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A typology for the university campus as a living lab for Facility Management education and research

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ABSTRACT

Background and aim – The university campus is a built environment facilitating activities centred around learning and knowledge development. This confluence of activities makes the university campus uniquely suited to bring together stakeholders and to generate meaningful experiences to not only learn about but also further develop the facilitation of such experiences in the Facility Management (FM) discipline. This study aims to lower thresholds for universities using their campus as an integral part of FM education and research.

Originality – This paper introduces a typology for FM focused campus living labs (CLL) to help specify university administrators' motives towards implementing living labs on campus.

Methods / Methodology – A conceptual FM CLL typology was developed through literature review on living labs and adapted for use in a FM context.

Results – Four types of FM CLL are suggested primarily based on the distinct purpose, the stakeholder mix, initiator role(s), and the desired/expected output: (1) *Learning company* for practical education, (2) *Incubator* for systems thinking, (3) *Test lab* as a R&D test bed, and (4) *Innovation hub* for knowledge development.

Practical or social implications – This paper provides administrators of higher education institutions with FM related programmes a typology which can aid them in aligning organisation objectives with the specific purposes for using the campus as a living lab for FM education/innovation. In time, this can help administrators/educators to facilitate more active/experiential learning activities, while also providing researchers with opportunities to develop knowledge of FM (practices).

Type of paper – Conceptual research paper (full).

KEYWORDS

Facility Management, Living Lab, Higher Education, Campus Living Lab.

INTRODUCTION

Facility management (FM) is a broad field “concerned with the management, operation and maintenance of FM education development (e.g., Roper, 2017; Awang et al., 2013; Sullivan, 2010). FM as an academic discipline has been considered a practice-led discipline with heavy emphasis on professionalism, requiring both theoretical knowledge and practical skills (Junghans & Olsson, 2014). Even though not well documented in academic research, FM education generally uses problem-based learning techniques and real case studies to develop higher-order thinking skills and apply the knowledge to practical contexts (e.g., Collins et al., 2021; Redlein et al., 2021; Bendiksen et al., 2020). Further, practical skills are trained through internships and various other forms of collaboration with the industry, though in case of a more engineering-oriented approach to FM (hard FM), some practical skills are developed in lab settings. Recent research findings are often incorporated in specific subjects and students take an active part in research through (e.g.) graduation projects.

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Yet, it seems that innovation in the FM industry is slow and mild (Mudrak et al., 2004; Roper, 2017). Professionals have lacked required competencies to drive innovation (Mudrak et al., 2004), and research findings do not reach FM practice 'in time' (Roper, 2017). On the other hand, FM as an academic discipline also needs further development – especially in terms of research (Junghans & Olsson, 2014). Thus, higher education institutions (HEIs) have an opportunity to make stronger connections between research, education and skill development, and the industry. This could be done through (e.g.) innovation pedagogy which emphasises connections between working life, research, and education (Kairisto-Mertanen et al., 2010) and by providing innovative environments for experimentation, collaboration, and learning (e.g., Schaffers et al., 2009). This type of approach supports further development of innovation competencies such as creativity, critical thinking, initiative, teamwork, and networking (Lappalainen, 2020).

Implementing innovation pedagogy requires working-life orientation, flexible curriculum, multidisciplinary approach, new teacher and student roles, active learning methods, assessment changes, integration between studies and R&D activities, and entrepreneurship and internationalisation (Lappalainen, 2020). As innovation in FM mainly relates to specific business operations, support services, and physical spaces (Nazali Mohd Noor & Pitt, 2009; Mudrak et al., 2004; 2005), it requires continuous and close collaboration with a specific organisation, but – in an FM context – this would also need to be supported by the client organisation. Thus, research activities can become scattered, and education is often limited to case study discussions.

The typical HEI campus seems like a natural fit for a so-called living lab (LL) for FM with its inherent complexity making it resemble a 'micro-society': a confluence of stakeholders with different objectives, engaging in multiple (primary) processes, in a combination of built and digital/virtual environment(s) which allow for on-site knowledge sharing, natural synergy between stakeholders, and cost reduction (Jansz et al., 2020).

The binary nature of HEIs makes the synergy apparent, as both learning (education) and developing (research) are at the core of LLs, while also making users more likely to engage in co-creation practices. HEIs can act both as research institutions and as practice spaces, enabling practice-led innovation in FM. A LL for FM education can act as a driver for learning and innovation about and for the FM industry. Therefore, this conceptual paper presents a 'typology' of what Campus Living Labs (CLLs) could look like in the context of FM innovation specifically and depending on the purpose the lab is to serve at the HEI.

DEFINING LIVING LABS

The concept of LLs finds its roots in human-centred development of software (Ståhlbröst, 2008). It was assumed that early involvement of users in software development can bring more knowledge, reduce time to market, and improve adoption rates of the software. Moreover, by adopting the principles of open innovation (Gassmann et al., 2010) through actively inviting stakeholders to co-develop, co-design, and co-test prototypes and solutions, internal innovation can potentially be accelerated and provide information on adoption in new markets.

There are different definitions of a LL. Some refer to a LL as an approach, methodology, or ecosystem for open user-centric innovation which brings together co-creation, research, and innovation in a real-life environment (ENoLL, 2022). In contrast, Westerlund & Leminen (2011, p.20) define LLs as a physical, digital, or virtual 'space', in which a comprehensive mix of stakeholders collaborate to create, design, validate, and test new services/products, technologies, or systems in a real-life environment. These definitions of LLs show overarching themes/similarities corresponding to LL principles as suggested by Steen & Van Bueren, (2017), Bergvall-Kåreborn & Ståhlbröst, (2009) and Hossain et al. (2019) related to

openness, being grounded in reality, and user-involvement/-empowerment aimed at sustainable value creation.

A particular type of LL is the urban living lab (ULL), according to Steen & Van Bueren (2017) these are different from other LLs in that they focus on finding solutions meant to increase sustainable development in urban contexts which are more complex leading to additional challenges related to inclusiveness and democratic decision-making.

Given the definitions presented above, HEI campuses could be considered an ideal environment for a LL with characteristics similar to the ULL, only at a smaller scale. Ståhlbröst & Holst (2012) explain that LLs should have access to a multi-contextual environment, technology, infrastructure, along with a diverse set of capable stakeholders and users. A ULL needs a city, but modern (university) campuses increasingly resemble cities both in their fit with LL requirements (Jansz et al., 2020; Ståhlbröst & Holst, 2012) and in their alignment with the objectives of the organisation (Den Heijer, 2011). Consequently, HEIs – through CLLs – could act not only as a research institution providing research power and infrastructure but also as an organisation in its natural setting with own users, departments, suppliers, businesses and operations for students and researchers to explore and innovate.

TOWARDS A CAMPUS LIVING LAB TYPOLOGY FOR FACILITY MANAGEMENT EDUCATION

ULLs are not a universal solution to every problem, they should be set up for a specific purpose (Steen & Van Bueren, 2017) in a well-defined ecosystem in order to identify relevant stakeholders. To clarify these potential purposes, Puerari et al. (2018) developed a typology of ULLs. In this typology they position LLs on two axes based on their purpose: a) learning versus making and b) product/service systems vs societal systems. Similarly, the purposes of Campus LLs (CLLs) can be positioned based on their purpose on the axes 1) *education-driven vs research-driven* and 2) *product-service systems vs socio-technical systems*. This first axis relates to the primary objectives of HEIs, the second to the potential impact of the CLL on (sustainable) development. This leads to four distinct types of CLLs. On the educational side, a CLL can serve as a learning company for students to practice skills or as an incubator for stakeholders to deepen understanding of the FM ecosystem. On the research side, a CLL can serve as a real-environment testbed for technology developed by knowledge institutes and business partners. And finally, a CLL can have a knowledge development purpose, for instance related to further FM innovation through observing other types of CLLs. As Puerari et al. (2018) point out, LLs can serve different needs for different stakeholders involved depending on their role and involvement. These four distinct categories differ also by their relationship with education, research, and industry and the setting in which the activities of those LLs take place (see Figure 1).

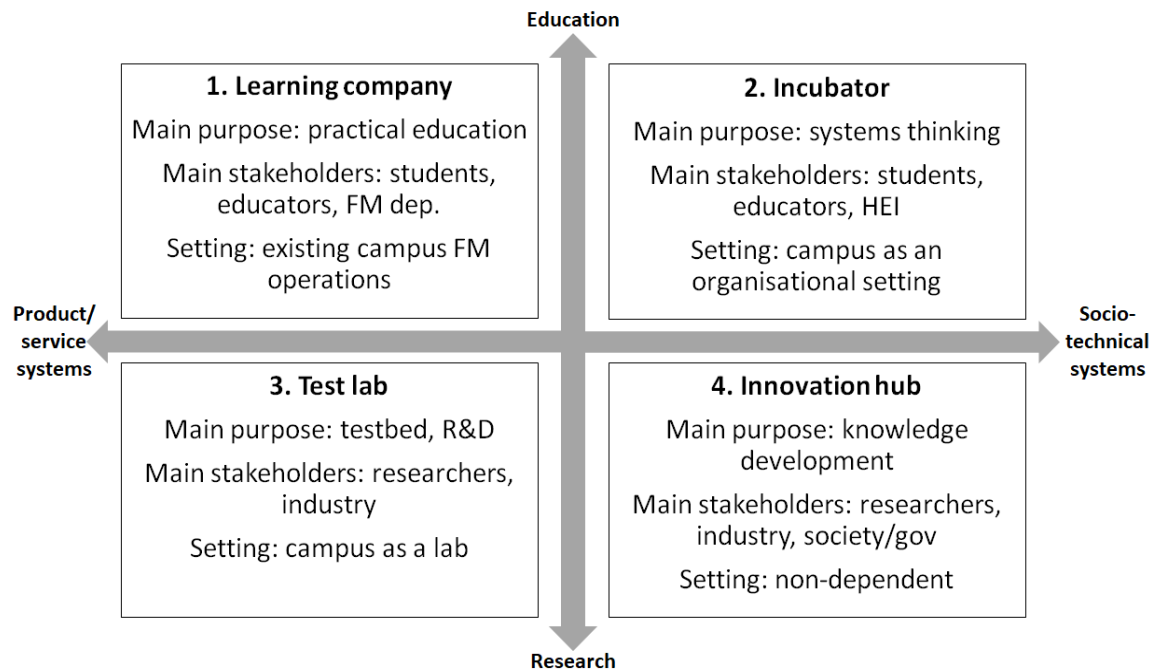


Figure 4 Four typologies of Campus Living Labs for Facility Management.

In the further development of the paper, we describe the types in more detail, specifically regarding the stakeholders involved, the activities performed within each type, and some of the challenges associated with each of the four types. Stakeholders considered were first observed as patterns from literature and were then compared with an existing framework of stakeholder types (Nyström et al. 2014) to ensure no perspectives were neglected. The CLL activities are rooted in categories of innovation activities as suggested by Almirall & Wareham (2011), while the challenges are derived from a comprehensive review on LL literature by Hossain et al. (2019).

- 1. Learning company.** A type of a LL which emphasizes skill development of FM through practical education. The main stakeholders are students and educators who interact closely with an internal FM organisation, be it in-house or outsourced FM service providers. The main setting where a LL takes place is related to existing campus FM operations: service points, FM organisational spaces.
 - Initiative for activities will be primarily with educational employees because of the close ties to the curriculum, while students should be expected to take more reactive position. Campus FM departments will serve as the primary facilitator of this CLL's activities, with industry and government representatives involved on case basis.
 - For this CLL the activities are aimed at operational training primarily focusing on producing (selecting, choosing), and executing product/service procedures within the context of campus (FM) operations. Example activities could be learning standard operating procedures (SOPs), functional design of processes, building management through walkthroughs and assessments, FM department observations (e.g., observations of meetings).
- 2. Incubator.** A type of a LL which emphasizes more complex knowledge development and systems thinking. Main stakeholders include students and educators as well as HEI acting as a contextual organisation. In this type of a LL, the campus acts as an organisational setting which students can explore and understand the complexities on the tactical and strategical level of FM.

- Initiative still lies with educators primarily, with students taking a reactive role. However, external actors take a more active role in providing the context of the CLL, as the learning objectives in this CLL are less process-based and more organizational (systemic).
 - This type of CLL takes a more inside-out perspective, thus exposing students to systemic issues related to FM operations in connection to the macro-environment it operates in (rather than the internal/operational focus of the *learning company*). Example activities could be organisational setting analysis, stakeholder needs analysis, organisational behaviour and change management needs assessments.
3. **Test lab.** A type of a LL which emphasizes FM innovation testing and validation. The main purpose of the LL is to act as a testbed for both external and internal innovations at a certain readiness level. Here, main stakeholders are researchers and industry, and campus spaces become physical settings for product/service testing with campus users acting as test user groups.
- Initiative comes mainly from researchers or (external) (private/public) organisations, with all parties involved in innovation-oriented activities.
 - Those activities are primarily focusing on product/service innovation through discovering, capturing, and generating/creating. However, these would also involve less generative activities like testing and refining. Example activities could be experimentation on live scenarios, insight generation through pilot testing of tangibles (furniture, equipment, technology) and intangibles (services, processes).
4. **Innovation hub.** A type of a LL which emphasizes broader knowledge development and research on societal implications of FM activities. Main stakeholders in this type of a LL are researchers, industry, governments, and society. Here, however, the setting of the campus becomes less relevant as the activities of this type of a LL are not location dependent other than being a hub and a (inspiring) meeting place for stakeholders.
- The initiative is likely to come from researchers, and more likely to originate from the public sector than private sector compared to the *test lab*.
 - This CLL's outward purpose focuses on the development of knowledge around the FM industry through capturing, discovering, and generation/creation, but moving away from testing/refining. Example activities could be development of FM policies, research on wider ecosystem implication of FM innovations, FM innovation and concept development.

DISCUSSION AND/OR CONCLUSIONS

This paper suggests a typology of CLLs for FM education and research, thus providing an illustrative framework for HEI educators/administrators with FM curricula who are considering setting up a LL. The distinctions between the four types may also introduce distinct challenges related to each type's characteristics.

For the *learning company* the challenges stem from its direct connection to the educational curriculum, thus forcing a CLL to adhere to standards/conditions which may limit emergence. For the educational programme managers, it may prove difficult to adequately measure the quality of education in such a setting. Due to the dependence on the available facilities and infrastructure, this CLL type is sensitive to constraints related to these factors. Additionally, another challenge with a learning company CLL is the actual service environment where learning happens, which from an efficiency point of view is most likely not optimal. Depending on the FM organisation's KPIs, it might receive high resistance.

The *incubator* CLL type may suffer similarly from the connection to a defined curriculum, and it provides a similar challenge for quality control. Because of the system-orientation, existing diversity issues within

higher education may limit the learning capacity within these types of CLLs, as they may not sufficiently represent society at large. Additionally, as HEI would act as a case study for educational purposes, the resistance to allow these types of activities might come from organisation's management and employee sides.

Whereas the *test lab* is less connected to the educational curricula, it may see difficulties related to the essential involvement of industry. Especially in securing funding, it may be imperative to demonstrate return on investment, which may prove difficult for a CLL. And although this type is less system-oriented, a homogenous (student) population may still hamper innovation based on limited diversity. For long-term projects the transience of student-involvement may prove difficult, as continuity among co-creators and researchers is less guaranteed. This type of a LL might lead to more sporadic and short-term activities that might cause disruption to normal campus activities.

As opposed to the former, the *innovation hub* – because of its focus on systemic issues – may have more opportunities to secure government funding and thus suffer less from not being able to clearly justify ROI beforehand. However, that same focus on systemic issues opens it up for issues related to (for example) representativeness of the population for research and innovation purposes. Here the diminished ability of students to commit long-term may also hinder continuity within development teams. This type of setup requires strong knowledge base inside HEI, collaboration with other departments as well as commitment from HEI (e.g., through a dedicated research team).

As one of the main goals of LLs is to provide applied learning opportunities, all four types of CLLs offer that as well. However, the focus of the learning is different. *Learning company* focuses more on the individual learning and personalised experience of students, while *Incubator* offers more organisational learning for FM and HEI. *Testlab* promises more ecosystem and real-world learning for broader set of stakeholders while *Innovation hub* explores societal learning occurrences. Of course, this means that the complexity of those LLs increases as more stakeholders get involved and they take more complex roles. This type of complexity growth can also be reflected with learning activities throughout the curriculum and years of studies. Moreover, even though CLLs for FM seem to be a natural setting for both education and research in FM, varying from practical skill development studying a specific case organisation, to various research activities, specific inter-stakeholder dynamics and curricular conditions might limit the possibilities of applying all four types of LLs on a certain campus. As the typology of CLLs for FM has been developed by having in mind a specific organisational context, this might prove to be a limitation as well. It requires further validation and testing (also in other HEIs). We hope to receive feedback and any considerations about the typologies in order to develop a more generalizable framework.

The FM CLL typology could lead to further research, identifying readiness or maturity levels of these typologies and providing a list of specific requirements necessary for implementation of each typology.

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