

How to Make Living Labs More Financially Sustainable? Case Studies in Italy and the Netherlands

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Abstract

In many urban environments, so-called Living Labs have been created. A Living Lab (LL) is an emerging innovation methodology that may serve to reduce the gap between new technology development and the adoption of this new technology by users, by bringing together all key actors in the innovation process: public administration, education institutes, companies, and citizens. However, a substantial number of LLs struggle to translate the customer value created into a sustainable business model. As a result, many LLs are financially not sustainable. Several previous studies found that most LLs primarily rely on public grants; thus, they often stop their activities when public funding ends. In this paper, we draw on a comprehensive literature review and practical evidence from three cases, to develop a framework of various funding options which can be employed by any LL that seeks to become more financially sustainable.

Keywords: living Lab, sustainability, open innovation, user innovation, innovation network, social impact, social challenges, co-creation

1. Introduction

In the last few decades, a strong focus on customers and value delivery has become the main source of competitive advantage (Talmar et al., 2019). Thus, many firms need to actively collaborate with customers to improve the effectiveness of their product development efforts (Nijssen et al., 2012). Furthermore, user-customers are valuable sources of product and service innovation (von Hippel, 2005). Moreover, users are not the only actors that firms increasingly have to engage in their innovation processes. The need for complex new products and services has paved the way for many organizations to draw on a broad set of external sources of knowledge. Customers, suppliers, distributors, manufacturers, service providers, universities, research centers and governmental institutions increasingly have overlapping, if not shared interests in creating smart and safe living environments. These shared interests have also given rise to various practices known as collaborative and open innovation (Chesbrough, 2006).

In this respect, the so-called Living Lab (LL) is an emergent methodology that can be instrumental in bridging the gap between new technologies developed in corporate or university research labs and the actual adoption of (products and services based on) these technologies by users (Schuurman, 2015). While Knight (1749) already coined the term ‘living laboratory’ when he referred to the human body as a combination of elements and conditions that work together and offer opportunities for experimentation, the modern concept of LL has been developed more recently. John Mitchell forged the term in the MIT Media Lab, where a realistic home-like environment was artificially recreated to allow researchers to observe and manipulate routine activities and interactions and to test new technologies (Schuurman, 2015).

Today, many LLs struggle to translate the value created into a sustainable business model, and as a result, most LLs are financially not sustainable (e.g., Brankaert, den Ouden, & Grotenhuis, 2014; Leminen, Westerlund, & Kortelainen, 2012). In this paper, we draw on a literature review as well as practical evidence from three cases to develop a framework of various funding options that can be employed by any LL that seeks to become more financially sustainable.

2. Literature Review

According to ENoLL (2016), LLs are “user-centered, open innovation ecosystems based on a systematic user

co-creation approach integrating research and innovation processes in real-life communities and settings". Indeed, a LL is not only an infrastructure, but also a network of people with their experiences (Mulder, 2008). The LL thus serves to connect research, citizens and the actual living environment (Franz, 2014) and works as an innovation intermediary and aggregator of external inputs that are translated into requirements and design parameters for valuable social innovation (Almirall & Wareham, 2011; Mention & Torkkeli, 2015). Indeed, a LL is an innovation network where heterogeneous stakeholders –such as firms, public institutions and knowledge centers collaborate with users to create, prototype, test and evaluate new products and services (Leminen et al., 2012; Niitamo et al., 2006).

2.1 Four Key LL Activities

The methodology of LLs involves four key activities: exploration, co-creation, experimentation and evaluation (ENoLL, 2016). Through the activity of *exploration*, a LL can capture new knowledge from external sources to enhance technological development (Schuurman et al., 2016) and discover new opportunities (Almirall & Wareham, 2011). Researchers, businesses and users explore novel manners of contextualizing knowledge and technologies in a real-life setting (Pierson & Lievens, 2005). Consequently, many LLs engage lead-users from the start of the innovation process, to involve them as co-developers of new products and services (Edvarsson et al., 2010).

Co-creating with users enables a company to understand user behaviors and preferences in a more accurate manner (Leminen et al., 2012). By co-creating with users, it is also possible to better meet the specific needs and aspirations of people in local contexts (ENoLL, 2016). However, co-creation in LLs can also go beyond the final consumer of a specific product or service, by bringing together all relevant actors and stakeholders in the innovation ecosystem for that product/service (Romme, 2017; Walrave et al., 2018).

Complex products and services such as smart lighting products and digital health services also require a substantial *experimentation* effort in LLs. As such, LLs often operate as pre-commercial and research-oriented platforms for experimentation, which provide opportunities to reduce the technological risks arising from the new product or service. The LL then offers an open engagement platform, in which one can experiment with the conditions for societal acceptance of the new product (Ballon et al., 2005) as well as the business models needed to make the new product economically viable (ENoLL, 2016).

Finally, *evaluation* involves the assessment of an innovative solution according to economic, cognitive, ergonomic and other criteria (Leminen & Westerlund, 2015). The user-feedback acquired in any LL has a formative purpose and is therefore processed and integrated in the development process in a highly iterative manner (Følstad, 2008). Overall, a LL can contribute to every phase of the innovation process by orchestrating and coordinating the activities of exploration, co-creation, experimentation and evaluation (Feurstein et al., 2008; Hakkarainen & Hyysalo, 2016). The LL thereby generates value to the entire supply chain (Ståhlbröst & Holst, 2012) and can also take explore and assess the environmental, social, and economic effects of the new products or services created and tested in the LL (Bergvall-Kåreborn et al., 2009; Leminen et al., 2012).

2.2 Economic, Business, and Public Value

The value created by a LL may vary in terms of the nature of this value and the actors affected. Hence, to better understand and direct the LL's activities, it is helpful to adopt a framework that differentiates between economic, business and public value (Gualandi & Leonardi, 2018). *Economic value* covers aspects that are highly tangible for various stakeholders, such as company growth, enhanced competitive advantage, or successful new business development (Baccarne, Mechant, & Schuurman, 2014). The economic value created by LLs is likely to benefit the entire value chain, in the form of better products and services (Mulder, 2008; Ståhlbröst & Holst, 2012) as well as reducing and sharing the development risks (Leminen & Westerlund, 2015). *Business value* is an extension of economic value and includes other forms of value, such as employee value, customer value, supplier value, and societal value (Bergvall-Kåreborn et al., 2009; Eriksson, 2010).

Finally, a LL generates *public value* when it supports and promotes the implementation of solutions responding to local challenges and opportunities and as such contributes to the implementation of public goals and policies (Cosgrave & Tryphonas, 2012), such as those in the area of safety and health. Public value therefore often refers to the non-financial impact of new products and services (developed in LLs) on the wellbeing of individuals and communities as well as the ecological environment (Mulgan, 2010). While public value is often considered to be the most important deliverable arising from LLs, it is also more difficult to define and measure than its economic and business counterparts (Ståhlbröst, 2012). As a result, there is not yet a comprehensive definition of public value arising from LLs (Wood & Leighton, 2010), given that they offer conditions and mechanisms for various stakeholders to collaborate and generate innovation outcomes in real-life environments (Leminen & Westerlund,

2015). LLs dedicated to public value can therefore effectively increase cohesion in society (Schuurman et al., 2016) and improve the behavior of users regarding issues like environmental awareness and urban safety (Ståhlbröst & Holst, 2016).

2.3 Research Question

Many LLs are not financially sustainable and struggle to translate the value they create into a viable LL business model (Brankaert et al., 2014). A significant number of LLs thus have to stop their activities when the public funding ends (Leminen et al., 2012). Indeed, financial sustainability is the key condition that allows a LL to remain operational in the long term (Veeckman et al., 2013). Financial sustainability here refers to two distinct aspects: first, it involves the basic economic requirement to be able to fund the LL's activities, and second, it refers to the LL's responsibility to the broader community. Hence, the ability to develop solutions that can improve human life and living conditions must have long-term financial support, rather than only for a short period (Tukiainen, Leminen, & Westerlund, 2015).

Several studies have demonstrated that most LLs primarily rely on public grants and subsidies (Brankaert et al., 2014; Wu, 2012). Even if this appears to be the only financing option in the short-term, it does not ensure viability in the long-term since many LLs stop their activities when public funding ends. Moreover, public subsidy programs (e.g. from the European Union) are increasingly required to serve private markets and thus grant agreements often require a revenue share from private sources (Katzy, 2012). Finally, many LLs do not make systematic use of business modeling techniques, to improve their cost structure, customer segmentation, and revenue streams (Mastelic, Sahakian, & Bonazzi, 2015).

The literature search conducted so far shows that financial sustainability is a fundamental challenge for many LLs. However, previous studies of LLs have not systematically addressed this problem. In this paper, we draw on three case studies to develop a framework of the funding options that can be employed by any LL in order to become financially sustainable. The main research question therefore is: *how can a Living Lab exploit the economic, business and public value it generates, to ensure the revenue streams that enable this LL to achieve financial sustainability?*

3. Three Cases

In this section, we present three cases: the Stratumseind Living Lab in Eindhoven, the Amsterdam Field Labs in Amsterdam, and the Textile & Clothing Living Lab in Palermo. A more detailed description of the research design as well as methods for data collection and analysis is available from the authors. The remainder of this section serves to describe the most interesting insights arising from the three cases.

3.1 Stratumseind Living Lab

The municipality of Eindhoven has developed various LL initiatives. The Stratumseind Living Lab (SLL), which is part of the Stratumseind 2.0 & Smart City program, is one of the most successful examples. This LL entails a test facility for new sensors, data harvesting, privacy, smart interfaces, smart lighting systems, and gaming. The mission of the SLL is to support companies and not-profit organizations in the development of innovative products, services and policies which can foster the economic environment of the region and structurally improve the economic and social functioning of the Stratumseind quarter of Eindhoven. The Eindhoven region provides a special context in which open innovation is broadly supported by many high-tech companies. The SLL has two kinds of stakeholders: strategic partners and project partners. The strategic partners are the public administrators of two municipalities (Eindhoven and Tilburg), two public agencies (the Police department and the Dutch Institute for Technology Safety and Security) and two universities (Eindhoven University of Technology and Tilburg University). The strategic partners are directly represented in the supervisory Board of Directors. Project partners include various established companies (both multinational firms and SMEs) as well as startups, which participate in at least one specific project of the SLL.

Through the activities of exploration, co-creation, experimentation and evaluation, the project partners run innovation projects in the SLL which result in the realization of different kinds of value. The equipment and competences provided by the LL enables the project partners to obtain economic value in the form of new products and services and/or increased functionalities of existing products/services. To collaborate with the SLL, its project partners have to pay a fee based on their needs and requirements. The LL creates public value for both strategic partners and citizens: in fact, the SLL helps its strategic partners to develop public services and policies which improve the safety of the Stratumseind area and address sensitive problems such as privacy policies, open data arrangements, and crime monitoring. The strategic partners have committed long-term to SLL, also by providing a basic funding that serves to finance SLL's overhead and related costs. The systematic process of

knowledge sharing and competence development in the network around SLL appears to result in a substantial capacity for innovation: that is, the SLL facilitates collaboration among its strategic and project partners which thus appropriate significant amounts of business value from it. As such, the SLL does not explicitly charge for the business value created, which is compensated by the fees paid by project partners and the basic funding provided by the strategic partners.

In conclusion, the SLL has reached a high level of financial maturity, because it draws on a diverse set of funding and revenue streams from a large number of stakeholders. Strategic partners from the public and education sector allow this LL to perform on a regular basis and secure its long-term viability. The fees paid by project partners, mostly from the business sector, enhance the agility of this LL by reducing the dependency on funding received from public stakeholders.

3.2 Amsterdam Field Labs

Several years ago, the municipality of Amsterdam developed the ambitious plan to increasingly operate in a 'locality-oriented' manner, with a prominent focus on social innovation. The municipality together with Amsterdam University of Applied Sciences (AUAS) established a knowledge alliance and initiated three LL initiatives, the so-called Amsterdam Field Labs (AFL), in urban areas around the city center. In 2017, the AFL was scaled up to a metropolitan perspective. Around the AFL, a network of public bodies, knowledge centers and social organizations was formed. Similar to the Eindhoven case (described in section 3.1), the AFL distinguishes between strategic partners and project partners. AUAS and the city of Amsterdam are the two main strategic partners that share the basic costs of sustaining the AFL network and together also define the main objectives. The project partners include two other universities and several social organizations (i.e., labor unions and social housing companies), which participate only in one or a few specific initiatives of AFL. AFL's focus on social innovation may explain why the business sector is almost entirely absent from the stakeholder network of this LL.

AFL's mainly focuses on in-field research, which is conducted together with citizens who are actively involved in defining new paths for policies and solutions to various social problems in the area of for example safety, unemployment and crime. As such, the AFL mainly generates public value, in line with the core interests of almost all partners involved. The participative and inclusive nature of AFL's initiatives also appears to allow the municipality of Amsterdam to co-create innovative policies, which have a potentially high impact on society. Similarly, AFL helps the AUAS department of Urban Management to become more integrated in the city's ecosystem and play a central role in developing social policies. Other stakeholders, such as social housing providers, are also mainly interested in the public value that AFL generates: in fact, these social enterprises are often required to actively contribute to the development of public policies. Hence, these project partners provide funding for specific projects. Inside the AFL, strategic and project partners can co-create new approaches to social innovation, by involving citizens in small-scale experiments and community-driven design, as such resulting in business value. AFL does not have separate compensation arrangements for public and business value. Indeed, the strategic partners provide grants and subsidies amounting to at least 50% of the annual budget, which allows the AFL to finance its basic activities. The remaining part of the budget is allocated to a specific project by both the strategic and project partners involved in the project. Finally, AFL's management does not deliberately aim to create economic value for its stakeholders, in view of the non-commercial purpose of the research conducted inside this LL. In this respect, the citizens of Amsterdam are the only recipients of tangible economic value, for example in the form of financial support and mentoring for self-employment (in the case of citizens that are unemployed).

In conclusion, AFL has secured financial sustainability mostly due to established relationships with a limited number of stakeholders from the public and education sector. Therefore, AFL can systematically address complex social problems and succeed in creating public value for citizens. At the same time, the long-term viability of AFL is largely dependent on two strategic partners; when one of these partners stops the funding, this LL cannot be sustained.

3.3 Textile & Clothing Living Lab

The Textile & Clothing Living Lab (TECLA) is an initiative that intends to exploit the potential of the Palermo region by reinforcing the innovative capacity of many actors in the textile field. TECLA is a physical space that encourages participants to discuss ideas and projects, meet partners, and develop collaborative methodologies so that textile and clothing manufacturers can explore new technologies and advanced multimedia tools. TECLA is hosted by ARCA, a university business incubator, which started as part of an EU-funded innovation program. The local authorities are not deeply involved and the public sector is mainly represented in TECLA by the

European institutions involved in several EU-funded projects conducted in this LL. TECLA engages students and professors from several fashion and design schools in the region, whereas the involvement of the University of Palermo is limited. ARCA is the most important business partner in TECLA. Moreover, TECLA has been building a diverse ecosystem of local and international enterprises active in the textile field, which are engaged in joint projects and initiatives. TECLA's activities also attract industry professionals, fashion designers, manufacturers and other key actors in the industry. In contrast to the two previous cases, TECLA does not explicitly distinguish between strategic and project partners.

TECLA supports the entire innovation process, that is, the exploration, co-creation and experimentation of new products and services, and linking them with successful business models. As such, this LL creates economic value for its partners in the form of new products and/or new product features. This economic value is generated by exploiting TECLA's knowledge and technologies, including in-field test facilities, advanced equipment and design tools. Business partners running projects inside the LL are required to compensate it for the services provided. The collaboration with the LL also results in business value for these partners: for example, TECLA provides incubation services such as due diligence consulting and entrepreneurial training. In addition, this LL fosters the innovativeness of the entire industry by developing an innovation mindset that cuts across traditional boundaries within this industry. Public value is created in two ways: on the one hand, TECLA supports the development of new products and businesses, and thereby contributes to solving the endemic problem of unemployment in the Palermo region. On the other hand, TECLA together with its European partners contributes to an environmentally, ethically and socially sustainable development in the textile industry. The work on accomplishing these objectives is largely supported from EU funds.

In conclusion, the TECLA case shows an interesting difference with the other two cases when it comes to securing income and revenue streams for financial self-sustainability. In fact, TECLA struggles to secure funding from business partners. In addition, the institutional situation in Italy is different from the Netherlands, and TECLA has thus far not been able to secure the financial commitment of major public bodies and education centers. For this reason, TECLA has been exploring alternative funding options. First, building on the earlier success in creating ARCA, one systematically applies for funding via open calls at local, national and European levels. Second, TECLA's management seeks to substantially reduce costs by sharing its physical location with other commercial users (e.g. co-working space and bar) and by offering its assets, tools and machineries for hire by external users.

4. Discussion

In the previous section, we presented the main insights arising from the three cases. In this section we describe a comprehensive framework that can support any LL in defining and developing financial sustainability. This framework serves to infer a number of generic insights from the cases outlined in the previous section; in this respect, the three cases appear to be rather diverse in terms of their maturity level, institutional setting and funding approach, and thus we can readily assume these cases adequately represent the entire population of LLs.

First of all, the cases show that LLs can draw on different funding options, which we classify as pay per service (PPS), subsidies (SUB), out of network funds (ONF) and cross-financing (CRF). Each of the three LLs described in the previous section has a different mix of these options. Since the four options are not mutually exclusive but rather complementary, we suggest any LL should seek to exploit the potential of every option. The three cases also show that there is not a 'one size fits all' financing strategy, but the best funding mix depends on several characteristics of the LL. Therefore, each LL should define its optimal funding mix, with the following guidelines in mind:

- The LL should explicitly distinguish between strategic and project partners: in this way, it is easier to link the various stakeholders to the most adequate financing option;
- The LL needs to explicitly classify the kind of value created, according to the three categories proposed in section 2; indeed, economic, business and public value are very different in nature, also in terms of the actors affected;
- Funding can be generated from the stakeholder-partners in the LL, but also from external actors;
- Most of the funding (to be) acquired is linked to the mission of the LL; however, especially in starting up a LL, one can obtain additional funds by exploiting assets and capabilities outside the boundaries of the LL's core activities and mission;
- Public and private funding are very different in nature and modality and tend to imply fundamentally different requirements and expectations.

Based on these guidelines and the findings in section 3, we propose a comprehensive framework that helps to visualize the entire spectrum of funding options: the Funding Mix Framework (FMF), outlined in *Figure 1*. The FMF can be employed by any LL to develop and fine tune a financially sustainable business model based on an appropriate mix of PPS, SUB, ONF and CRF.

4.1 Pay Per Service

Pay per service (PPS) is the most immediate monetary revenue arising from the services offered by the LL. For this reason, it can be conceived as the financial return on the economic (i.e. transactional) value generated. Economic value is primarily delivered to business partners, which turn to the LL for support in developing or improving their commercial products and services. In this respect, the source of PPS is mostly private. In rare occasions, PPS can arise from creating business or public value; in these cases, the PPS funding partially shifts toward the public sector. Evidently, the stakeholders that contribute via PPS belong to the LL's network. Finally, PPS is a funding option that is only available at the project level.

4.2 Subsidies

Subsidies (SUB) are the prevailing source of funding provided by strategic partners, which provide SUB to generate public and business value. In fact, strategic partners commit to a long-lasting relationship with the LL, with the aim to develop shared goals and objectives. In this respect, public value is delivered to citizens and stakeholders from the public sector and/or higher education, which compensate the LL in the form of subsidies. In addition, the various public, educational and business organizations are the main recipients of more specific forms of business value, which also justifies these subsidies. Hence, SUB is a funding option that mainly relies on public sources. Finally, we observed that the SUB funding option is connected to the entire innovation process and operations of the LL.

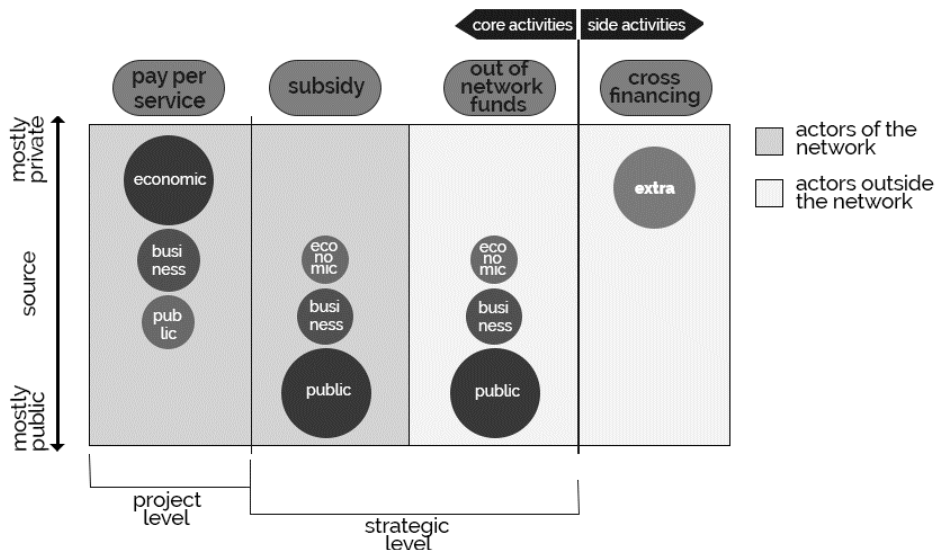


Figure 1. Funding mix framework

4.3 Out Of Network Funds

The mission of a LL is generally in line with the United Nations' sustainable development goals. For this reason, LLs have the opportunity to acquire funds by systematically submitting proposals to supranational (e.g. EU), national and regional calls. Many LL projects are compatible with public policies, and open calls provide interesting opportunities to finance the creation of public value. These Out-of-Network-Funds (ONF) are made available primarily by public bodies and are, thus, mostly coming from public sources. Some calls come from private entities, like banks, but these are rather exceptional. The public bodies providing funds are not directly involved in the LL's network, but are only responsible for granting proposals based on predefined criteria. Finally, ONF resources do support the mission of the LL and, thus, mainly relate to the strategic level.

4.3 Cross-Financing

In contrast to the previous three funding options, the cross-financing option is not linked to the activities of the LL and does not contribute to its immediate network. In fact, cross-financing (CRF) is an alternative way to profit from the LL's assets, such as its physical location or equipment. For example, the LL can sublet part of its physical space to a bar or to a co-working office, or more temporarily to events, conferences, and meetings. The LL can also make its equipment available to external users paying a rental fee. As such, the source of CRF is almost exclusively private and completely external to the LL's core activities.

5. Conclusions

This study contributes to the literature on LLs from a theoretical as well as practical perspective. We have identified several deficiencies in the current literature regarding the long-term sustainability of LLs. Whereas many studies of LLs have analyzed their networks, activities and missions, the conditions inhibiting or promoting sustainability of a LL are under-researched. Previous studies in this area have implicitly assumed the creation of value by any LL, and the monetary recognition by its stakeholders is often taken for granted. The lack of a structured approach to the long-term financial sustainability of LLs has been highlighted by several other researchers (Brankaert et al., 2014; Leminen et al., 2012; Schuurman, 2015; Ståhlbröst, 2012).

First, this paper contributes to the current literature by proposing a classification of value: the three cases confirmed that economic, business and public value adequately represent the entire spectrum of value created by a LL. Second, our study sheds light on the modality and extent to which different players financially support LLs: indeed, by defining four funding options, we enrich the extant literature with a taxonomy of the available financing options. Finally, the funding mix framework (FMF) developed in this paper extends existing theories of LLs with a holistic view of the relationships between stakeholders, value creation and funding options. Here, the FMF can support founders and managers of a LL in enhancing their LL's financial sustainability. Indeed, the FMF not only provides a visualization of every possible funding option but also provides several down-to-earth guidelines for developing the optimal funding mix contingent on the characteristics of the LL.

In conclusion, LLs can foster the innovation ecosystems they are embedded in and can possibly have a positive impact on the society at large. In order to have this impact, LLs need to be adequately funded to perform their operational activities (Bergvall-Kåreborn et al., 2009). Collaboration between the various actors inside and outside the LL's network is key to secure funds on a constant basis (Niitamo et al., 2006) and the funding mix framework can help practitioners to define an appropriate funding model. Furthermore, this framework helps LLs to position themselves effectively, in order to generate substantial revenues from the services provided (Garcia Guzmán et al., 2013; Rits, Schuurman, & Ballon, 2015). Indeed, our framework can help LLs to diversify their sources of income, thereby reducing their dependence on public grants (Brankaert et al., 2014; Wu, 2012). The FMF is grounded in three case studies of living labs that are very different from each other, which suggests that this framework covers the entire range of potential financing strategies. Nevertheless, the FMF should be tested on a larger sample of living labs in future studies, to further increase its practical relevance.

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