific innovation centres are preferably located in a dynamic, innovation-oriented environment – usually large cities with an innovative and entrepreneurial environment. Innovation centres are physical spaces and/or teams set up by organisations in a global tech hub, with the goal of leveraging the startup, industry, and academic ecosystem that these hubs provide.

In 2015, 38% of the largest 200 companies by revenue (based on the Bloomberg list) have set up innovation centres (Capgemini, 2015). Another strategy adopted by firms is to set up digital platforms to exchange ideas with other companies (or consumers). Although distance should play less and less of a role with all the digital possibilities ('death of distance'), it can be concluded that when it comes to innovation, physical proximity still plays a major role. This may lead companies not only to set up innovation centres or digital platforms, but also to open up their sites to other companies and institutions in order to work on innovations together. This has led to the concept of the industrial co-innovation[11] campus.

The industrial co-innovation campus differs from a science park in that its main leading actor is a (large) company, which is often also the initiator. A science park, on the other hand, is usually focused on a university. The company may be located on the site itself or in the immediate vicinity. The concept of the industrial co-innovation campus is a clear result of changing perceptions of the collaborative opportunities between companies and the benefits of physical proximity. In the past, there have been other spatial developments in which companies settled together in order to benefit from each other's proximity, often referred to as clusters. Industrial co-innovation campuses differ in that they usually occupy a clearly delineated area often owned by the leading company. Moreover, they focus on co-innovation, and resident companies are expected (and encourage each other) to actively engage in collaborative projects, share knowledge and expertise, and strive for innovation excellence.

In some cases, at a later stage the leading company ceases to exist or leaves the site, and the campus can morph into what is traditionally known as a science park – as in the case of Pivot Park (Oss, The Netherlands, were MSD was the leading company) or High Tech Campus (Eindhoven, The Netherlands, were Philips was the leading company).

To date, the concept of an industrial co-innovation campus has not yet been widely applied. As this notion is relatively new, the conclusions reached on the distinguishing features of industrial co-innovation campuses should be considered as tentative and need to be further researched. It is to be expected that both concepts, co-innovation campuses and science parks, can show clear differences, particularly in terms of land ownership and management. In the case of a science park with clear relationships between companies and research institutes, in-depth (academic) research may be pursued and breakthroughs with a large market impact may be sought. Where companies work together with a large company, they are more likely to develop innovations that help strengthen their position in a certain market, or innovations that help to open up new markets. This is not to say that there cannot be a relationship with a university or other research institute, but such a relationship is of a different, weaker order

[11] Open innovation and co-innovation are considered synonyms here.

than that of companies located at a science park.

The concept dates back some ten years, when in the Netherlands a number of initiatives were created or started to be developed whereby a large company would make space on its site available to other companies based on the idea of co-innovation. A co-innovation campus can be described as an entity involving:

> [...] medium-sized and large innovative firms establishing their own 'science park'. [...] The industrial co-innovation campus differs from a general science park in various ways:
>
> - In essence it is all about the links between the host firm and the partner firms established on the company site, whereas the focus of firms located in a science park is clearly on the nearby university.
> - The inter-company links on a science park are generally less intense than those on an industrial campus.
>
> Setting up an industrial co-innovation campus can be successful if the leading firm:
>
> - strongly advocates the idea of innovation and wants to innovate in close cooperation with its suppliers (open innovation or co-innovation);
> - is established in a region which has the characteristics that stimulate innovation and
> - has the space needed by other firms and can create the qualities required to make such an estate a success (Van Dinteren, 2016).

If the lead company maintains a strict admission policy, to achieve a solid and well-functioning network of companies and institutes, a precondition is that it understands the dynamics of inter-organisational networks and develops - or has developed - skills in managing networks and facilitating network processes. Companies can have the opportunity for developing an industrial co-innovation campus when sufficient space is made available – e.g., because of outsourced activities to other countries, optimisation of space due to the introduction of new technology, or surplus of land holdings.

Box 3 Representative Examples

A first example of an industrial co-innovation campus is the Biotech campus in Delft, The Netherlands (https://www.biotechcampusdelft.com/en/). For decades, DSM in Delft has been involved in biotechnological innovations. In 2018, the board of DSM gave its commitment to open up its site in Delft (The Netherlands) for third parties active in biotechnology, and to share its knowledge and infrastructure to create an open innovation campus. The Technical University of Delft is actively collaborating with DSM to successfully develop the Biotech Campus Delft. This is an open innovation campus that helps realize a more responsible living environment, away from a depleting, fossil-based economy to a circular, bio-based economy. The campus hosts startups, tech- and service-providers, SMEs and established companies in the field of industrial biotechnology. Campus management supports the whole innovation cycle, from research to pilot, to production. On the campus, cooperation and knowledge transfer between companies and knowledge institutes is encouraged.
In 2018, DSM and partners Municipality Delft, TU Delft, Province South-Holland and Innovation Quarter, set up the non-profit foundation Planet B.io, supporting entrepreneurs on the Biotech Campus and aiming to contribute to sustainability by promoting industrial biotechnology. Planet B.io actively invests in creating a hub offering students internships, research simulation, and support to companies to grow their innovative business. Planet B.io provides labs and offices and focuses in particular on overcoming scale-up challenges. Planet B.io also facilitates collaborations with the Delft University of Technology, with DSM, with the pilot facility BPF, and creates a community of researchers, professors, co-entrepreneurs, investors and authorities.

A rather recent development is the Novartis Campus in Basel, Switzerland (https://www.campus.novartis.com/en). Novartis has the ambition to create an attractive 20 ha area in which employees can be invited to work together in a new, creative, and communicative fashion. It is an open network for biotechnology, life sciences, digital healthcare and research institutions of all sizes. Tenants have access to a variety of services and amenities, from restaurants and shops to cleaning and security. They also offer (in cooperation with Switzerland Innovation Park Basel Area) startup support, workspaces and networking opportunities. The wide range of services offered, combined with the facilities on site and

the focus on creating an attractive, innovation-stimulating working environment, ensure that this development has all the elements of a state-of-the-art science park. A special element in this campus is the attention paid to architecture, with each building on the campus being designed by a different architect, including Frank O. Gehry, Diener & Diener, and Sanaa.

An example of an industrial co-innovation campus in an early stage of development is the Solvay site in Neder-over-Heembeek, north of Brussels (https://www.shl.dk/new-solvay-campus/). The site is outdated, with offices being spread out in 20 buildings, often distant from one another and hindering the interaction between employees. The restructuring process consists in concentrating the employees in one building, and subsequently repurposing the remaining facilities and creating new ones. In particular, these should host companies and institutions with which Solvay already has a relationship, or with whom close cooperation is expected to lead to new products and breakthroughs. The site will be dedicated to high-tech innovations in chemistry and advanced materials. From there, Solvay intends to develop R&D activities both internally and with partners. An area in the south-eastern part of the site is intended to accommodate other companies, startups, research centres and departments of universities.

3.2.2 Scale and location

The size of an industrial co-innovation campus can vary, often falling within the range from 15 to 50 hectares. The lower limit of 15 hectares offers sufficient opportunities to make it attractive from an urban planning point of view. While a smaller campus does not harm the possibilities for interaction, it might lead to a reduced volume of interaction possibilities due to the smaller size, primarily in terms of employees. Both the Bosch IoT Campus and the Bayer CoLaborator in Berlin are good examples of such smaller developments. The Bosch Campus[12] focuses mainly on the Internet of Things (IoT) and welcomes in particular startups or young companies, supporting them on their product development, benefitting in turn from the proximity to latest ideas and developments. Bayer's CoLaborator[13] is rather small, consisting of a building with 800 m^2 of lab, office, and communal space and nine distinct units of combined laboratories and offices. Bayer provides collaboration and networking opportunities through, among others, scientific workshops, pitching events, conferences, and social events. Both Bosch and Bayer emphasise the independence of their tenants.

Co-innovation campuses are usually located in the city outskirts, typically in an industrial site – e.g. industrial estates or free-standing industrial sites – made available by the leading company.

3.2.3 Governance and management

The initiator of a co-innovation campus is an established company (possibly stimulated by a government), which is the one in charge of governance and management. The governance may thus be limited to the management of the company itself, but there may also be a broader-based board, a steering committee, or another management model. This may be the case, for example, if the government provides (financial) support, or a university collaborates with the companies located on the site. In an article by the Brookings Institution, this model was succinctly described as "industry-driven, university-fuelled, government-funded" (Donahue et al., 2018). According to the authors, the strongest cluster initiatives are driven by the private sector. The strategy to be followed is based on extensive contacts with companies in the cluster. These are local companies that believe they will benefit by working collectively.

The concept of co-innovation campus does not necessarily exclude the involvement of a university or other knowledge institutes, which may take part in the endeavour. However, unlike in STPs, the central hub of the innovation network is a leading innovative company. Knowledge institutions can contribute by e.g., providing research results sparking innovation, supplying talent, and making facilities available. Similarly, government involvement remains possible, increasing in that case the chances of

[12] https://bosch.io/locations/berlin/
[13] https://www.colaborator.bayer.com/en/colaborator-berlin

stimulating the regional economy. For instance, among the partners of the abovementioned BioTech Campus in Delft (Box 3) there are Delft University of Technology and several government organisations. Together with the lead company, which still owns the site, they are working together to accelerate the growth of this campus for white biotechnology, i.e. applied to the food and industry sector.

3.2.4 Target users and services

The target group of a co-innovation campus is determined by the company that initiated and manages the campus. The composition is no different to that of STPs and consists of innovative private companies, universities and higher education institutions in line with the business focus of the main company. They can be both cross-sectoral and sector specific, but it could be assumed that small campuses might function better when adopting a more focused aproach.

The purpose of a co-innovation campus is first and foremost the cooperation between companies and institutions to achieve innovations within a certain sector (or across sectors). The knowledge exchange and cooperation is central. As the leading and host actor is a large and innovative company, possibly leader in its sector, the resident companies can benefit from expensive, state-of-the art facilities they otherwise would not have access to. Through its knowledge and market position, the lead company can support the entire innovation cycle of the established companies and institutions, from research, to pilot, to production.

Services offered can include business development workshops, prototyping, testing and evaluation, training and consulting. For instance, the BioTech Campus in Delft has set up a separate organisation together with other stakeholders, which actively invests in creating an innovation hub providing training, support to companies, labs and offices, and facilitates collaboration of resident companies with other actors from the triple helix (Box 3).

Box 4 Additional Readings

CapGemini Consulting & Altimeter (2015). The innovation game: why and how businesses are investing in innovation centres. https://www.capgemini.com/consulting/wp-content/uploads/sites/30/2017/07/innovation_center_v14.pdf

Donahue, R., et al. (2018). Rethinking cluster initiatives. Brookings Institution. https://www.brookings.edu/research/rethinking-cluster-initiatives/

Meulenbroeks, K (year unknown). Development Biotech Campus Delft & Bioprocess Pilot Facility. https://www2.cm-evora.pt/mecine/presentations/Delft/SPH_Biotech%20Campus%20Delft_Mecine.pdf

Novartis Campus Basel (year unknown). Where innovators advance life sciences. https://www.campus.novartis.com/sites/campus_com/files/novartis-campus-brochure.pdf

Steiber, A. (2020). Technology Management: Corporate-Startup Co-Location and How to Measure the Effects. *Journal of Technology Management & Innovation*, 15 (2). http://dx.doi.org/10.4067/S0718-27242020000200011

Van Dinteren, J. (2016). Your own innovation campus. https://www.linkedin.com/pulse/your-own-innovation-campus-jacques-van-dinteren

Van Dinteren, J., & Jansen, P. (2021). "Areas of Innovation". Nijmegen: the Innovation Area Development Partnership (IADP). https://iadp.co/new-book-on-innovation-areas

3.3 Innovation Districts

3.3.1 Description

An innovation district is a designated existing urban area that has a strong mix of knowledge institutions, companies and startups that are focussed on innovation, but often without a very specific sectoral focus (as can be the case with STPs). Because they are generally inner-city areas, there is a strong mix of functions. In addition to the aforementioned business activities, these include recreational functions, retail and residential. In many cases, the development of such a district coincides with a restructuring of the urban environment.

If we look at the different types of innovation districts, then innovation districts are a fairly recent phenomenon. Although the first ideas for an innovation district in Barcelona date back to the 1990s, it was only two decades ago that the development really got underway. In the United States, the development seems to have been favoured by the decline of the inner cities (donut cities), which made cheap space available for innovative small companies. In many situations, the creation of innovation districts seems to involve existing areas and the development of the innovation area is accompanied by its restructuring. Less common are IDs developed *ex novo*, i.e. without the presence of extant anchor institutions and through a complex and overarching master plan. To a certain extent, Milan Innovation District (MIND) belongs to this *sui generis* ID model, albeit building on top of infrastructures inherited from the EXPO 2015 experience[14].

Box 5 Representative Examples

The Kendall Square Innovation District (Cambridge, Massachusetts; https://kendallsquare.mit.edu/) is a clear example of a university-led development. The first ideas emerged in the 1960s, when the term "innovation district" had not yet been coined. When MIT began investing in research in the late 1970s that would create the biotech boom, and entrepreneurs and startups began looking for new office space next to the university in the 1980s, Kendall Square, with its abundant parking and empty industrial space, beckoned. Since 2010, the Massachusetts Institute of Technology (MIT) has been working with other stakeholders on a plan to bring new vibrancy and diversity to the area, including housing, laboratory and research space, retail, and an attractive public space. Within a one-mile radius, 66,000 people now work. Although a metro station is located a short distance away, pressure on the area is increasing in the form of traffic congestion and rising housing prices. MIT has invested heavily in solving some of these infrastructural challenges.

There is a particularly interesting development in the city of Stockholm, called Hagastaden (https://ssci.se/en/activities/hagastaden), which could perhaps be described as an innovation district in the making. The City of Stockholm singled out the area as an urban development project in the early 2000s. At the same time, the medical university, Karolinska Institutet, was developing an idea that involved creating a centre for bio scientific research in an attractive environment. This prompted the cities of Stockholm and Solna to jointly invest in a new area – Hagastaden. It is being integrated with the New Karolinska Solna University Hospital, a completely new university hospital which opened 2016 to meet future demands for medical care and research. Hagastaden is an emerging cluster for life science actors large and small. By 2030, the area of Norra Station between the city of Stockholm and Solna, will be built and developed into an entirely new neighbourhood with a mixture of apartments, workplaces, cultural attractions, green areas, world-leading research and highly specialized medical care. The area covers almost 100 ha and will employ 50,000 people.

Another example is the Knowledge Quarter in London (https://www.knowledgequarter.london/). Not prompted by urban redevelopment, but first and foremost based on the desire of companies and institutions around King's Cross Station to work more closely together in the field of innovation. Within a one-mile radius of King's Cross is a remarkable cluster of organisations spanning research, higher education, science, art, culture and media. Individually, they offer resources for specialists in numerous fields, from architecture and the arts to biotechnology and veterinary science. The Knowledge

[14] https://www.mindmilano.it/en/

Quarter brings together over 85 cultural, research, scientific, business and academic institutions both large and small under one umbrella. The Knowledge Quarter fosters knowledge exchange and collaboration between staff and users of cross-disciplinary communities to exchange ideas, expertise and evidence. Developing networks to encourage collaborative projects, training, commissioned research and access to funding, engaging a wide variety of audiences and benefiting the local research community. Although primarily an economic network focused on innovation, the urban development component is now coming into play as well, including new buildings for Google and an urban plan for the area.

3.3.2 Scale and location

Innovation takes place where people come together. It is not a phenomenon for isolated spaces. That is why innovation districts appear in existing urban areas. As economies become more specialised and knowledge-intensive, companies increasingly appreciate the way city centres achieve a high degree of face-to-face contact and informal meetings. The prediction that due to new communication technologies "distance is dead" has not come true.

Innovation Districts are characterised by an 'open' structure without sharp borders; if boundaries are defined, it is usually for coordination needs. The Knowledge Quarter in London, for example, describes its territory as an area within a one-mile radius of King's Cross railway station.

Central locations such as this give access to a broad pool of skilled and creative employees, whom themselves appreciate the liveliness of inner cities, especially when it comes to shopping and leisure offers, cultural facilities and places to meet with others. Centrally located innovation districts can be reached easily by different modes of transport. However, it is not necessary to travel or commute, as the district and its immediate surroundings offer a great variety of housing opportunities. This mix of functions makes the district dynamic and attractive for young knowledge workers seeking a vibrant, small community with a combination of living, working and recreation.

Although the first innovation districts were found in the central parts of cities, we are now seeing innovation districts emerge in other urban locations as well. A study of innovation districts in the United Kingdom (Arup, 2018) shows that innovation districts can also emerge on the edge of a central business district or even elsewhere in the city. Increasingly, knowledge-intensive jobs are clustering in the CBDs of UK cities. Several cities such as Manchester, Leeds, Bristol and Newcastle are expanding the physical size and economic contribution of their city centres through regenerating and connecting city centre fringe innovation districts. Others are creating or enhancing separate new urban quarters that are well connected with the CBD and other economic assets. The most high-profile example is the Queen Elizabeth Olympic Park in East London, which has benefited in huge transport infrastructure investments to connect it to central London and Canary Wharf, as well as to surrounding centres and neighbourhoods. Other examples include the Glasgow West End and Waterfront Innovation District, where recent and current investments in a major expansion of the university campus, a new hospital, and new conference and exhibition facilities are being brought together to create a coherent urban district. In Knowledge Quarter Liverpool, a new campus and commercial development is creating a vibrant urban district (Van Dinteren and Jansen, 2021).

Table. 2 A Typology of UK Innovation Districts

Type of innovation District	Example
City centre expansion – development of new urban quarters, or strengthened connections with edge of city centre campuses, to expand the size and	Oxford Road Corridor, Manchester Leeds Innovation District

economic contribution of city centre economies and central business districts.	Knowledge Quarter London (in so far as the Kings Cross Central scheme has expanded a long-established knowledge quarter) The emerging Bristol Temple Quarter district next to Bristle Temple Meads Station Newcastle Science Central
New urban quarters – generally in inner urban areas based around major transport nodes, expanding campuses, and improved connections to city centres and surrounding developments and neighbourhoods.	Queen Elizabeth Olympic Park, London Glasgow West End and Waterfront Innovation District Knowledge Quarter Gateway and the Paddington Village development within Knowledge Quarter Liverpool
Out-of-town technology parks – some out of town technology parks are being repurposed and reinvented as innovation districts, with a wider mix of uses, and stronger links to nearby city-based innovation assets	Advanced Manufacturing Park, Sheffield Alderley Park, Cheshire Proposed University of Leeds, Technology Park in Aire Valley Leeds National Manufacturing Institute for Scotland at Inchinnan, Renfrewshire

Source: own elaboration from ARUP, 2018

Katz and Wagner (2014) identify three main models of innovation districts, based on their location:

- The "anchor plus" model refers to innovation districts located in the downtowns and mid-towns of central cities. There, large-scale mixed-use development takes place around major anchor institutions, and a wide base of related firms, entrepreneurs and spin-off companies are involved in commercialization activities.
- Innovation districts falling under the "re-imagined urban areas" model are usually located near or along historic waterfronts. They consist in industrial or warehouse districts undergoing a physical and economic transformation. This is often powered by transit access, a historic building stock, and proximity to downtowns in high rent cities, accompanied by the presence of advanced research institutions and anchor companies.
- The "urbanized science park" model is typical of suburban and exurban areas, and includes traditionally isolated, sprawling areas of innovation that are urbanizing through increased density and proliferation of new activities (e.g. retail and restaurants) that are mixed instead of separated.

Taken the various models of innovation districts into account, we can conclude that the minimum size of an innovation district is around 50 hectares, and the bigger ones are up to 200 hectares.

3.3.3 Governance and management

The importance of e.g., networks, offer of services, availability of space, and information in the innovation process requires an organisation generating and managing such a specific work and business environment. In the case of an innovation district, this will be an organisation of companies and institutions established in the area, maybe with the involvement of the municipality or other relevant parties (e.g., Chambers of Commerce, financial institutions). This is due to the fact that IDs are generally located in an existing urban area with numerous owners. Both public and private parties should be led by ambitious people who are respected and supported by entrepreneurs, residents and others. All parties should be represented in a management organisation where coordination takes place, and the long-term strategy is set, implemented, and adjusted. Given the nature of the development, it is appropriate to set up an interdisciplinary team on the local government side (Van Dinteren, 2023).

Management organisations take various shapes, with triple and quadruple helix actors, being directly or indirectly committed (e.g. by steering or through investment committees). In most cases, multiple real estate developers and investors, universities, hospitals, research institutes and businesses are involved from the private sector. On the public sector side,

there is involvement at various levels of governance – from city, to state, to national governments. The scope of the management organisations is not limited to managing and financing the hardware (e.g., infrastructure, buildings, public spaces), but includes also socio-economic activities. Examples are the programming of community events, contributing to the development of a surrounding ecosystem, involving local communities, supporting startups and accelerators, organising tech nights. Financing such activities is complex, and the financial effort is often inconsistent, limited in time, and concentrated on a selected activity. Consequently, service offering can represent a challenge.

The management of an innovation district can be shaped in different ways, depending on the specific context and objectives of the district. Below are some possibilities (Van Dinteren, 2023):

- Public-private partnership: a common way to manage an innovation district is through a public-private partnership, in which the public and private sectors work together to develop and manage the district. This can be in the form of a joint development company or a company or organisation appointed by the government.
- Community-based governance: another approach is community-based governance, where the local community plays an essential role in managing the district. This can be done, for example, through a Community Development Corporation, which is set up and run by residents and entrepreneurs.
- Self-governance: some innovation districts opt for a self-governance model, where the management structure is built from the organisations already operating in the district. This may be a non-profit organisation or an association of entrepreneurs committed to the district's growth and development.
- Hybrid: many innovation districts have a hybrid management structure, using elements of several of the above approaches.

Most importantly, management in an innovation district is transparent and accessible to all stakeholders, and there is clear accountability and communication between the various parties involved in the development and management of the district.

The organisation's scope also includes coordination of investments, policy formulation and implementation.

Innovation districts can come in many forms, and the management can vary accordingly. For instance, albeit representing a rare occurrence, the ex-novo development of an innovation district (e.g., the Milano Innovation District) is more straightforward and presents a lower level of complexity compared to a scenario where numerous parties, already settled in the area, have to coordinate and align interests to transition into an ID. Depending on the contingent situation, the organisation can take on either an informal or a semi-formal setup; similarly, the scope of management activities is often non-comprehensive but can be more granular in some cases.

3.3.4 Target users and services

An innovation district usually has a mix of target groups, including companies, startups, and institutions, often operating in a variety of sectors. Emblematic example is 22@Barcelona, with four different clusters of economic activity. Less common are innovation districts that have a clear emphasis on a particular sector, such as the Ontario Media Innovation District and MediaCityUK in Manchester, UK. In general, the varieties of target users of Innovation Districts are broader and less focused than in other Organised Innovation Spaces.

The mixed character of an Innovation District is often one of its most attractive features, as it offers opportunities for so-called crossovers – i.e., new ideas about products that come about through cooperation between two or more completely different activities. For instance, research revealed that innovation districts in the United Kingdom "are seeking to build strengths and develop linkages across a range of different sectors, recognising the benefits of interaction between them. They have all succeeded in amplifying cross-sectoral activity" (Arup, 2018). This study demonstrates how management organisations coordinate linkages between different industrial, educational, and research activities. An example can be found in

London's Knowledge Quarter, which showcases cross-thematic collaborations:

- The Public Collaboration Lab at Central Saint Martins and Camden Council have formed a strategic partnership, exploring how design research and teaching can contribute to service, policy, and social innovation within the context of the local government.
- The Digital Music Lab project, a collaboration between City University of London's Machine Learning Group, UCL, the British Library, and Queen Mary University, focuses on developing research methods and software infrastructure to analyse and explore large-scale music collections.
- London Metropolitan Archives and the London School of Hygiene and Tropical Medicine partnered to engage school children on the topic of the spread of infectious diseases (Arup, 2018).

Due to the mix of ownership structures, usually there is no admission policy in an innovation district. People and companies can therefore establish themselves relatively freely (within the limits of the law).

A wide range of services is being offered to the guests in Innovation Districts. As a result, management organisations often work together with various suppliers, like well-known social networking programmers, such as the Venture Café Foundation. Services offered vary from basic real estate services to extensive business and financial support for initiatives born and grown in the innovation district.

Box 6 Additional Readings

Adu-McVie, R., et al. (2022). Innovation district typology classification via performance framework: insights from Sydney, Melbourne, and Brisbane. *Buildings*, 12 (9): 1398. https://doi.org/10.3390/buildings12091398

Aretian & Opinno (2019). The atlas of innovation districts. https://www.aretian.com/atlas

Arup & the UK Innovation District Group (2018). UK Innovation Districts and Knowledge Quarters; driving more productive growth. https://www.arup.com/perspectives/publications/research/section/innovation-districts-how-can-we-drive-growth-in-major-uk-cities

Hegyi, F. B., et al. (2021). Measuring the impact of urban innovation districts. European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/11053

Katz, B., Wagner, J. (2014). The rise of innovation districts. Brookings Institute. https://c24215cec6c97b637db6-9c0895f07c3474f6636f95b6bf3db172.ssl.cf1.rackcdn.com/content/metro-innovation-districts/~/media/programs/metro/images/innovation/innovationdistricts1.pdf

Lund, E., et al. (2020). Public-Private Partnerships for Science and Technology Parks: utilising PPPs and related models for the development and operation of STPs and innovation districts. European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/3057

Pancholi, S., et al (2020). University and innovation district symbiosis in the context of placemaking: insights from Australian cities. *Land Use Policy*, 99. https://doi.org/10.1016/j.landusepol.2020.105109

Van Dinteren, J. (2023). What exactly is an innovation district? Paper for the 40th IASP International Conference, Luxembourg City.

Van Dinteren, J., & Jansen, P. (2021). Areas of Innovation. Nijmegen: the Innovation Area Development Partnership (IADP). https://iadp.co/new-book-on-innovation-areas

Innovation Quarter (2022). Keys to Developing a Vibrant, Dynamic Innovation District. Winston-Salem: Innovation Quarter. https://www.innovationquarter.com/innovation-districts/

3.4 Areas of Innovation

3.4.1 Description

According to the definition provided by the International Association of Science Parks and Areas of Innovation, Areas of Innovation (AOIs) are:

> Places designed and curated to attract entrepreneurial-minded people, skilled talent, knowledge-intensive businesses and investments, by developing and combining a set of infrastructural, institutional, scientific, technological, educational and social assets, together with value added services, thus enhancing sustainable economic development and prosperity with and for the community[15].

Different types of "spaces for innovation" that respond to this definition have emerged in the last years. A redefinition of the expression "Area of Innovation" including elements or features that allow distinguishing between several of these new spaces would seem in order.

Areas of Innovation usually refer to relatively big geographical units, wider than STPs or Innovation Districts, but smaller than what are usually referred to as Innovation Regions. In many cases, they spread out over the area of a city or part of a region. The term "corridors" (e.g., Innovation Corridor) can also be understood as an Area of Innovation.

An AOI encompasses different elements conducive to the development and consolidation of a knowledge-based economy, and may include within its territory other entities and projects – such as STPs, Incubators, and Living Labs –, as well as a variety of institutions involved in the economic development of the area – like universities, technology centres, special facilities for firms and startups, and public agencies.

The evolution of Areas of Innovation can be often traced back to a pre-existing entity, such as a STP or a university, acting as an aggregating hub. In this context, the emergence of AOIs is explained as a sort of adaptive evolution of the traditional STP, lacking a social dimension and failing to engage in a sustainable ecosystem (Pique et al., 2019).

In literature, a notion related to that of AOIs is that of knowledge cities/Cities of Knowledge (Pique et al., 2020; O'Mara, 2005) – "clusterisation of activities related with science, technology and innovation in urban areas, which operate as engines for economic development" (Pique et al., 2019).

For the variety of innovation players and stakeholders they comprise and the complexity and different layers of interrelations among them (Tataj, 2022), AOIs are closer to being ecosystems in their own right than actors operating in innovation ecosystems.

Box 7 Representative Examples

In approximately a 2km radius, the City of Göteborg (Sweden) hosts in its urban area three STPs – Lindholmen, Sahlgrenska, and Johanneberg – two universities, Chalmers and Gothenburg University, and numerous research institutes, such as AI Sweden and RISE. The city has a high density of testbeds and LLs, and is home to major companies operating in the automotive, life sciences, and ICT sectors – such as Volvo, Volvo Cars, Geely, Ericsson, SKF, AstraZeneca, Getinge, Mölnlycke, and RUAG Space. To support the creation of an attractive and fertile environment for sustainable growth and innovation, Göteborg municipality, in collaboration with the region, established Business Region Göteborg, a non-for-profit organisation representing thirteen municipalities in the region. It promotes business development and innovation in the area by fostering collaboration between business, academia, and public sector, and attracting foreign direct investments. It supports businesses by

[15] IASP. What is a science park? and other definitions from IASP. https://www.iasp.ws/our-industry/definitions/science-park

facilitating access to e.g., public funding, private and institutional investors, incubation programmes, networks, and collaboration spaces.

The City of Espoo (Finland)'s innovation ecosystem is built around strategic partnerships with Aalto University and VTT Technical Research Centre of Finland. It benefits from the presence of strong corporations such as Nokia, and a rich startup ecosystem.[16] A high level of concentration of innovation actors is reached in particular in the so-called Espoo Innovation Garden in the Otaniemi-Keilaniemi-Tapiola area, hosting a science community of more than 25 HEI and research centres, including Aalto University and VTT. It is home to companies like Kone, Fortum, Neste Oil and Rovio, and hosts the startup hub and incubator Startup Sauna. The area covers around 4 km^2 and has 44,000 residents, 5,000 researchers and 16,000 students. It hosts 200 local foreign companies, and workers representing 100 different nationalities. About half of the R&D activities in Finland take place in this area. Sectors of focus are the ICT or ICT-intensive services (Rissola, 2017). Enter Espoo, entirely owned by the city of Espoo, orchestrates the city ecosystem and acts as a facilitator in the area to help companies, investors, visitors, and travel professionals to access business opportunities in Espoo's innovation ecosystem. It provides advice on access to services, matching with startups and technologies, as well as partners and working and collaboration spaces, also through digital platforms. It also strives to increase the attractiveness of the city by promoting travel opportunities and offering support and guidance to visitors. With this purpose, it works together with the startup ecosystem, travel companies, education institutions, neighbouring cities in the Greater Helsinki area, as well as local and national agencies. Key actors are represented in Enter Espoo's Boards.

Ann Arbor in Michigan (US) developed into an AOI thanks to the presence of an enabling environment supported by the Univeristy of Michingan and the Innovation District of Ann Arbor SPARK (Tataj, 2022). A favourable entrepreneurial innovation ecosystem in the city first emerged around, and under the leadership of, the University of Michigan, which pushed for the creation of a public-private platform for regional economic development that in 2006 materialised into Ann Arbor SPARK. Ann Arbor SPARK is a non-for-profit organisation based on a public-private-partnership between business, government, and academic institutions, providing business development services such as business expansion, startup incubation and acceleration, and access to funding. It also provides co-working spaces, trainings, and networking opportunities (Berarducci, 2019). The organisation brings together a plethora of partners – private actors, institutional investors, public administrations, and higher education institutions – represented in the Board of Directors.[17] Innovation efforts are focused on strategic sectors such as the automotive and mobility industry, life sciences, data and ICT. In particular, the Ann Arbour SPARK played a key role in relaunching the traditional automotive sector, leading its transition to industry 4.0. Building on this legacy, the city of Ann Arbour hosted real-world testbeds and living lab projects on mobility, orchestrated under the guidance of SPARK and with the involvement of strong stakeholders (Tataj, 2022).[18] Examples are A2GO, an autonomous vehicle shuttle service; the Ford's City Insight Platform for the use of dynamic metrics; and the Ann Arbor Connected Vehicle Test Environment, a real-world testing environment for advanced mobility infrastructure.[19]

Atlanpole is a key project of the Greater Nantes Area of Innovation, comprising nearly 500 companies, several science parks, incubators, accelerators, and connecting all of Western France's innovative clusters from various fields including digital, advanced manufacturing, biotech, agrifood and clean tech. As the main Innovation Hub in Western France, Atlanpole is the official science-based business incubator for the whole Pays de La Loire region. It hosts (as the end of June 2020) 497 resident companies employing roughly 28,000 people, from startups and SMEs to large companies including the Chantiers de l'Atlantique, and Airbus as well, with two large manufacturing plants in Nantes and Saint-Nazaire. Atlanpole is also home to 71 research and higher education organisations. It is a centre of excellence for a number of key industries such as agrifoods, aeronautics, biotechnologies, sustainable development, wood and derivatives, culture and creativity, complex composite and metal materials, mechanical industries, sea life sciences, ICT, as well as health.

[16] Gassen, G., Creating a thriving innovation environment: Recipes for success of multi-stakeholder partnerships, Webinar, EU Knowledge Valorisation Week, April 21st, 2021.
[17] Ann Arbor SPARK 2021 Annual Report, May 16th, 2022.
[18] Ann Arbor SPARK 2021 Annual Report, May 16th, 2022.
[19] Ann Arbor SPARK Sector Report, Automotive Technology and Mobility, June 14th, 2022.

3.4.2 Scale and location

Being often born out of a process of accumulation and aggregation, Areas of Innovation tend to be scattered throughout the city or part of a region. Regardless of their scale, AOIs often develop around pre-existing STPs and/or lead universities, such as in the case of Göteborg (Sweden) and Ann Arbor (Box 7).

The spatial dimension criterion plays a key role in differentiating AOIs from other OISs, especially Innovation Districts: where the latter are usually spatially concentrated, the former are more dispersed, and cover a wider geographical area.

3.4.3 Governance and management

The fertile substrate for the development of an AOI can develop through a tacit and spontaneous bottom-up process. However, when a critical mass of assets in the territory is reached (e.g., higher education, research, and innovation entities, research and knowledge base, skills, and entrepreneurial environment) a certain level of coordination is needed in order to be able to identify an AOI. After that, it is possible to denote the orchestration of an AOI, meant as a deliberate process or "collaborative intentionality" (Tataj, 2022). This process can be guided or facilitated by independent bodies, often related to public actors such as local/regional administrative authorities, as in the cases of Göteborg and Espoo (Box 7).

These independent bodies (publicly owned established companies, foundations, etc.) tend to be formally established. Yet, and due to the large areas in which they operate, their "authority" over those areas is less comprehensive than that the STP managers have over their parks, as AOIs focus more on services, networking, coordination, investment attraction, than on infrastructures and real-estate-based operations.

In other words, although the organisational set-up can take a formal configuration, the management of AOI is not comprehensive, and the operational activities remain under the purview of innovation actors like STPs, such as in the case of Göteborg (Rissola, 2019).

3.4.4 Target users and services

Broadly speaking, AOIs drive the process of aggregation of resources (Nikina-Ruohonen, 2021) necessary for the business and innovation ecosystem to thrive. They provide high-value services for business and startups, and opportunities for researchers and professionals. This can happen indirectly, through the innovation actors that AOIs host, and/or directly, through the orchestrating organisation itself – such as in the case of Business Region Goteborg (Box 7).

AOIs can also offer a desirable living environment, good quality of life, and an attractive destination for business tourists (Pinho, 2019), like the city of Espoo. Excellent education and job opportunities can also represent favourable conditions encouraging the installation of new residents, researchers, and professionals - as in the case of Ann Arbor (Box 7).

In this sense, AOIs provide an ideal setting for the transition to a quadruple-, and even quintuple-, helix paradigm, integrating citizens/users and the environment in the innovation process and economic growth.

Box 8 Additional Readings

Berarducci, L. (2019). Ann Arbor SPARK *Economic Development Journal*. 18(4): 11-16. https://www.iedconline.org/pages/edj-fall-2019/

Hirtenkauf, A. G., et al. (2022). On the naming of innovation districts. *Journal of Evolutionary Studies in Business,* 7(2): 268-297. https://doi.org/10.1344/jesb2022.2.j113

Nikina-Ruohonen, A. (2021). Leading and Managing Areas of Innovation: The Multi-Stakeholder and Startup Perspectives. HHBIC 2020, 17–18.11.2020, Online. https://esignals.fi/research/en/2021/02/15/leading-and-managing-areas-of-innovation-the-multi-stakeholder-and-startup-perspectives/#e3946ea5

Pinho, M., and Marques, J. (2019). Business tourism in Porto: An empirical investigation of its potentialities and development challenges. *International Journal of Tourism Cities*. https://doi.org/10.1108/IJTC-05-2019-0071

Pique, J.M., et al. (2020). Application of the Triple Helix Model in the Creation and Evolution of Areas of Innovation. In: Abu-Tair, A. et al., (eds), Proceedings of the II International Triple Helix Summit, THS 2018. *Lecture Notes in Civil Engineering*, 43, Springer, Cham. https://doi.org/10.1007/978-3-030-23898-8_17

Pique, J.M., et al. (2019). Areas of innovation in cities: the evolution of 22@ Barcelona. *International Journal of Knowledge-Based Development*, 10 (1): 3-25. https://doi.org/10.1504/IJKBD.2019.098227

Rapetti, C., et al. (2022). Performance Indicators for the Evolution of Areas of Innovation: Porto Digital Case. *Journal of evolutionary studies in business*. 7(2): 219-267. https://doi.org/10.1344/jesb2022.2.j112

Rissola G., et al. (2017). Place-Based Innovation Ecosystems: Espoo Innovation Garden and Aalto University (Finland). JRC, European Union. https://data.europa.eu/doi/10.2760/949545

Tataj, D. et al. (2022). The Ann Arbor SPARK-Network Intelligence as a driver for the emergence of a next generation science and technology park. *Journal of Evolutionary Studies in Business*. 7(2): 100-132. https://doi.org/10.1344/jesb2022.2.j108

3.5 Incubators and Accelerators

3.5.1 Description

The first public business incubator was founded in the beginning of the 1960s in the United States. In the last 30 years, thousands of incubators have sprung up around the world, and business incubators are now a global phenomenon. Nearly every region with a university also has an incubator with some form of networking and resources. Many larger companies and conglomerates have embraced the incubator concept, and by supporting staff with ideas internally, businesses have sought to develop their company's future business portfolio.

> "An incubation model is broadly defined as the way in which an incubation entity provides support to startups to improve the probability of survival of the portfolio companies and accelerate their development. It is the model used by the organization or mechanism to deliver incubation services to startup companies and create and capture value from them" (Pauwels et al., 2016).

Many countries have well-established national incubator programs designed to support knowledge- and technology-intensive firms with international growth potential. Newness is one of the liabilities for startup ventures that incubators seek to mitigate for entrepreneurs and their ventures, with the goal of improving growth and development. One service many incubators offer is some type of scaling or accelerator programme designed to facilitate market traction. Other services, depending on incubator design, include access to physical resources such as office space and infrastructure, capital, business support, and networking opportunities. Incubators often focus on a particular industrial segment like food, deep-tech, or life science. Private, corporate incubators seek to develop new business ideas within the company's field of operations.

The group of businesses that many incubators seek to recruit often have a highly innovative aspect in their operations, and offer a product or service that is new to the market. These entrepreneurs often lack needed resources, as well as an established reputation and access to networks needed to secure them. In other words, new entrepreneurs may have an idea that could lead to a sustainable business in the long term, but no real knowledge or skills in how to develop and commercialise it. The situation requires knowledge and skills that young entrepreneurs usually do not possess, such as in marketing, sales, and finances – everything that is involved in the future growth and development of new ideas. It is at this point that incubators and their support activities can make a difference.

Incubators can support a new firm in difficulties by compensating for the lack of resources affecting the venture. This supports the process of ideation that the incubator firm must focus on in its early stages of development, giving the firm a respite from needing to create market legitimacy on its own. Incubators also play an important role in mediating contacts and networks that can help the entrepreneur build relations with customers, investors, and other important actors in the wider ecosystem.

Box 9 Representative Examples

Imec is a global R&D and innovation centre based in Leuven, Belgium, specialising in nano- and digital technologies. In addition to being a research institute establishing its own spinoffs, Imec adopts an incubation model, being active in supporting external startups and scaleups by providing access to infrastructure, expertise, mentoring, and funding.[20]
It hosts an accelerator programme, imec.istart, working to create healthy startups by validating their proof-of-concept or prototype and supporting them gain initial market traction and prepare for international growth. imec.istartSince its launch in 2011, imec.istart has supported over 260 tech startups (successful exit: 40+; ceased operations: 40; currently active: 180; unicorn: 1). It has also created two pre-seed investment funds (in 2017, a EUR 30 million evergreen fund in

[20] https://www.imec-int.com/en/what-we-offer/venturing/resources-deep-tech-startups

Belgium; in 2022, a EUR 12 million fund in the Netherlands) while expanding its activities to the Netherlands. Since 2017, UBI Global has ranked imec.istart as the #1 university-business accelerator in Europe and #4 globally. Imec.istart is embedded in the imec research organization as a separate team. The management team consists of a program director and fund manager, as well as a manager of the Belgian program and the Dutch program. Key stakeholders are imec; the Flemish regional government; Fund Partners (co-invested in both funds), Program Partners (industry-specific partners contributing with their know-how and network); Investment Partners; the broader international investor community; and mentors, alumni, and education institutes. Novel-T is a strategic partner and key stakeholder in imec.istart.nl. (The Netherlands). Tenants receive 12–18 months of intensive coaching as well as a mentoring programme, workshops, guidance from domain experts, and other support activities (e.g., shared workspace, software deals, marketing & communications advice, access to investors). Content is tailored to the needs of each startup. Imec.istart welcomes spin-offs from imec research groups and affiliated research organizations, as well as external startups. The programme is industry-agnostic, but only supports startups active in the field of digital technologies (mainly software) and nanotechnologies (chips, sensors, battery technology, photonics, robotics, and so on). All startups are assigned a team of at least two co-founders upon sign-up, and, in most cases, are pre-revenue.
In 2017, together with the Flemish Government, Imec has supported the launch of imec.xpand, providing capital to both imec spin-offs and external deep tech start-ups with the potential to grow into successful companies with a global impact. While imec.expand operates autonomously from imec, selected companies receive financial and operational support from seed to exit, gaining access the imec ecosystem and its unique infrastructure, expertise, and network, giving them a global competitive advantage. The 117 million euros raised in the first imec.xpand were invested in 16 companies that as of 2018 had raised almost 350 million euros of additional financing. As announced in March 2022, the second imec.xpand capital round has raised 150 million euros.[21]

Sting is an incubator (and accelerator) supporting promising Swedish tech startups to increase their chances of survival and growth. The incubator is a key player in Stockholm's startup ecosystem, and has also been instrumental in the development of the Swedish incubator system as well as a role model and inspiration for other incubators in the Nordic countries. Sting supports 25–30 new startups annually; since its inception in 2002, Sting has been a crucial force behind 300 startups that now employ over 3,000 employees. The incubator has three core programmes: "Sting Incubate Deeptech", "Sting incubate", and "Sting accelerate". It provides: i) experienced in-house business coaches (former entrepreneurs and venture capitalists) who hold weekly meetings based on a milestone plan agreed upon with the tenant. Important areas include sales, marketing, financing, and recruitment. ii) expert coaches (professional consultants) who offer 30 hours of coaching in, for example, SEO, tech road mapping, and digital marketing. iii) industry mentors (successful entrepreneurs from various industries) who are available for 2–4 meetings annually per company. The management team consists of a CEO, investor relations managers as managers of talent acquisition and team development. Sting is owned by Electrum (a public-private foundation) and Royal Institute of Technology (KTH). Key stakeholders include Propel Capital (started by Sting, portfolio of 170+ startups); SUP46, THINGS, and H2 (startup hubs); and Luminar Ventures. Financing comes from public funds (Vinnova, the KTH Holding, the City of Stockholm, and Stockholm Regional Council) and private sources (partners, self-financing). Tenants are offered office space, coaching, and funds of up to EUR 50,000. Sting is a non-profit organisation with a re-investment programme. All accepted firms pay via a fee-based model according to their success, in the form of warrants, which the incubator either uses to become a minor shareholder in the firms after 3 years, or relinquishes to receive cash in return. Like the warrants of other shareholders, Sting's warrants will be diluted when the firm acquires new investors. If the firm is successful and sold within 10 years, Sting will receive cash, to be re-invested in the incubator for the support of new ventures.

3.5.2 Scale and location

Generally, incubators rent their premises and avoid owning property. They choose to reside in ecosystems that will provide a good inflow of tenants, often near a university or in a city centre. Their size is usually measured in number of tenants, instead of square metres, although no study has yet to find evidence for an optimal incubator size. Of particular importance are critical tenant mass and availability of sufficient resources. To reach critical mass, incubator membership should be large enough that diverse, interactive relationships easily form. Some incubators are relatively small, with a few hundred square metres and 10–15 tenants, while others are much larger, with tenant businesses situated in different cities or on various university campuses. Finally, there are examples of virtual incubators, with tenants located elsewhere but with access to incubator services.

[21] https://www.imec.be/nl/pers/imec-xpand-haalt-eur-117-miljoen-op-om-in-innovatieve-bedrijven-te-investeren-waar-imec-kennis-ervaring-en-infrastructuur-een-doorslaggevende-rol-speelt

3.5.3 Governance and management

Incubators are usually operated by public bodies, but there are also privately run incubators. Universities, science parks, and local public administrations are often important stakeholders in incubator governance. These normally have representatives on the governing board, but they are not involved in the day-to-day operations of the incubator. Administration is usually small, and an incubator manager, supported by a few co-workers, manages daily operations.

A subordinate area manager can be in charge of, for example, startup processes, sustainability issues, or investor relations. In some countries, like Sweden, a well-developed, national public incubator system is an important source of financial support. Incubators are allowed to apply for grants at regular intervals. To receive funding, tenants must fulfil the criteria set up by the incubator for participation in activities and for incubation and exit processes. Financial stakeholders may also have their own views on tenant recruitment and how these fulfil the criteria related to the extent of innovation, the uniqueness of the knowledge assets, scaling possibilities, and adaptation to a sustainable society. Therefore, investors and funding bodies could considerably affect the design, strategy, and operation of incubators.

Owners of privately controlled incubators, such as industrial companies, seek to harness the driving force of their innovative and entrepreneurial employees. It may be to develop internal innovation into commercial products and services, or to establish new projects or new business areas. Private incubators may also specialize in turning innovative technologies into products – that is, commercializing the ideas of innovative co-workers from other companies that are unable to do so. How the private incubator chooses to support innovators and entrepreneurs follows the same logic found in public incubators. Many corporations have established in-house incubators and accelerators expressly for the purpose of startup collaboration. They achieve scaling of an idea by providing facilities, consultation, training, funding, and occasionally market access.

3.5.4 Target users and services

Incubator usually target startup entrepreneurs (new ventures), teams or individual entrepreneurs. The maturity of the incubator tenants and their ideas can vary, and it is not unusual that a tenant will leave the incubator before the original planned exit. Some incubators have seasoned entrepreneurs in residence so that new entrepreneurs who are developing an idea and contemplating applying to the incubator can test their entrepreneurship skills. This arrangement gives the incubator real-time knowledge of potential applicants and their chances of success if recruited, and is also helpful for the beginning entrepreneur.

A not-so-rare occurrence is for incubators to favour the recruitment of teams of founders over an individual working alone on an idea. Team members tend to complement each other concerning e.g., skills, experience, and driving force, and incubators will often help the sole entrepreneur build a team after recruitment. The character of the tenants often reflects the ecosystem where the incubator is located. For instance, when many tenants are involved in the field of computer gaming, there may be a university nearby that offers research and training in that field. Incubators with a focus on biomedicine may have hospitals and research institutes with just such an interest located in the ecosystem.

Incubators' services focus on supporting startup firms and university-to-business technology transfer, to lead students into entrepreneurship, and to offer acceleration programmes that support high growth ventures in their scaling efforts and whose goal establish a position on the market. To these ends, the services on offer for incubator tenants – resources that are both 'hard', like infrastructure and funding, and 'soft', such as networks and training – are designed to match the needs and maturity of the tenants.

In-house or consulting coaches and mentors support the business development of the incubator tenants, individually or in groups. Another added-value for tenants are the

learning opportunities arising from interactions with other entrepreneurs, as well as the day-to day support they can provide to each other. Other services on offer include various seminars on subjects such as business development, financing, marketing, and sales, and networks for customers and various investors, like venture capitalists and business angels. Incubators continue to play an increasingly significant role in supporting young and new entrepreneurs in the surrounding ecosystem.

Box 10 Additional Readings

Bergek, A., & Norrman, C. (2008). Incubator best practice: A framework. *Technovation*, 28(1-2), 20-28. https://doi.org/10.1016/j.technovation.2007.07.008

Bøllingtoft, A., & Ulhøi, J. P. (2005). The networked business incubator—leveraging entrepreneurial agency? *Journal of Business Venturing*, 20(2), 265-290. https://doi.org/10.1016/j.jbusvent.2003.12.005

Colombo, M. G., & Delmastro, M. (2002). How effective are technology incubators? Evidence from Italy. *Research policy*, 31(7), 1103-1122. https://doi.org/10.1016/S0048-7333(01)00178-0

Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: an assessment of incubating models", *Technovation*, 25(2), 111-121. https://doi.org/10.1016/S0166-4972(03)00076-2

Klofsten, M., et al., (2020). Incubator specialization and size: Divergent paths towards operational scale. *Technological Forecasting and Social Change*, 151. https://doi.org/10.1016/j.techfore.2019.119821

Mian, S. A., Klofsten, M., & Lamine, W. (2021). Handbook of Research on Business and Technology Incubation and Acceleration. Edward Elgar Publishing.

Pauwels, C., et al., (2016). Understanding a new generation incubation model: The accelerator. *Technovation*, 50, 13-24. https://doi.org/10.1016/j.technovation.2015.09.003

3.6 Living Labs

3.6.1 Description

The European Network of Living Labs describes Living Labs as:

> user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. LLs are both practice-driven organisations that facilitate and foster open, collaborative innovation, as well as real-life environments or arenas where both open innovation and user innovation processes can be studied and subject to experiments and where new solutions are developed. LLs operate as intermediaries among citizens, research organisations, companies, cities and regions or joint value co-creation, rapid prototyping or validation to scale up innovation and businesses.[22]

According to said definition, distinguishing features of a LL should be:

- active user involvement;
- real-life settings;
- multi-stakeholder participation;
- a multi-method approach;
- co-creation, i.e., iterations of design cycles with different sets of stakeholders.

While attempting to systematise the extensive knowledge produced on LLs, the definition does not fully address the operational dimension of LLs (Huang and Thomas, 2021) – useful for practitioners, policymakers, and other stakeholders wishing to get involved in LLs (Steen and Van Bueren, 2017). On the other hand, the day-to-day use of the expression, both by academics and practitioners, does little to help settle the debate around the ultimate definition of Living Lab. The term, in its multiple facets (e.g. Urban Living Lab, see *infra*) tends to be used interchangeably with words like "testbeds", "incubator", "hub", or "city lab" (European Commission, 2021; Steen and Van Bueren, 2017). A case study analysis focussing on 90 innovation projects taking place in Amsterdam provided evidence of a phenomenon of misalignment between the labelling choices and actual characteristics of innovation initiatives – with only 12 checking the boxes of both development *and* user-participation enabling genuine co-creation (Steen and Van Bueren, 2017)[23].

Originated as a novel research method for firms to test products and traditionally focused on technological innovation, LLs have then developed into co-creation methodologies and spaces for open innovation[24]. Currently, they extended their focus on sectors such as eHealth, ICT, energy, sustainability, and e-mobility, and are often used in smart cities for technological and social innovation, as well as to develop urban policies (Nesti, 2015).

Following this evolution, the concept of Urban Living Labs has emerged, highlighting the embeddedness of the experimentation activities in the urban context – be it a street, a district, or a whole city (Habibipour, 2020). In this instance, individuals tend to be involved as citizens, or "empowered residents" (Leminen et al., 2017), rather than mere users (Chronéer et al., 2019; Habibipour, 2020). Compared to traditional LL, ULL also present an intrinsically higher level of complexity, in terms of e.g. politics, decision making, and financing models (Chronéer et al., 2019), and entail a long-term commitment. Another notion that has emerged in both literature and practice is that

[22] Definition provided by ENoLL. Among the most cited definitions there are also: Leminen (2013); Følstad (2008); Dell'Era and Landoni (2014).

[23] The authors suggest that projects focussing only on researching, testing, implementing, or demonstrating a pre-developed product, albeit in a real-life environment, should not be referred to as LLs but rather as pilot projects, showcases, test sites, or demos of existing innovations (Westerlund and Leminen, 2011). Similarly, projects lacking users' direct participation should not qualify as proper LLs (Chronéer et al., 2019; Steen and Van Bueren, 2017).

[24] In its wider definition, "Living Lab" seems to be often used as an umbrella term for a physical spaces, networks, methodologies, and projects entailing user-centric co-creation and real-life conditions. Consistently with our methodological choices, for the purpose of this taxonomy we will mostly refer to LLs as physical experimentation spaces.

of Rural Living Labs, facilitating social innovation, innovation in digitalisation, and in business models and entrepreneurship. Compared to ULL, they tend to present less advanced innovations and infrastructures, and stakeholders and activities are scattered throughout a peri-urban or rural area[25].

Of interest is also the notion of Living Lab platform, a "geographical area that forms the arena for multiple living labs focusing on various problems" (Steen and Van Bueren, 2017). The goal of LLs as innovation platforms, as opposed to single short-term and challenge-specific projects, is to foster the creation of an innovation-conducive environment, by promoting and coordinating initiatives within a certain geographical area (Steen and Van Bueren, 2017). LLs have also been described as open innovation networks, or Living Lab networks, building their operations mostly on voluntary collaboration, with the purpose, value-creation, and formality of the coordination mechanism depending on the lead actors (Leminen et al., 2017; Leminen et al., 2012).

Box 11 Representative Examples

HSB Living Lab is a ten-year long research and collaboration project in the built environment sector. The Living Lab consists of a residential building with 29 apartments for students and guest researchers on the campus of Chalmers University of Technology, Gothenburg, Sweden. It entails short and long-term research projects to take place in the research building – such as testing of new methods and materials, and surveys linked to behaviour in the accommodation. Among the partners involved there are Chalmers University of Technology, Johanneberg Science Park, and a wide number of companies (e.g., property construction and management, ICT, technical consultancy), such as HBS and Akademiska Hus. The aim is to facilitate and develop sustainable solutions for the future of living, through the active participation of target-users in both testing and development of innovative products and services. The realistic setting ensures that the solutions developed meet market needs, providing the real estate industry with innovative, financially attractive and viable building solutions.

Living Lab for Health (Catalonia, Spain) is an initiative managed by the IrsiCaixa AIDS Research Institute, offering various programmes and activities to tackle health challenges through a systemic and collaborative approach. It provides consultancy services, such as support in strategic decision-making and in the set-up of Multiactor Communities of Practice. It facilitates the development of participatory research projects, from ideation to implementation. It also produces research on systemic innovation and provides education and training to researchers and students. Partly funded by the Research Institute, the LL counts as main partners "la Caixa" banking Foundation and the regional health public authority. The LL also relies on EU grants, as well as on funding from private companies (e.g. healthcare, pharmaceuticals) and other financial actors (SciShops.eu, Case Study).

ENERGY & WATER – Greater Copenhagen Living Lab is an educational and collaborative living lab in Copenhagen operating in the field of climate adaptation, energy and water supply, and UN SDGs for sustainable cities. It provides engaging education and knowledge, showcases sustainable city solutions, and applies participatory processes – such as co-designing of climate solutions with students, and GIS-based citizen and user involvement for the development of climate adaptation projects. The LL is a public-private partnership between the 'Environmental Educational Services' in the City of Copenhagen and HOFOR, Greater Copenhagen Utility.[26]

In Thessaloniki Smart Mobility Living Lab (ThSMLL) the entire city of Thessaloniki is a citizen-centred platform for testing technological and innovative solutions for mobility, cooperative and autonomous vehicles in real-world conditions. It collects, filters, processes and analyses data related to the mobility of persons and provides value-added services. The data and services are available to public and private institutions, as well as to the citizens (e.g. to remain informed about traffic conditions). For the past decade, ThSMLLhas been aiming at facilitating the re-use of data as well as supporting decision making at both the private and public sector, through the development of algorithms and use of special software. The LL is managed by the Hellenic Institute of Transport (HIC), part of the Centre for Research and Technology-Hellas (CERTH), and is supported by the Municipality of Thesssaloniki, which provides essential mobility data and

[25] In this respect, RLLs seem to consist more in a project or short-term pilot than in an established experimentation space (Habibipour et al., 2021).
[26] https://enoll.org/network/living-labs/?livinglab=energy-amp-water--greater-copenhagen-living-lab

collaborates in EU funded projects[27]. On top of academia and public institutions, ThSMLL's extensive network of mobility stakeholders includes companies, technology providers, and transport network operators[28].

The EU-funded project UNaLab established Urban Living Lab (ULL) demonstration areas in Eindhoven, Tampere and Genova, for experimentation, demonstration and evaluation of replicable nature-based solutions addressing climate- and water-related urban challenges. A network of 7 follower cities and two observers benefitted from the experience gained by the three pilot cities. The NBS were co-created with and for local stakeholders and citizens – contributing to the development of smarter, more inclusive, more resilient and more sustainable urban communities. Led by the three local authorities, the ULLs involved residents and citizens, schools, students, NGOs, private professionals, public professionals and government representatives, companies, academy and researchers (Campailla and Titley, 2019).

City Innovation Exchange Lab (CITIXL) is a public-private partnership in Amsterdam that implements inclusive experimentation, testing with the public in Living Labs, and sharing their expertise and experience globally. The initiative is the follow-up of the IoT Living Lab, promoting IoT interactivity in public spaces to encourage citizens and cities in testing and prototyping innovations. The original project received support from the Open Data Incubator, a project funded by the Horizon 2020 research and innovation programme (Van der Veen, 2016). CITXL helps cities identify common problems, co-develop solutions, identify technology and social impact, leveraging its wide network of LLs in Amsterdam.

3.6.2 Scale and location

Contrary to other forms of open and collaborative innovation, LLs provide a concrete setting for experimentation (Westerlund and Leminen, 2011; Shaffers et al., 2007).

LLs can occupy spaces ranging from individual buildings and campuses, to roads, neighbourhoods or districts, up to large-scale public services at city level, at times extending to peri-urban and rural areas (some examples are provided in Box 11).

Compared to other LLs, the Urban Living Lab expands its activities on a broader urban territory, which can affect how stakeholders are engaged. If ULLs normally take up a clearly defined geographical area and have a manageable scale (Voytenko et al., 2016), a RLL tends to be more scattered and lack spatial concentration.

Regardless of the scale, the presence of real-life (or almost real-life) conditions is one of the key features that differentiates a LL from other controlled experimentation environments, such as testbeds and prototyping platforms (Ballon et al., 2005).

3.6.3 Governance and management

LLs are mostly funded and managed by public actors, such as local governments and universities or research centres. As such, they usually are either entirely public endeavours, or run in a public-private partnership – although some cases of purely private LLs can still be found (Nesti, 2015).[29] The UNaLab handbook for Urban LLs confirms that Public-Private-People Partnerships (4P) is a typical LL governance model, due to its user- (or citizen-) centred approach. The chosen forms to include representatives from the quadruple helix are usually consortium, association, cooperative, and charity (Habibipour, 2020).

Depending on the nature of the LL, the governance can range from bottom-up to top-down. In the former case, the LL is mostly facilitated, with the governance covering development/validation of ideas and needs, and is usually led by public organisations or users. The latter approach is usually applied when companies, universities, or research organisations are in the lead, and is closer to proper management, with a hierarchical structure and formalised control of activities (Leminen, 2013; Leminen et al., 2012).[30]

[27] https://www.imet.gr/index.php/en/news-en-2/910-project-media-release-en
[28] https://www.interregeurope.eu/good-practices/thessaloniki-smart-mobility-living-lab-tiessmll
[29] The study refers to Living Labs set in the EU and being members of ENoLL.
[30] Other authors suggest that the optimal governance model for ULLs should involve a combination of both bottom-up and top-down approaches. The bottom-up approach explicates its potential in the assessment of needs and issues to address through users and citizens involvement, but requires to be complemented by a system providing official visions, targets and procedures. Vice versa, a top-down approach can be further empowered by the participation of civil servants and politicians (Juujärvi and Lund, 2016). For an analysis of Leminen's classification of LLs according to initiating actors, see *infra*.

In terms of scope, the governance can cover the identification of the LL vision; investment decisions; IP management; organization of activities; maintenance of infrastructures; planning of research; monitoring and evaluation. The tasks can also cover administration and management, and project-level decisions – such as project selection and role assignment (Westerlund et al., 2018). Managed assets can be infrastructures such as facilities, ICT networks, hardware, software, sensors, and produced data; its nature and use (e.g. hosting events, workshops, and testing activities) can vary depending on the lab's mission and projects (Westerlund et al., 2018; Habibipour, 2020), and ownership can belong to the LL or a stakeholder.

Tangible outcomes that can derive from LLs' activities include designs, products, prototypes, and other solutions. Intangible assets can be ideas, knowledge, IP rights, services, and social innovations. IP rights in particular can constitute an important (albeit problematic) asset in LLs pursuing technological innovations (Hossain et al., 2019), and therefore stakeholders need to determine ownership of both background and foreground IP. However, adopting a user innovation model, LLs need to achieve a balance between leaving room for creativity and knowledge exchange (European Commission, 2021; Ståhlbröst et al., 2018), and the need to secure ownership of the innovation (Westerlund et al., 2018).

In a LL, stakeholders will typically belong to the whole spectrum of the quadruple helix – i.e. public administration, academia, business, and civil society. They can be "affectees" with a passive role, experimenters, innovators, lead participants, or mere testers (Habibipour, 2020). Examples can be tech and service providers; suppliers; competitors; research units of universities; municipalities; customers and users; citizens (Chronéer et al., 2019); students; consultants; user communities; non-profit organisations (Hossain et al., 2019); interest groups; companies, SMEs or micro-enterprises; practitioners (Ståhlbröst et al., 2018).

Distinguishing feature of a LL is that end-users or citizens are not a mere object of study, but actively participate in the co-creation process (Westerlund and Leminen, 2011). Because of that, LLs are often referred to as public-private-*people* partnerships.

The management team can decide to regulate or not users participation (Closed vs Open Living Labs) (Dell'Era and Landoni, 2014); on the other hand, the LL has ultimately limited authority over those stakeholders for which participation is voluntary and does not entail any contractual obligation. Thus, disengagement and drop-out of stakeholders during experimentation and testing is a concrete risk (Ståhlbröst et al., 2015; Leminen, 2013).

As anticipated, in practice the level of involvement of users varies across organisations or projects identifying as LLs, from user-centred, user-driven, or user-led innovation (Edwards-Schachter, 2019), to full participatory approaches (Huang and Thomas, 2021). In certain cases, there is no engagement in proper co-design and co-production (Nesti, 2015), or users actively participate only in one innovation stage, i.e. testing, or are passive participants in a user-oriented design (Steen, 2017).

Based on the categories of stakeholders initiating or driving the initiative, Westerlund and Leminen (2011) have provided an interesting classification of LLs, highlighting differing purpose, value-creation logic, outcomes, and duration, which should facilitate stakeholders in choosing the type of LL to participate in and what role to adopt (Leminen et al., 2012). Table 3 provides an overview of this classification, and relates it to the most common terminology used to refer to LL or similar endeavours (Edwards-Schachter, 2019).

Table 3 Categories of LLs and stakeholders

LLs Categories (Leminen, 2012)	Purpose and features	Duration	Initiating/ driving actors	Common terminology[31]
Utiliser-driven	Pursue specific R&D objectives. Focused on developing and testing firm products and services, to collect insight on users to support business development.	Short-term	Companies, research organisations	Traditional LL (1st generation LL, testbeds)
Provider-driven	Aim to promote research and produce new knowledge. Some have project lifespans, whereas others have been established as proper innovation platforms.	Short-, medium-, long-term	Universities, consultancies	University LL, Co-lab, Fab-lab
Enabler-driven	Usually pursue public interest objectives, such as the development of a city area; improvement of quality of life; development of smart city solutions or nature-based solutions; sustainability. Because of the complexity of its goals, enabler-driven LLs tend to last longer. Firms' involvement has been traditionally low, as private actors struggle to perceive the value created in these contexts.	Long-term	Public-sector actors, non-governmental organisations, funding actors such as municipalities, regional development organizations.	Urban LL, Rural LL, City Lab, Sustainable LL, Policy Lab, Social Innovation Lab
User-driven	Aimed to address specific problems or common interests, e.g. local housing communities. They are generally long lived, and facilitated by other actors, which provide resources, knowledge, or other forms of support.	Long-term	End-customers, citizens, residents, consumer groups, citizen communities, rural communities	Urban LL, Rural LL, Co-creation lab

Source: own elaborations based on Leminen et al., 2012 and Edwards-Schachter, 2019.

With respect to the management of LLs, a distinction must be made between the set-up and operation of LL platforms or networks and the management of individual projects. The management team of a LL is led by a manager or coordinator (an individual and/or a body) in charge of the overall LL operations and its projects. Dedicated staff, either at project or at LL level, is usually allocated to the user-centred interactions, and a panel manager interacts with users at project-level. Specialists can be dedicated to the management of individual R&I projects and/or piloting activities. Skills in business management might also be needed to develop an appropriate business model for innovation projects and/or the whole LL. Other type of actors are then involved at various stages of the management phase – such as innovators, users, "affectees", financers, and context providers (Ståhlbröst et al., 2015; Ståhlbröst et al., 2018).

Although stakeholder participation modalities and the overall LL governance require a flexible approach, the presence of a clear owner or leader of the LL are crucial (Voytenko et al., 2016). Similarly, the evaluation of activities and impact are important to adapt the LL's vision and goals (Voytenko et al., 2016) – especially considering the user-centred nature of LLs and the iterative approach adopted.

It must be noted that most LLs seem to currently operate on a project-related basis (Schaffers and Turkama, 2012), and their survival is often dependent on political willingness and public funding. Considered the high rate of mortality of LLs (Nesti, 2018), ensuring their long-term financial sustainability seems to remain a challenge. In this regard, the engagement of the private

[31] Extensive examples of terms commonly used to refer to LLs can be found in Edwards-Schachter (2019).

sector remains key for their success – notwithstanding the potential risk of trade-offs between private and public interests (Voytenko et al., 2016).

3.6.4 Target users and services

Broadly speaking, LLs provide resources to convert stakeholders' ideas and needs into products and services (Westerlund et al., 2018).

Although LLs as on open innovation methodology are supposed to involve all stakeholders from the quadruple helix spectrum, services and target users of a LL or a LL project can vary from case to case – depending on its mission (technological vs social/urban innovation) (Westerlund et al., 2018; Juujärvi and Lund, 2016).

Referring to the classification in Leminen (2013), provider-driven LLs provide services to utilisers, educate students in LL research projects, and offer solutions to other stakeholders. Enabler-driven LLs develop solutions matching context-related needs – e.g. improving living conditions of citizens and communities in a geographically restricted area. Utiliser-driven LLs provide a mechanism and resources for users to develop new ideas and prototypes, and validate and test products and services. Finally, user-driven LLs aim to meet needs of users and user communities – e.g. improving living conditions or activities.

As innovation intermediaries between entrepreneurs and users, LLs can provide companies with resources and services for business development – e.g., product research, incubation space, market trend analysis, physical and virtual spaces for experimentation and product testing with users, education (Hossain et al., 2019; Westerlund et al., 2018), idea-generation processes design and pre-market launch assessments (European Commission, 2021). They can also provide education, help foster employment and entrepreneurship, and support the development of digital infrastructures (Westerlund et al., 2018).

A LL can also offer to its partners and stakeholders access to (real or virtual) networks (Fahy et al., 2007), and to knowledge that would otherwise be difficult to acquire for industry partners and public administrations (Westerlund et al., 2018).

Finally, as opposed to other innovation platforms, LLs can also generate useful insight on how to develop regulatory frameworks and public policy in relation to specific innovative technologies and solutions, providing value to local public administrations, and at times also to regulators at other governance levels (European Commission, 2023; Kert, 2022). Indeed, they can be actively used as an agile governance tool for the exploration of the relationship between emerging technologies and regulation of innovation, supporting innovation governance and addressing societal challenges (Alonso Raposo et al., 2021).

Box 12 Additional Readings

Alonso Raposo, M., et al. (2020). JRC future mobility solutions living lab (FMS-Lab): conceptual framework, state of play and way forward. European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/964269

Chronéer, D., Ståhlbröst, A., and Habibipour, A. (2019). Urban Living Labs: Towards an Integrated Understanding of their Key Components. *Technology Innovation Management Review*, 9(3): 50–62. http://doi.org/10.22215/timreview/1224

Dell'Era, C., & Landoni, P. (2014). Living Lab: A methodology between user-centred design and participatory design. *Creativity and Innovation Management*, 23(2): 137-154. https://doi.org/10.1111/caim.12061

Følstad, A. (2008). Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. *Electronic Journal of Virtual Organisations*, 10(5): 99–131. http://hdl.handle.net/11250/2440026

Habibipour, A. et al. (2020). Living Lab Handbook for Urban Living Labs developing nature-based solutions. UNaLab. https://unalab.eu/en/documents/urban-living-lab-handbook

Habibipour, A., et al. (2021). Rural Living Labs: Inclusive Digital Transformation in the Countryside. *Technology Innovation Management Review*, 11(9/10): 59-72. http://doi.org/10.22215/timreview/1465

Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. *Journal of cleaner production*, 213: 976-988. https://doi.org/10.1016/j.jclepro.2018.12.257

Huang, J. H., & Thomas, E. (2021). A Review of Living Lab Research and Methods for User Involvement. *Technology Innovation Management Review*, 11(9/10): 88-107. http://doi.org/10.22215/timreview/1467

Juujärvi, S., & Lund, V. (2016). Enhancing Early Innovation in an Urban Living Lab: Lessons from Espoo, Finland. *Technology Innovation Management Review*. 6 (1): 17-26. http://doi.org/10.22215/timreview/957

Kert, K., Vebrova, M. and Schade, S. (2022). Regulatory learning in experimentation spaces, European Commission, 2022. https://publications.jrc.ec.europa.eu/repository/handle/JRC130458

Leminen, S., et al. (2017). Towards Third-Generation Living Lab Networks in Cities. *Technology Innovation Management Review*, 7(11): 21-35. http://doi.org/10.22215/timreview/1118

Nesti, G. (2018). Co-production for innovation: the urban living lab experience. *Policy and Society*, 37(3): 310-325. https://doi.org/10.1080/14494035.2017.1374692

Ståhlbröst, A., et al. (2015). Stakeholders in smart city living lab processes. Americas Conference on Information Systems, 13-15 August 2015. http://urn.kb.se/resolve?urn=urn%3Anbn%3Ase%3Altu%3Adiva-32793

Ståhlbröst, A., et al. (2018). UNALAB ULL FRAMEWORK-D2.1 Deliverable. UNaLab. https://unalab.eu/en/publications

Steen, K., & Van Bueren, E. (2017a) The defining characteristics of urban living labs. *Technology Innovation Management Review*, 7(7). http://doi.org/10.22215/timreview/1088

4. CONCLUSIONS

The conceptual analysis conducted thus far on physical innovation entities, substantiated by an illustrative array of practical examples, allows to draw the following profiles of Organised Innovation Spaces, of which a schematic outline is provided in Table 4.

Science and Technology Parks are mostly located in urban or peri-urban areas, and are characterised by one or more sites with clearly defined boundaries. The nature of the physical dimension of STPs seem to also affect their governance model, based on the presence of a legally constituted management body and on-site management teams, with extensive control over its premises, services, and activities. In comparative terms with other OISs, the concentrated location, formal organisational structure, and comprehensive management constitute key distinguishing features of an STP. In terms of users and services, STPs are known for making available a wide array of services, from ancillary to high-added value, targeted to "traditional" innovation actors, *i.e.,* companies, research organisation, and Higher Education Institutions.

Industrial Co-Innovation Campuses present a similar profile to that of an STP: they have a formal and comprehensive governance model, are located within a clearly delimited area, and provide a wide variety of facilities and services to industry and academic institutions. They mostly differ in terms of ownership model: a STP is usually driven by, or strongly anchored to, an academic institution, whereas a co-innovation campus is initiated and managed by one industry actor (often with a leading position in its field), and is thus oftentimes located in an industrial site made available by the principal company. For this reason, it will be more probable to find a co-innovation campus in a peri-urban area, at the outskirts of the city, then in urban surroundings.

Innovation Districts usually cover a broader and less clearly delimited area than that of an STP or Industrial Campus. They are less spatially concentrated and are developed in an urban context, often consisting in regeneration projects of run-down areas. Albeit being led by a formal organisation (be it private, public or a partnership of triple-helix stakeholders), IDs present a less comprehensive management than parks and industrial campuses, as the focus of their activity is mostly on coordination, orchestration, ecosystem development, community engagement, and the likes. Within the radius of what is identified as an ID, a wider variety of users than industry and PROs/universities can establish themselves, benefitting from spatial proximity and contributing to the development of the ecosystem – like hospitals, employees, students, and citizens.

After IDs, Areas of Innovation represent a further step in the continuum of innovation spaces, being geographical dimensions spreading across urban and peri-urban areas. Even though they can at times present formally established independent bodies, because of their scattered nature AOIs are mostly orchestrated, and their management is thus non-comprehensive. A distinguishing feature of AOIs is that not only they include in their radius a wide variety of innovation actors from the triple-helix (HEIs, public administrations, businesses and clusters), but they do so by reaching a critical mass. They can also comprise other OISs, such as STPs – which, together with universities, are also often epicentre of their development –, incubators and accelerators, and Living Labs.

Incubators have a formal organisation, with a dedicated, if relatively small, management team holding comprehensive control over their operations. They usually are sectoral and focus their incubation (and acceleration) services to very-early-stages and early-stages startups (and scale-ups), thus presenting a narrower focus in term of target users. As already mentioned, incubators can be part of another OIS, such as an STP, of a university (in which case students with innovative ideas and entrepreneurial mind-set are the main users), or corporate (initiated and operated by a private company). There are also incubator good practises in larger companies that have

adopted the incubator concept, in order to boost their future operations.

Finally, Living Labs have a more or less informal organisational setup, consisting e.g., in a consortium, with non-comprehensive management that aims at facilitating interactions among stakeholders more than at running the operations. Being very versatile, they can be found across the whole spectrum of urban or non-urban locations, depending on their thematic specialisation. They are the emblem of the open innovation model: LL's initiators, stakeholders, and users can belong to the whole continuum of the quadruple-helix, with citizens, residents, students, and other civil society members being integral part of the innovation process as co-creators.

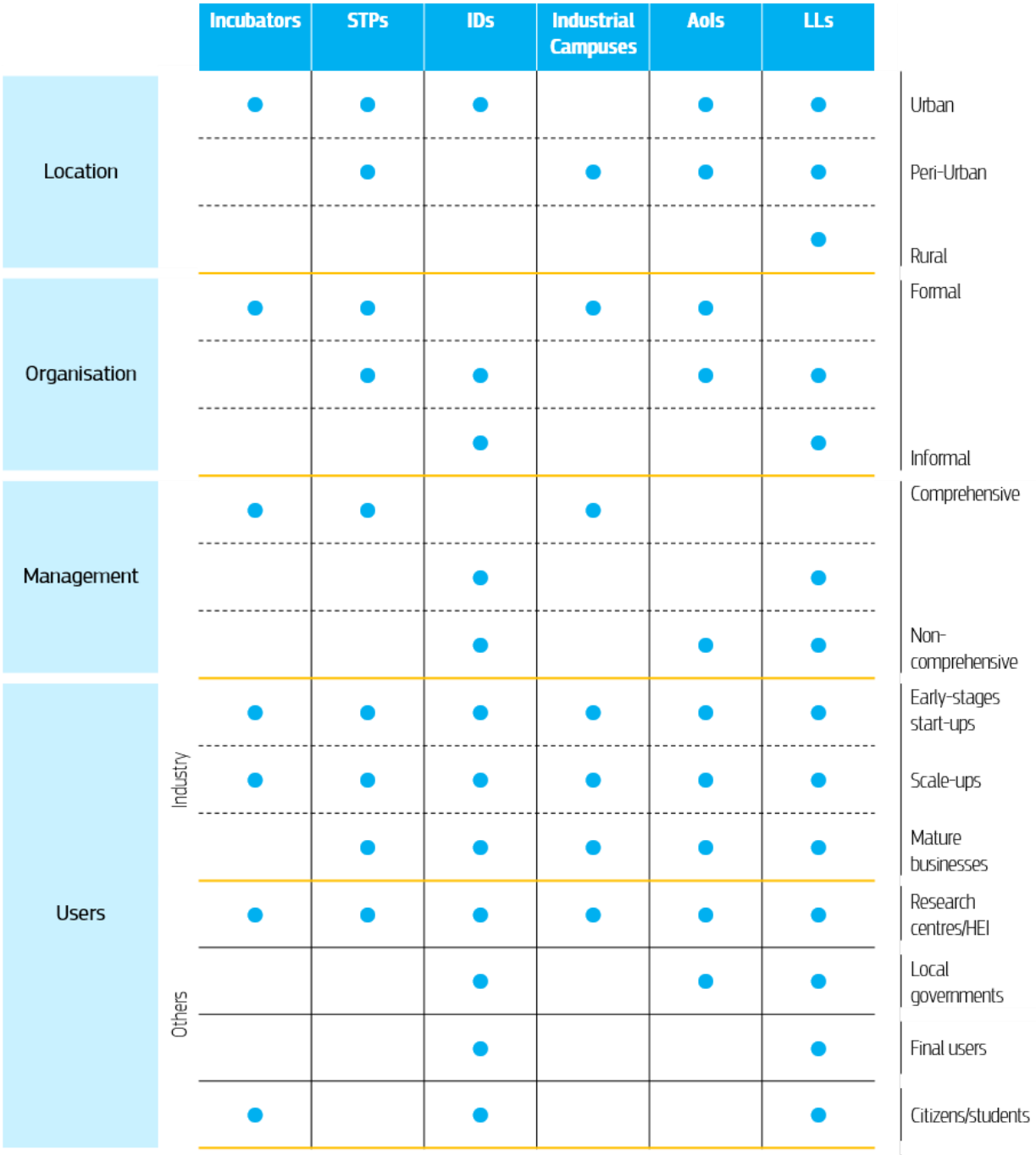
Although too broad generalisations are best avoided, as the phenomenology of OISs can present also consistent variations, by approaching the results transversally it is possible to provide some final observations across the four criteria selected to identify the OISs.

Firstly, each OIS presents a relatively circumscribed profile in terms of geographic location (excluding LLs); however, the true distinguishing element seems to be related more to spatial concentration and existence of clearly defined boundaries. In this respect, it would seem that as the spatial concentration of the OIS decreases (e.g., IDs, AOIs, LLs), the governance becomes softer and more oriented toward orchestration, and strictly understood management tends to cover a more and more narrow set of activities.

With regard to targeted users, it can be noted that such flexibility is also more conducive (or better suited?) to "frontier" models of innovation – i.e., involving a wider selection of quadruple-helix stakeholders (citizens, final users, students), and/or entailing participatory processes and co-creation methods. Conversely, as conceptual categories, none of the OISs (with the exclusion of incubators/accelerators) presents a clear profile in terms of maturity of companies hosted, as it is possible to find heterogeneous real-life examples.

In conclusion, the present report attempted to address the need for the systematisation of the knowledge on innovation ecosystems, focusing on their physical dimension – namely Organised Innovation Spaces. Far from being an exhaustive account of all innovation-related actors and entities, this contribution investigates only one of the many pieces composing the multifaceted innovation ecosystem puzzle, leaving room for further work on other, non-physical dimensions of (open) innovation and co-creation, and potential intersections between the two.

Table 4 Taxonomy of Organised Innovation Spaces



Source: own elaboration

BIBLIOGRAPHY

Adu-McVie, R., et al. (2022). Innovation district typology classification via performance framework: insights from Sydney, Melbourne, and Brisbane. Buildings, 12 (9): 1398. https://doi.org/10.3390/buildings12091398

Alonso Raposo, M., et al. (2020). JRC future mobility solutions living lab (FMS-Lab): conceptual framework, state of play and way forward. European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/964269

Ann Arbor SPARK. 2021 Annual Report, May 16th, 2022. https://annarborusa.org/wp-content/uploads/2022/07/SparkAR2021-lo-1.pdf

Ann Arbor SPARK. Sector Report, Automotive Technology and Mobility, June 14th, 2022. https://annarborusa.org/wp-content/uploads/2022/07/Auto-Mobility-Sector-2022-6.pdf

Aretian & Opinno (2019). The atlas of innovation districts. https://www.aretian.com/atlas

Arup & the UK Innovation District Group (2018). UK Innovation Districts and Knowledge Quarters; driving more productive growth. https://www.arup.com/perspectives/publications/research/section/innovation-districts-how-can-we-drive-growth-in-major-uk-cities

Ballon, P. et al., (2005). Test and Experimentation Platforms for Broadband Innovation: Examining European Practice. 16th International Telecommunications Society Europe Conference, Porto, Portugal, 4-6 September 2005. https://dx.doi.org/10.2139/ssrn.1331557

Berarducci, L. (2019). Ann Arbor SPARK. *Economic Development Journal*, 18(4): 11-16. https://www.iedconline.org/pages/edj-fall-2019/

Bergek, A., & Norrman, C. (2008). Incubator best practice: A framework. *Technovation*, 28(1-2), 20-28. https://doi.org/10.1016/j.technovation.2007.07.008

Bøllingtoft, A., & Ulhøi, J. P. (2005). The networked business incubator—leveraging entrepreneurial agency?.*Journal of Business Venturing*, 20(2), 265-290. https://doi.org/10.1016/j.jbusvent.2003.12.005

Bosch, The Bosch digital office in Berlin. https://bosch.io/locations/berlin/

Campailla, S., and R. Titley (2019). STAKEHOLDERS AND TARGET GROUPS-D7.1 Deliverable. UNaLab. https://unalab.eu/en/publications

CapGemini Consulting & Altimeter (2015). The innovation game: why and how businesses are investing in innovation centres. https://www.capgemini.com/consulting/wp-content/uploads/sites/30/2017/07/innovation_center_v14.pdf

Carrillo, J., et al. (2014). Knowledge and the city: concepts, applications and trends of knowledge-based urban development. Routledge, New York (NY). https://doi.org/10.4324/9781315856650

Chronéer, D., Ståhlbröst, A., and Habibipour , A. (2019). Urban Living Labs: Towards an Integrated Understanding of their Key Components. *Technology Innovation Management Review*, 9(3): 50–62. http://doi.org/10.22215/timreview/1224

Co.Lab, Bayer Co.Lab Incubators. https://www.colaborator.bayer.com/en/colaborator-berlin

Colombo, M. G., & Delmastro, M. (2002). How effective are technology incubators? Evidence from Italy. *Research policy*, 31(7), 1103-1122. https://doi.org/10.1016/S0048-7333(01)00178-0

Davies, J. (2013). From Third Generation Science Parks to Areas of Innovation. In: Paper for the 30th IASP World Conference on Science and Technology Parks. http://inhalt.com.br/portodigital/Planary1Speaker2JANE(DAVIES)UK.pdf

Davies, W. (2015). Developing Knowledge Cities. In: Davies, W. (eds) Theme Cities: Solutions for Urban Problems. *GeoJournal Library*, 112, Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9655-2_11

Dell'Era, C., & Landoni, P. (2014). Living Lab: A methodology between user-centred design and participatory design. *Creativity and Innovation Management*, 23(2): 137-154. https://doi.org/10.1111/caim.12061

Donahue, R., et al. (2018). Rethinking cluster initiatives. Brookings Institution. https://www.brookings.edu/research/rethinking-cluster-initiatives

Edwards-Schachter, M. (2019). Living Labs for social innovation. In: Howaldt, J., et al. (Eds.), Atlas of Social Innovation, Vol. 2 - A World of new Practices. https://doi.org/10.14512/9783962386887

ENoLL. Energy & Water. Greater Copenhagen Living Labs. https://enoll.org/network/living-labs/?livinglab=energy-amp-water--greater-copenhagen-living-lab - description

European Commission, Directorate General for Regional and Urban Policy (2014). Setting up, Managing and Evaluating EU Science and Technology Parks: An Advice and Guidance Report on Good Practice. LU: Publications Office. https://data.europa.eu/doi/10.2776/73401

European Commission, SWD (2023) 277 final. Regulatory learning in the EU. Guidance on regulatory sandboxes, testbeds, and living labs in the EU, with a focus section on energy. https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/new-commission-staff-working-document-sheds-light-experimentation-spaces-regulatory-learning-2023-07-25_en

Fahy, C., et al. (2007). Services of living labs and their networks. http://repository.wit.ie/id/eprint/1495

Fiorentino, S. (2022). New investment models for urban innovation ecosystems. European Commission, Joint Research Centre, Publications Office of the European Union. https://data.europa.eu/doi/10.2760/49669

Følstad, A. (2008). Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. *Electronic Journal of Virtual Organisations*, 10(5): 99–131. http://hdl.handle.net/11250/2440026

Galán-Muros, V., Hegyi, F., Blancas, A., et al. (2021). Exploring the concept of geographies of innovation: case studies from Amsterdam, Barcelona, Melbourne, and Stockholm, European Commission, Joint Research Centre, Publications Office of the European Union, 2021. https://data.europa.eu/doi/10.2760/268816

Gassen, G., Creating a thriving innovation environment: Recipes for success of multi-stakeholder partnerships, Webinar, EU Knowledge Valorisation Week, April 21st, 2021. https://ec.europa.eu/research-and-innovation/en/research-area/industrial-research-and-innovation/eu-valorisation-policy/knowledge-valorisation-platform/repository/espoo-innovation-ecosystem-open-collaboration-strategies-practice

Granstrand, O, & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation*, 90. https://doi.org/10.1016/j.technovation.2019.102098

Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: an assessment of incubating models", *Technovation*, 25(2), 111-121. https://doi.org/10.1016/S0166-4972(03)00076-2

Habibipour, A. et al. (2020). Living Lab Handbook for Urban Living Labs developing nature-based solutions. UNaLab. https://unalab.eu/en/documents/urban-living-lab-handbook

Habibipour, A., et al. (2021). Rural Living Labs: Inclusive Digital Transformation in the Countryside. *Technology Innovation Management Review*, 11(9/10): 59-72. http://doi.org/10.22215/timreview/1465

Hegyi, F. B., et al. (2021). Measuring the impact of urban innovation districts. European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/11053

Hirtenkauf, A. G., et al. (2022). On the naming of innovation districts. *Journal of Evolutionary Studies in Business*, 7(2): 268-297. https://doi.org/10.1344/jesb2022.2.j113

Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. *Journal of cleaner production*, 213: 976-988. https://doi.org/10.1016/j.jclepro.2018.12.257

Huang, J. H., & Thomas, E. (2021). A Review of Living Lab Research and Methods for User Involvement. *Technology Innovation Management Review*, 11(9/10): 88-107. http://doi.org/10.22215/timreview/1467

IASP Global Survey, 2022. https://www.iasp.ws/our-industry/knowledge-room/iasp-global-survey-2022--science-and-technology-parks-and-areas-of-innovation-throughout-the-world

IASP. Statistics. https://www.iasp.ws/our-industry/statistics

IASP. What is a science park? and other definitions from IASP. https://www.iasp.ws/our-industry/definitions/science-park

Innovation Quarter (2022). Keys to Developing a Vibrant, Dynamic Innovation District. Winston-Salem: Innovation Quarter. https://www.innovationquarter.com/innovation-districts/

Juujärvi, S., & Lund, V. (2016). Enhancing Early Innovation in an Urban Living Lab: Lessons from Espoo, Finland. *Technology Innovation Management Review*. 6 (1): 17-26. http://doi.org/10.22215/timreview/957

Katz, B., Wagner, J. (2014). The rise of innovation districts. Brookings Institute. https://c24215cec6c97b637db6-9c0895f07c3474f6636f95b6bf3db172.ssl.cf1.rackcdn.com/content/metro-innovation-districts/~/media/programs/metro/images/innovation/innovationdistricts1.pdf

Kert, K., Vebrova, M. and Schade, S. (2022). Regulatory learning in experimentation spaces, European Commission, 2022. https://publications.jrc.ec.europa.eu/repository/handle/JRC130458

Klofsten, M., et al., (2020). Incubator specialization and size: Divergent paths towards operational scale. *Technological Forecasting and Social Change*, 151. https://doi.org/10.1016/j.techfore.2019.119821

Leminen, S. (2013). Coordination and participation in living lab networks. *Technology Innovation Management Review*, 3(11). http://doi.org/10.22215/timreview/740

Leminen, S., et al. (2012). Living Labs as open-innovation networks. https://urn.fi/URN:NBN:fi:amk-201803213624

Leminen, S., et al. (2017). Towards Third-Generation Living Lab Networks in Cities. *Technology Innovation Management Review*, 7(11): 21-35. http://doi.org/10.22215/timreview/1118

Liberati, D., et al. (2016). Science and Technology Parks in Italy: Main Features and Analysis of Their Effects on the Firms Hosted. *The Journal of Technology Transfer* 41(4): 694–729. https://doi.org/10.1007/s10961-015-9397-8

Lund, E. (2019). The Strategic Choices That Science and Technology Parks Must Make. In: Amoroso, S., Link, A., Wright, M. (eds) Science and Technology Parks and Regional Economic Development, *Palgrave Advances in the Economics of Innovation and Technology*, Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-30963-3_2

Lund, E., et al. (2020). Public-Private Partnerships for Science and Technology Parks: utilising PPPs and related models for the development and operation of STPs and innovation districts. European Commission, Joint Research Centre, Publications Office, 2020. https://data.europa.eu/doi/10.2760/3057

Meulenbroeks, K (year unknown). Development Biotech Campus Delft & Bioprocess Pilot Facility. https://www2.cm-evora.pt/mecine/presentations/Delft/SPH_Biotech%20Campus%20Delft_Mecine.pdf

Mian, S. A., Klofsten, M., & Lamine, W. (2021). Handbook of Research on Business and Technology Incubation and Acceleration. Edward Elgar Publishing.

Nesti, G. (2015). Living labs: a new tool for co-production? International conference on Smart and Sustainable Planning for Cities and Regions, Springer, Cham. https://doi.org/10.1007/978-3-319-44899-2_16

Nesti, G. (2018). Co-production for innovation: the urban living lab experience. *Policy and Society*, 37(3): 310-325. https://doi.org/10.1080/14494035.2017.1374692

Ng, W., et. al. (2019). Towards a segmentation of science parks: A typology study on science parks in Europe. *Research Policy*, 48(3): 719-732. https://doi.org/10.1016/j.respol.2018.11.004

Nikina-Ruohonen, A. (2021). Leading and Managing Areas of Innovation: The Multi-Stakeholder and Startup Perspectives. HHBIC 2020, 17–18.11.2020, Online. https://esignals.fi/research/en/2021/02/15/leading-and-managing-areas-of-innovation-the-multi-stakeholder-and-startup-perspectives/#e3946ea5

Novartis Campus Basel (year unknown). Where innovators advance life sciences. https://www.campus.novartis.com/sites/campus_com/files/novartis-campus-brochure.pdf

O'Mara, M.P. (2005). Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley. *Journal of American History*, 92 (3): 1043–1044, Princeton-New Jersey: Princeton University Press. https://doi.org/10.2307/3660092

OECD (2011). Regions and Innovation Policy. OECD Reviews of Regional Innovation. https://doi.org/10.1787/9789264097803-en

Pancholi, S., et al (2020). University and innovation district symbiosis in the context of placemaking: insights from Australian cities. *Land Use Policy*, 99. https://doi.org/10.1016/j.landusepol.2020.105109

Pauwels, C., et al., (2016). Understanding a new generation incubation model: The accelerator. *Technovation*, 50, 13-24. https://doi.org/10.1016/j.technovation.2015.09.003

Pinho, M., and Marques, J. (2019). Business tourism in Porto: An empirical investigation of its potentialities and development challenges. *International Journal of Tourism Cities*. https://doi.org/10.1108/IJTC-05-2019-0071

Pique, J.M., et al. (2019). Areas of innovation in cities: the evolution of 22@ Barcelona. *International Journal of Knowledge-Based Development*, 10 (1): 3-25. https://doi.org/10.1504/IJKBD.2019.098227

Pique, J.M., et al. (2020). Application of the Triple Helix Model in the Creation and Evolution of Areas of Innovation. In: Abu-Tair, A. et al., (eds), Proceedings of the II International Triple Helix Summit, THS 2018. *Lecture Notes in Civil Engineering*, 43, Springer, Cham. https://doi.org/10.1007/978-3-030-23898-8_17

Rapetti, C., et al. (2022). Performance Indicators for the Evolution of Areas of Innovation: Porto Digital Case. *Journal of evolutionary studies in business.* 7(2): 219-267. https://doi.org/10.1344/jesb2022.2.j112

Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe, OJ L 170, 12.5.2021, p. 1–68, art. 2 (47). http://data.europa.eu/eli/reg/2021/695/oj

Rissola, G. (2019). Science and Technology Parks as Drivers of Place-Based Innovation Ecosystems: Two Examples from Europe. In: Amoroso, S. et al. (eds), Science and Technology Parks and Regional Economic Development. *Palgrave Advances in the Economics of Innovation and Technology*, Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-30963-3_10

Rissola, G., & Haberleithner, J. (2020). Place-based innovation ecosystems: a case-study comparative analysis, European Commission, Joint Research Centre, Publications Office. https://data.europa.eu/doi/10.2760/492676

Rissola, G., et al. (2017). Place-Based Innovation Ecosystems: Espoo Innovation Garden and Aalto University (Finland). JRC, European Union. https://data.europa.eu/doi/10.2760/949545

Romano, M., et al. (2014). Science Parks and Intellectual Capital: An Integrated Model for Intangibles' Representation, Evaluation and Control. Schiavone, F., and Romano, M. (eds), *Journal of Intellectual Capital*, 15(4): 537–53. https://doi.org/10.1108/JIC-06-2014-0070

Schaffers, H., & Turkama, P. (2012). Living labs for cross-border systemic innovation. *Technology Innovation Management Review*, 2(9). http://doi.org/10.22215/timreview/605

Schaffers, H., et al. (2007). Exploring business models for open innovation in rural living labs. IEEE International Technology Management Conference (ICE), IEEE, 2007. https://www.researchgate.net/publication/30510231_Exploring_Business_Models_for_Open_Innovation_in_Rural_Living_Labs

Schuurman, D., & Protic, S. M. (2018). Living Labs versus Lean Startups: An Empirical Investigation. *Technology Innovation Management Review*, 8(12): 7-16. http://doi.org/10.22215/timreview/1201

SciShops (year unknown). Case study: Living Lab for Health, Spain. https://www.scishops.eu/case-study-living-lab-for-health-spain/

Ståhlbröst, A., et al. (2015). Stakeholders in smart city living lab processes. Americas Conference on Information Systems, 13-15 August 2015. http://urn.kb.se/resolve?urn=urn%3Anbn%3Ase%3Altu%3Adiva-32793

Ståhlbröst, A., et al. (2018). UNALAB ULL FRAMEWORK-D2.1 Deliverable. UNaLab. https://unalab.eu/en/publications

Steen, K., & Van Bueren, E. (2017a) The defining characteristics of urban living labs. *Technology Innovation Management Review*, 7(7). http://doi.org/10.22215/timreview/1088

Steen, K., & Van Bueren, E. (2017b). Urban living labs: A living lab way of working. https://research.tudelft.nl/en/publications/urban-living-labs-a-living-lab-way-of-working

Steiber, A. (2020). Technology Management: Corporate-Startup Co-Location and How to Measure the Effects. *Journal of Technology Management & Innovation*, 15 (2). http://dx.doi.org/10.4067/S0718-27242020000200011

Tataj, D. et al. (2022). The Ann Arbor SPARK-Network Intelligence as a driver for the emergence of a next generation science and technology park. *Journal of Evolutionary Studies in Business*. 7(2): 100-132. https://doi.org/10.1344/jesb2022.2.j108

Van Dinteren, J. (2016). Your own innovation campus. https://www.linkedin.com/pulse/your-own-innovation-campus-jacques-van-dinteren

Van Dinteren, J. (2023). What exactly is an innovation district? Paper for the 40th IASP International Conference, Luxembourg City.

Van Dinteren, J., & Jansen, P. (2021). Areas of Innovation. Nijmegen: the Innovation Area Development Partnership (IADP). https://iadp.co/new-book-on-innovation-areas

Vasconcelos Gomes (de), L.A., et al. (2018). Unpacking the innovation ecosystem construct: Evolution, gaps and trends. *Technological forecasting and social change*, 136: 30-48. https://doi.org/10.1016/j.techfore.2016.11.009

Vásquez-Urriago, A. R., et al. (2016). Science and technology parks and cooperation for innovation: Empirical evidence from Spain. *Research Policy*, 45(1): 137-147. https://doi.org/10.1016/j.respol.2015.07.006

Voytenko, Y., et al. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of cleaner production*, 123: 45-54. https://doi.org/10.1016/j.jclepro.2015.08.053

Wagner, J., Katz, B., & Osha, T. (2019). The evolution of innovation districts: The new geography of global innovation. The Global Institute on Innovation Districts: New York, NY, USA . https://www.giid.org/the-evolution-of-innovation-districts-download

Westerlund, M., & Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. *Technology Innovation Management Review*, 1(1): 19-25. http://doi.org/10.22215/timreview/489

Westerlund, M., Leminen, S., & Habib, C. (2018). Key Constructs and a Definition of Living Labs as Innovation Platforms. *Technology Innovation Management Review*, 8(12): 51-62. http://doi.org/10.22215/timreview/1205

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