



## Trade Fairs and Innovation Labs: Potential Articulations

### *Feiras De Negócios e Laboratórios de Inovação: Possíveis Articulações*

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#### HIGHLIGHTS

- O artigo discute como feiras de negócios, apesar de estimularem inovação, carecem de interações contínuas. A articulação com laboratórios de inovação surge como estratégia para ampliar trocas de conhecimento, colaboração multisectorial e geração de soluções inovadoras sustentáveis.
- Ao caracterizar feiras de negócios como ecossistemas temporários e colaborativos, o estudo evidencia seu potencial como ambientes férteis para experimentação, aprendizagem coletiva e inovação, especialmente quando integradas a metodologias participativas.
- Os laboratórios de inovação são apresentados como espaços flexíveis, físicos ou virtuais, orientados à coprodução e à experimentação em contextos reais, capazes de responder às limitações das feiras ao promover processos contínuos de inovação e engajamento entre múltiplos stakeholders.
- O ensaio identifica convergências conceituais e operacionais entre feiras e laboratórios de inovação, destacando que a integração entre ambos pode agregar valor a expositores e visitantes, fortalecer redes colaborativas e acelerar o desenvolvimento de produtos, serviços e processos inovadores.

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KEY WORDS

Trade fairs  
Innovation labs  
Innovation  
Collaboration

ABSTRACT

**Objective:** To discuss the potential articulation between innovation laboratories and trade fairs, examining how their integration can enhance continuous interaction, knowledge exchange, and innovation generation within business ecosystems.

**Design/Method/Approach:** A theoretical essay based on a selection of international literature on innovation laboratories and trade fairs. The selected texts were analyzed according to their relevance to the study's guiding questions and conceptual intentions.

**Originality/Relevance:** The study introduces an underexplored connection between trade fairs and innovation laboratories, proposing that labs can serve as a complementary mechanism to strengthen innovation processes within trade fair environments.

**Main Results/Findings:** Findings indicate that trade fairs have specific needs—such as sustained interaction, collaborative problem-solving, and knowledge exchange—that innovation laboratories are well-positioned to address. By operating together, fairs and labs can offer enhanced value to exhibitors and visitors through co-creation and innovative solution development.

**Theoretical/Methodological Contributions/Implications:** The essay advances the literature by presenting a conceptual rationale for integrating innovation laboratories into trade fair ecosystems, expanding theoretical discussions on innovation mechanisms associated with such events.

**Social/Managerial Contributions:** The insights generated support trade fair organizers and public policymakers in designing and implementing innovation laboratory initiatives within trade fairs, aiming to amplify their economic, social, and technological benefits.

PALAVRAS-CHAVE

Feiras de negócios  
Laboratórios de inovação  
Inovação  
Colaboração

RESUMO

**Objetivo:** Discutir a articulação entre laboratórios de inovação e feiras de negócios, analisando como essa integração pode fortalecer interações contínuas, trocas de conhecimento e a geração de inovação nos ecossistemas empresariais.

**Design/Metodologia/Abordagem:** Ensaio teórico desenvolvido a partir da seleção de bibliografias internacionais sobre laboratórios de inovação e feiras de negócios.

**Originalidade/Relevância:** O estudo apresenta uma conexão pouco explorada entre feiras de negócios e laboratórios de inovação, propondo que os laboratórios podem atuar como um mecanismo complementar para fortalecer os processos de inovação nesses eventos.

**Principais Resultados/Achados:** Os resultados indicam que as feiras de negócios possuem necessidades específicas — como interações contínuas, resolução colaborativa de problemas e intercâmbio de conhecimentos — que podem ser atendidas por laboratórios de inovação. Atuando de forma integrada, feiras e laboratórios podem oferecer maior valor a expositores e visitantes por meio da cocriação e do desenvolvimento de soluções inovadoras.

**Contribuições Teóricas/Metodológicas/Implicações:** O ensaio avança na literatura ao apresentar uma fundamentação conceitual para a integração de laboratórios de inovação ao ecossistema das feiras de negócios, expandindo discussões teóricas sobre mecanismos de inovação associados a esses eventos.

**Contribuições Sociais/Gerenciais:** As reflexões apresentadas oferecem subsídios para organizadores de feiras e formuladores de políticas públicas estruturarem iniciativas de laboratórios de inovação em feiras de negócios, ampliando seus benefícios econômicos, sociais e tecnológicos.

## 1. Introduction

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Trade shows are spaces that bring together an entire production chain. Sarmento and Simões (2018) state that they still require further research, as conceptual articles are scarce and indicate the potential for building theoretical foundations on the subject. Trade fairs represent markets concentrating the leading industry-related players in a single space and a short period (Gebesmair, Ebner-Zarl & Musik, 2022; Rinallo & Golfetto, 2006).

They can be called vertical when they promote products and services for a single industry or horizontal when they generate offers for various sectors (Kijewskia, Yoona & Youngb, 1993). Exhibitors and visitors seek to participate in fairs that provide high-quality business opportunities and services (Jin, Bauer & Weber, 2010; Silva, Paço & Moutinho, 2023). Trade fairs are promotional tools for various products in the experiential world of the 21st century (Rai & Nayak, 2018).

Kirchgeorg, Jung, and Klante (2010) state that trade fair organizers should offer a wide range of services and play new roles, such as brokers and networking facilitators. Sarmento and Farhangmehr (2016) point out that trade shows that provide quality services end up attracting more engaged stakeholders.

Furthermore, the literature highlights innovation as one of the most important objectives for participation in trade fairs (Hansen, 1999; Parodi & Proenca, 2025; Silva, Vale & Moutinho, 2022). Therefore, when trade fairs place innovation as part of their strategies, this positively affects their performance (Chiou, Hsieh & Shen 2007). Sarmento and Simões (2018) conclude that visitors' overall satisfaction and intention to participate in future editions are determined by the products' quality and innovation and by the experience provided in the interaction with the exhibitors' staff.

Some of these characteristics connect to the attributes of innovation labs. A lab is a participatory process that brings together people with different points of view (Barau, Kafi, Sodangi, & Usman, 2023; Pathways Network, 2018; Silva-Junior, Emmendoerfer, Almeida & Mediotte, 2024) in arenas where new solutions are developed (Malmberg et al., 2017; Olavo Beneyto, Nebot & Emmendoerfer, 2022). They facilitate participatory processes, encourage innovation and experimentation, are results-oriented, and aim to generate concrete solutions (Asenbaum & Hanusch, 2021).

These laboratories can be configured in different ways, with varying work methodologies, institutional arrangements, teams, project types, and autonomy levels, among other institutional and organizational factors, which ultimately influence their capacity and results (Ferrarezi, Lemos & Brandalise, 2018). Furthermore, they offer opportunities for learning (formal and informal) and creative problem-solving, enabling the creation of new products, services, or processes (Rosenow-Gerhard, 2020).

Based on these characteristics of trade fairs and innovation labs, some questions emerge:

- a) Could trade fairs support physical and virtual innovation labs to expand the range of services offered, improve the interaction between participants, and intensify the exchange of information and knowledge?
- b) What would be necessary so innovation labs could be implanted in trade fairs?
- c) Which elements/indicators/factors show that innovation labs can work in trade fairs?
- d) Which elements/indicators/factors can limit or inhibit the implantation of innovation labs in trade fairs?

Such questions will not be exhausted and fully answered in this work, but used for reflection purposes and to serve as a starting point for its main objective, which is: to discuss possibilities for articulation between innovation labs and trade fairs. In this way, it helps to identify practices for trade fairs to increase their benefits, which according to Sarmento and Simões (2019) and Shereni, Ncube and Mazhande (2021) is a topic that should be continually debated further in the literature.

The main stakeholders in the sector's production chain are present in trade fairs, fostering economic, social, cultural, political, and organizational factors essential to the dynamics of innovation. This is achieved through the interaction of different actors, through formal and informal relationships, who share information, resources, and skills (Silva-Junior & Emmendoerfer, 2021; Silva-Junior et al., 2024).

Furthermore, it is important to highlight that innovation is important for company performance, as pointed out by Barbosa, Fernandes Junior, Bouzada e Oliveira (2022), who indicate that a typical company is more likely to experience high growth when innovation initiatives are present.

This theoretical essay is organized into six parts. This first contextualizes and discusses the proposal of this study. In the following section, the methodological procedures of the work are explained. The third and fourth present the basic concepts on trade fairs and innovation labs. In the fifth part, an interrelationship between these two themes is made. Finally, the final considerations of the article are mentioned.

## 2. Methodological Procedures

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This study is characterized as a theoretical essay. The main contribution of this type of work is to consider separate theoretical pieces together and contemplate an integrative perspective. The theoretical essay has a critical stance, which presents a leap "(...) into the unknown and into the unusual and accepted by the system" (Boava, Macedo & Sette, 2020, p. 70, our translation). The theoretical essay was chosen precisely because of its characteristics, enabling the development of a study integrating subjects that are theoretically distant in principle and with few studies that correlate them critically.

Although the theoretical essay does not have methodological rigor, its main strength lies in its reflective property, to understand reality and be used consciously and intentionally in understanding a subject (Meneghetti, 2011).

Although reflective and subjective in nature, and lacking in methodological rigor, this type of scientific study requires, at a minimum, maintaining the rigor inherent in scientific production (Minayo, 2017). Thus, the theoretical framework was identified through a non-systematic search of national and international literature on the topics under study: trade fairs and innovation labs. The research was not restricted to a specific time period, and was conducted in databases such as Spell, Scopus, and Web of Science. The search terms used were "trade fair," "business fair," "innovation," "innovation labs," and "Living Labs," in any field.

The selected texts were analyzed to delve deeper into the subject and select considerations that could contribute to the study. Subsequently, the main potential of the articulation between innovation labs and trade fairs is discussed.

## 3. Trade Fairs

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Trade fairs are physical meetings where manufacturers, distributors, and suppliers meet and exhibit their products or describe their services to invited people, including current and potential customers, suppliers, other business partners, and the press (Bonomo, 1983). Sarmento and Simões (2019) and Silva et al. (2023) write that trade fairs are events where participants interact face-to-face or virtually. The context of trade fairs can be: business-to-business (B2B), with actors belonging to the trade, or business-to-consumer (B2C), open to the general public (Palumbo & Herbig, 2002).

Trade fairs can also be temporary and cyclical clusters/ecosystems (Bathelt & Schuld, 2008; Power & Jansson, 2008; Rinallo, Bathelt & Golfetto, 2017). These temporary platforms allow for vertical interactions with companies belonging to partner or competitor industries; and horizontal interactions with companies in the same industry, which provides interactive learning, knowledge creation, and networking (Bathelt & Schuld, 2008). The main stakeholders of trade fairs, according to the organizers, are: assemblers, exhibitors, sponsors, City Hall and public authorities, who act as supporters and leaders in these events (Locatelli, 2022).

Fairs create the opportunity for information exchange and formal and informal social interaction, which can reduce relational distance and increase trust between business partners (Borghini, Golfetto & Rinallo, 2006; Hansen, 1999; Rinallo, Borghini & Golfetto, 2010; Rosson & Seringhaus, 1995; Sarmento, Farhangmehr & Simões, 2015). Trade fairs allow close contact over a period of time (Bathelt & Schuld, 2008; Shereni et al., 2021).

Moreover, they have an informal atmosphere (Sarmento et al., 2015) with emotionalized scenarios (Kirchgeorg et al., 2010), full of sensory stimuli (Borghini et al., 2006; Rinallo et al., 2010), which ends up promoting interactions among participants (Sarmento et al., 2015). In this way, they become multidimensional relational spaces (Gebesmair et al. 2022; Rinallo et al., 2017; Shereni et al., 2021).

Trade shows offer companies opportunities for a number of purposes, including enhancing their knowledge of their industry, actively participating in the fairs, and testing their products in the market (Locatelli & Mourão, 2023). Furthermore, the authors emphasize that participants in major trade shows use the economic and social spaces created by these events as powerful networks to enhance their companies' integrated objectives.

Trade fairs propagate knowledge and customer engagement, representing privileged communication contexts (Rosson & Seringhaus, 1995; Sarmento et al., 2015). They also provide a favorable environment for developing positive emotions towards the company or the brand (Sarmento & Simões, 2018). Thus, a fair environment is rich in information and learning (Rinallo et al., 2010), generating macro and micro-level effects for participants (Borghini et al., 2006).

Many companies use trade fairs to present their products at different development stages (Kim & Mazumdar, 2016), and visitors search for new products/equipment at them (Westwood, Schofield & Berridge, 2018). Trade fairs that encourage interaction and knowledge exchanges are rich environments for innovation (Sarmento et al., 2015). Silva, Vale and Montinho (2023) indicate that innovation, proactivity, risk-taking, competitiveness and autonomy are a set of important elements for exhibitor networking. However, it is still necessary to understand how this knowledge can be shared among the participants to improve innovation practices (at the individual, organizational, and industry levels) and if it occurs only at the fair or before and after the event (Sarmento & Simões, 2018). Below is a presentation of the innovation laboratories.

#### 4. Innovation Labs

Innovation labs are not considered a new phenomenon but have recently become more prominent (Tönurist, Kattel, & Lember, 2015). Until the 2000s, innovation labs were seen only as a research infrastructure, such as a building or a set of buildings. Later, they started to be used to support innovation projects with a dynamic network of multiple stakeholders (Pino et al., 2013). Their main goals have been to drive and manage user-driven innovation in real-world settings (Pino et al., 2013; Schiuma & Santarsiero, 2023) and to stimulate interaction between technological and socio-economic forces (Franz, Tausz & Thiel, 2015).

Although innovation labs have become a popular tool (Franz, 2015), academic and practical studies on the topic are still needed (Gryszkiewicz, Lykourentzou & Toivonen, 2016; Hossaina, Leminen & Westerlund, 2019; Niitamo, Kulkki, Eriksson & Hribernik, 2016; Tönurist, Kattel & Lember, 2017). However, this research field has gained visibility, which is not always positive, as studies can become fragmented and diverse (Greve, Vita, Leminen, & Westerlund, 2021).

Labs come in different shapes and sizes according to cultural contexts, creators' intentions, participants involved, and other nuances of their creation and management. They can be short-lived events or long-lasting institutions (Feitoza, 2018; Gryszkiewicz et al., 2016). These characteristics provide labs with multiple classifications and nomenclatures, which can result in endlessly complex and ultimately unusable terminology (Asenbaum & Hanusch, 2021). However, there is still no widely accepted definition of innovation labs (Baccarne, Schuurman & Seys, 2013; Leminen, Turunen & Westerlund, 2015; Robles, Hirvikoski, Schuurman & Stokes, 2016). The absence of a widely recognized definition (Grotenhuis, 2017) indicates the lack of a common understanding of the concept and its meanings (Bergvall-Kareborn & Stahlbrost, 2009; Bezerra, Pereira, Brito, & Bresciani, 2022). Table 1 briefly presents some definitions found for innovation labs or living labs.

**Table 1:** Innovation Lab Definitions

Definition	Author(s)
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Experimentation environment where technology takes shape in real-life contexts and where (end) users are considered "co-producers".	(Bergvall-Kareborn, Ihlström, Stahlbrost & Svensson, 2009)
Infrastructure design based on the systematic involvement of users in an innovative process under real-life conditions.	(Leminen, Westerlund & Nyström, 2012)
Collaboration space to create, prototype, validate, and test new technologies, services, products, and systems in real-life contexts.	(Leminen et al., 2012)
Networks composed of heterogeneous actors, resources, and activities that provide a platform for developing and applying user-driven innovation.	(Leminen et al., 2012)
Multi-stakeholder collaboration space and end-user involvement are the core elements of an approach.	(Baccarne et al., 2013)
Emergent approach that involves multiple users to co-create value that leads to innovation.	(Veeckman, Schuurman, Leminen & Westerlund, 2013)
Semi-autonomous organization, in which different actors participate on a long-term basis with open collaboration, to work out solutions to "open-closed" systemic challenges.	(Gryszkiewicz et al., 2016)
User-centered research methodology to detect, prototype, validate, and refine complex solutions in multiple and evolving real-life contexts.	(Niitamo et al., 2016)
Innovative tool that provides opportunities for testing, validation, development, and co-creation at all stages of a design and commercialization process.	(Buhl, Von Geibler, Echternacht & Linder, 2017; Leminen, Rajahonka & Westerlund, 2017)
Space for the participatory involvement of various stakeholders who co-create solutions to a given problem, not just verbally but in practice, whether they are physical or digital objects and must then be tested and validated, if necessary refined or reinvented until approval.	(Asenbaum & Hanusch, 2021)
Innovation labs, or living labs, can be defined as a methodology geared toward two main ideas: involving users in an early stage of the innovation process and experimenting in a real-life context.	(Nguyen & Marques, 2022)
Innovation labs are conceptualized as boundary spaces and intermediaries of innovation. Internally, they support the development of new organizational capacities, while externally, they foster engagement with diverse actors, facilitating mutual understanding and the co-construction of knowledge across different domains and interests.	(Silva-Junior, Emmendoerfer & Silva, 2024)
Innovation labs — whether physical, virtual, or hybrid — function as critical catalysts for science-industry collaboration, establishing structured environments in which heterogeneous stakeholders engage in co-creation, experimentation, and iterative problem-solving. In doing so, they not only facilitate the development of novel solutions to complex societal and technological challenges but also broaden and institutionalize the mechanisms of knowledge transfer.	(Osorio, Giones, Dupont & Camargo, 2025)

Source: Elaborated by the authors.

When analyzing the definitions of innovation labs, commonly identified factors involve the participation of different actors/stakeholders, collaboration, and the creation of products, services, and processes, not only conception (Barau et al., 2023). The stakeholders involved in innovation labs can include suppliers, customers, users, competitors, universities, and other organizations (Leminen et al., 2017).

Network-based multi-actor collaboration may be one factor that has attracted attention to innovation labs (Leminen et al., 2015; McPhee, Leminen, Schuurman, Westerlund & Huizingh, 2016; Leminen et al., 2012). This provides an open and dynamic research and innovation ecosystem involving solution developers, local authorities, policymakers, and user communities (Leminen et al., 2012; Nguyen & Marques, 2022; Vecchio, Elia, Ndou, Secundo & Specchia, 2017). Different actors' participation is necessary because a single organization has limited capacity (Memon, Meyer & Tunio, 2022). Gryszkiewicz et al. (2016) and Tönurist et al. (2017) reinforce the need for collaboration between agents and the ability to coordinate users' interdisciplinary needs.

In this study, an innovation lab is understood as a platform that provides shared resources and integrates a variety of private and public stakeholders to gather, create, communicate, and deliver new knowledge; validate existing products, services, and processes; and facilitate professional development and social impact (Westerlund, Leminen, & Rajahonka, 2018). Given their definition, labs have several benefits: they help conduct experiments and obtain user feedback, providing a place where co-creation is facilitated (Hyysalo & Hakkarainen, 2016); they can tap tacit knowledge that can be used to translate latent user needs into new products and services, or improve existing ones (Franz, 2015; Leminen et al., 2012); and provide governance and a framework for collecting user insights and filtering problems to support entrepreneurship and intra-entrepreneurship (Hakkarainen & Hyysalo, 2013; Jimeno-Morenilla, Molina-Carmona, Pertegel-Felices & Trujillo-Torres, 2025; Silva, Vale & Moutinho, 2022).

Labs produce outcomes: tangible, such as designs, products, prototypes, solutions, and systems; and intangible, such as concepts, ideas, property rights, knowledge, and services (Buhl et al., 2017). These outcomes

are based on the labs' ability to facilitate co-creation and improve access to knowledge (Leminen, Nyström, Westerlund & Kortelainen, 2016), which decreases market risk when launching new offerings, increases return on investment, and accelerates the time to put outcomes into operation (Niitamo, Westerlund & Leminen, 2012).

## 5. Innovation Labs and Trade Fairs: Reflections and Possibilities

Considering trade fairs and innovation laboratories, it can be observed that they can act complementarily, stimulating the innovative process. This is because trade fairs are environments full of sensory stimuli (Borghini et al., 2006; Rinallo et al., 2010), which mobilize interactions and relationships among participants (Sarmento et al., 2015). In this way, they are an enabling space to gather, create, communicate, and deliver new knowledge; validate existing products, services, and processes; and facilitate professional development and social impact (Westerlund et al., 2018). In other words, it is a necessary environment for the innovation lab to intensify the exchange of information and knowledge between different actors.

For innovation labs to be implemented in trade fairs, organizers must be interested in promoting one more service to the participants. This would add even more value to the fair and its businesses. Therefore, it is necessary to involve public authorities, the entities related to the fair's focus sector, educational institutions, exhibitors, and visitors. Multi-actor collaboration is essential, as it is one of the factors that has attracted attention to innovation labs (Leminen et al., 2015; McPhee et al., 2016; Leminen et al., 2012) and creates an open and dynamic research and innovation ecosystem (Leminen et al., 2012; Memon et al., 2022; Osorio et al., 2025; Vecchio et al., 2017), which is a fair's function.

The factors demonstrating that innovation laboratories can work in trade fairs are: fairs integrate different actors of the same business sector (Bathelt & Schuldt, 2008; Silva, Paço & Moutinho, 2023), and they enable lab implementation since they require the participation and collaboration of various actors/stakeholders (Asenbaum & Hanusch, 2021; Baccarne et al., 2013; Gryszkiewicz et al., 2016; Leminen et al., 2012; Veeckman et al., 2013).

Laboratories - since they can adapt their action, size, and duration - would be adaptable to the fair formats, which are currently physical or virtual (Sarmento & Simões, 2019), being traditionally temporary and cyclical ecosystems (Bathelt & Schuldt 2008; Power & Jansson, 2008; Rinallo et al., 2017). In addition, laboratories can bring together different stakeholders, allowing information and knowledge exchanges, and enhancing collective learning (Nguyen & Marques, 2022). Thus, laboratories, as boundary spaces and intermediaries of innovation, can capture information from the external environment and employ it to enhance organizational capabilities and to strengthen the development of internal actions (Silva-Junior, Emmendoerfer & Silva, 2024).

Another element that supports innovation laboratory implementation in trade fairs is that they allow face-to-face contact for some time (Bathelt & Schuldt, 2008). This enables the opportunity for information exchange, social interaction, and increased trust among business partners (Borghini et al., 2006; Hansen, 1999; Rinallo et al., 2010; Rosson & Seringhaus, 1995; Sarmento et al., 2015) and disseminates knowledge (Rosson & Seringhaus, 1995; Sarmento et al., 2015) and innovation (Sarmento et al., 2015). Therefore, fairs would be favorable environments for the development of innovation labs (Franz et al., 2015; Pino et al., 2013).

Another facilitating attribute is that laboratories seek to transform user needs into new products and services or improve existing ones (Franz, 2015; Leminen et al., 2012; Schiuma & Santarsiero, 2023). Many companies use trade fairs to present their products in different development stages (Kim & Mazumdar, 2016), and visitors seek new products/equipment at trade fairs (Westwood et al., 2018). Thus, visitors/users could tell companies their needs and participate in creating a solution during the fair through experimentation, contributing to product improvement, or generating new ideas for future products.

Furthermore, Celuch (2021) states that global emergencies require organizations, regardless of sector, to move beyond the status quo of their current practices and work to meet the Sustainable Development Goals (SDGs) for positive impact. In this regard, the United Nations (2020) already

indicates a need to build resilient infrastructure, promote sustainable industrialization, and foster innovation for organizations to survive in the future. However, the absence of public policies and trade fair organizers' and stakeholders' lack of understanding/engagement can inhibit innovation lab implementation at fairs.

Considering that innovation labs require a dynamic, collaborative environment with diverse stakeholders to be implemented, enabling innovation. These needs are met by the characteristics of trade shows, coupled with the fact that the entire industry chain is involved during the fair. Furthermore, innovation labs can easily adapt their operations to the specific needs of the participants.

Concluding this section, Table 2 is presented with a summary of the possible links between business fairs and innovation laboratories, which is the main objective of this study.

**Table 2: Summary of possible partnerships - Trade Fairs vs. Innovation Laboratories**

Aspects	Trade Fairs	Innovation Laboratories	Possible articulations
Main Features	Environments with sensory stimulation that bring together different actors from a sector. They are temporary and cyclical, and can be physical or virtual.	These environments require collaboration between multiple actors. They are adaptable in terms of performance, size, and duration.	Trade shows provide the dynamic and collaborative environment that innovation labs need to operate.
Function	Create interactions and relationships, validate products and services, and disseminate knowledge.	Transform user needs into new products and services, or improve existing ones.	Laboratories can use trade shows as a platform for product testing and collecting direct feedback from visitors and companies.
Supporting Factors	They bring together the entire industry chain in a single location, facilitating face-to-face contact and the exchange of information and trust.	Multi-stakeholder collaboration is a key factor in their success. They enable collective learning and co-creation.	Bringing together the entire industry chain at the fair facilitates collaboration among multiple stakeholders, which favors the implementation of a laboratory.
Added Value	It adds value to businesses by attracting exhibitors and visitors seeking innovation.	It promotes sustainable innovation and organizational resilience by focusing on the Sustainable Development Goals (SDGs).	Implementing laboratories at trade shows adds a new service, increasing the value of the show and fostering innovation within the sector.
Factors that may inhibit implementation	-	-	Absence of public policies and lack of understanding or involvement of organizers and stakeholders.

*Source: Elaborated by the authors.*

After these discussions, final considerations are presented.

## 6. Final Considerations

This theoretical essay made it possible to start discussions to begin on the relationship between innovation laboratories and trade fairs. It concludes, in the theoretical field, that there is the possibility of implementing innovation labs at trade fairs, whether virtual or physical - considering that innovation labs need to create a dynamic collaboration environment for their implementation, which enables innovation. These needs are met by the characteristics of trade fairs, adding the fact that the entire chain of a sector is together during the fair period. Furthermore, innovation labs can easily adapt their operations, depending on the particularities of those requesting the actions.

It can be seen, with the provocations made in this work, that fair organizers must prepare to link up with innovation labs, which will add value to the event and mobilize participants. If the organizers do not see this possibility, higher education institutions, innovation promoters and public authorities can do so, aiming to bring benefits to everyone involved.

It is worth reflecting on why this articulation is not yet a widely developed practice. Furthermore, it is important questioning the reasons for the literature has not dedicated itself to addressing this relationship - considering that the correlation between these topics is evident in several



journal databases, such as Scopus and Web of Science (in research carried out in 2025).

The study's limitations include the shortcomings of the theoretical essay itself, as it lacked a systematic literature review and empirical research. Therefore, we suggest that future research on the potential for linkages between trade shows and innovation labs be based on other data sources, particularly primary data collected from different stakeholders in the trade show ecosystem.

Despite its limitations, this article makes important contributions to the literature, advancing the discussion of practices and measures that can

increase the benefits of the trade fairs, which according to Sarmento & Simões (2019) and Shereni et al. (2021) is a topic that should be continually debated further. More practically, it can provide fair organizers and public policy makers with information to implement innovation labs at trade fairs. This implementation can become a differentiator at trade shows for both exhibitors and attendees, adding value and engagement to the event. Furthermore, it can encourage higher education institutions, innovation advocates, and public authorities to encourage and participate in these initiatives.

## References

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1. Asenbaum, H., & Hanusch, F. (2021). (De)Futuring democracy: Labs, playgrounds, and ateliers as democratic innovations. *Futures*, 134, 1-11. <https://doi.org/10.1016/j.futures.2021.102836>
2. Baccarne, B., Schuurman, D., & Seys, C. (2013). Living labs as a navigation system for innovative business models in the music industry. *Proceedings of the ISPIM Conference – Innovating in Global Markets: Challenges for Sustainable Growth*, Espoo, Finland, 14.
3. Barau, A. S., Kafi, K. M.; Sodangi, A. B. & Usman, S. G. (2023). Recreating African biophilic urbanism: The roles of millennials, native trees, and innovation labs in Nigeria. *Cities & Health*, 7(2), 213-223. <https://doi.org/10.1080/23748834.2020.1763892>
4. Barbosa, J. G. P., Fernandes Junior, J. L. A. F., Bouzada, M. A. C., & Oliveira, M. A. A. (2022). The influence of organizational and technological innovation in the growth of Brazilian companies. *Brazilian Journal of Management and Innovation*, 10(1), 123-143. <https://doi.org/10.18226/23190639.v10n1.06>
5. Bathelt, H., & Schuldt, N. (2008). Between luminaires and meat grinders: International trade fairs as temporary clusters. *Regional Studies*, 42(6), 853-68. <https://doi.org/10.1080/00343400701543298>
6. Bergvall-Kareborn, B., & Stahlbrost, A. (2009). Living lab: An open and citizen-centric approach for innovation. *International Journal of Innovation and Regional Development*, 1(4), 356-370. <https://doi.org/10.1504/IJIRD.2009.022727>
7. Bergvall-Kareborn, B., Ihlström, C., Stahlbrost, A., & Svensson, J. (2009). *A Milieu for Innovation – Defining Living Labs*. [https://www.researchgate.net/publication/228676111\\_A\\_Milieu\\_for\\_Innovation-Defining\\_Living\\_Labs](https://www.researchgate.net/publication/228676111_A_Milieu_for_Innovation-Defining_Living_Labs)
8. Bezerra, D. M., Pereira, A. W. R., Brito, B. A. V., & Bresciani, L. P. (2022). Laboratórios de inovação no setor público: O estágio atual das pesquisas e práticas internacionais. *Reunir: Revista de Administração, Contabilidade e Sustentabilidade*, 12(1), 14-31. <https://doi.org/10.18696/reunir.v12i1.1365>
9. Boava, D. L. T., Macedo, F. M. F., & Sette, R. S. (2020). Contribuições do ensaio teórico para os estudos organizacionais. *Revista Administração em Diálogo*, 22(2), 69-90. <https://doi.org/10.23925/2178-0080.2020v22i2.41951>
10. Bonoma, T. V. (1983). Get more out of your trade shows. *Harvard Business Review*. Retrieved from <https://hbr.org/1983/01/get-more-out-of-your-trade-shows>
11. Borghini, S., Gofetto, F., & Rinaldo, D. (2006). Ongoing search among industrial buyers. *Journal of Business Research*, 59(10-11), 1151-1159. <https://doi.org/10.1016/j.jbusres.2006.06.005>
12. Buhl, J., Von Geibler, J., Echternacht, L., & Linder, M. (2017). Rebound effects in living labs: Opportunities for monitoring and mitigating re-spending and time use effects in user integrated innovation design. *Journal of Cleaner Production*, 151, 592-602. <https://doi.org/10.1016/j.jclepro.2017.03.001>
13. Celuch, K. (2021). Event technology for potential sustainable practices: A bibliometric review and research agenda. *International Journal of Event and Festival Management*, 12(3), 314-330. <https://doi.org/10.1108/IJEFM-08-2020-0051>
14. Chiou, J.-S., Hsieh, C.-H., & Shen, C.-C. (2007). Product innovativeness, trade show strategy and trade show performance. *Journal of Global Marketing*, 20(2-3), 31-42. [https://doi.org/10.1300/J042v20n02\\_04](https://doi.org/10.1300/J042v20n02_04)
15. Feitoza, M. A. (2018). Laboratório de inovação: Proposição de um modelo para a gestão central da Fundação Oswaldo Cruz (FIOCRUZ) (Doctoral dissertation). Fundação Getúlio Vargas, Rio de Janeiro, RJ, Brasil.
16. Ferrarezi, E., Lemos, J., & Bandalise, I. (2018). *Experimentação e novas possibilidades em governo: Aprendizados de um laboratório de inovação*. ENAP.
17. Franz, Y. (2015). Designing social living labs in urban research. *Info*, 17(4), 53-66. <https://doi.org/10.1108/info-01-2015-0008>
18. Franz, Y., Tausz, K., & Thiel, S.-K. (2015). Contextuality and co-creation matter: A qualitative case study comparison of living lab concepts in urban research. *Technology Innovation Management Review*, 5(12), 48-55. <https://timreview.ca/article/952>
19. Gebesmair, A., Ebner-Zarl, A., & Musik, C. (2022). Symbolic representations of cultural industries at content trade fairs: Bourdieu's "economic world reversed" revisited. *Poetics*, 92, 1-13. <https://doi.org/10.1016/j.poetic.2021.101614>
20. Greve, K., Vita, R., Leminen, S., & Westerlund, M. (2021). Living labs: From niche to mainstream innovation management. *Sustainability*, 13(2), 1-24. <https://doi.org/10.3390/su13020791>
21. Grotenhuis, F. D. J. (2017). Living labs as service providers: From proliferation to coordination. *Global Bus Organ Excellence*, 36(4), 52-57. <https://doi.org/10.1002/joe.21790>

22. Gryszkiewicz, L., Lykourentzou, I., & Toivonen, T. (2016). Innovation labs: Leveraging openness for radical innovation? *Journal of Innovation Management*, 4(4), 68-97. [https://doi.org/10.24840/2183-0606\\_004.004\\_0006](https://doi.org/10.24840/2183-0606_004.004_0006)

23. Hakkarainen, L., & Hyysalo, S. (2013). How do we keep the living laboratory alive? Learning and conflicts in living lab collaboration. *Technology Innovation Management Review*, 3(12), 16-22. <https://doi.org/10.22215/timreview/749>

24. Hansen, K. (1999). Trade show performance: A conceptual framework and its implications for future research. *Academy of Marketing Science Review*, (8), 1-12. [https://doi.org/10.1142/9789812817983\\_others01](https://doi.org/10.1142/9789812817983_others01)

25. Hossaina, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. *Journal of Cleaner Production*, 213(10), 976-988. <https://doi.org/10.1016/j.jclepro.2018.12.257>

26. Hyysalo, S., & Hakkarainen, L. (2016). The evolution of intermediary activities: Broadening the concept of facilitation in living labs. *Technology Innovation Management Review*, 6(1), 45-58. <https://doi.org/10.22215/TIMREVIEW/960>

27. Jimeno-Morenilla, A., Molina-Carmona, R., Pertegel-Felices, M. L., & Trujillo-Torres, J. M. (2025). Creating a lab to foster intra-entrepreneurship for university digital transformation. *Knowledge Management Research & Practice*, 1-16. <https://doi.org/10.1080/14778238.2025.2484016>

28. Jin, X., Bauer, T., & Weber, K. (2010). China's second-tier cities as exhibition destinations. *International Journal of Contemporary Hospitality Management*, 22(4), 552-571. <https://doi.org/10.1108/09596111011042749>

29. Kijewskia, V., Yoon, E., & Youngb, G. (1993). How exhibitors select trade shows. *Industrial Marketing Management*, 22(4), 287-298. [https://doi.org/10.1016/0019-8501\(93\)90025-3](https://doi.org/10.1016/0019-8501(93)90025-3)

30. Kim, T., & Mazumdar, T. (2016). Product concept demonstrations in trade shows and firm value. *Journal of Marketing*, 80(4), 90-108. <https://doi.org/10.1509/jm.14.0160>

31. Kirchgeorg, M., Jung, K., & Klante, O. (2010). The future of trade shows: Insights from a scenario analysis. *Journal of Business & Industrial Marketing*, 25(4), 301-312. <https://doi.org/10.1108/08858621011038261>

32. Leminen, S., Nyström, A-G., Westerlund, M., & Kortelainen, M. J. (2016). The effect of network structure on radical innovation in living labs. *Journal of Business & Industrial Marketing*, 31(6), 743-57. <https://doi.org/10.1108/JBIM-10-2012-0179>

33. Leminen, S., Rajahonka, M., & Westerlund, M. (2017). Towards third generation living lab networks in cities. *Technology Innovation Management Review*, 7(11), 21-35. <https://doi.org/10.22215/timreview/1118>

34. Leminen, S., Turunen, T., & Westerlund, M. (2015). The grey areas between open and closed in innovation networks. *Technology Innovation Management Review*, 5(12), 6-18. <https://www.theseus.fi/handle/10024/141066>

35. Leminen, S., Westerlund, M., & Nyström, A-G. (2012). Living labs as open-innovation networks. *Technology Innovation Management Review*, 2(9), 6-11. <https://doi.org/10.22215/timreview/602>

36. Locatelli, D. R. S., & Mourão, P. J. R. (2022). Why are they here? The intentions of Brazilian exhibitor at business fairs. *Revista Administração Em Diálogo*, 24(1), 76-95. <https://doi.org/10.23925/2178-0080.2022v24i1.52454>

37. Locatelli, D. R. S. (2022). Identificação dos stakeholders das feiras de negócios brasileiras: O olhar dos organizadores. *Administração de Empresas em Revista*, 4(30), 20-49. <https://revista.unicuritiba.edu.br/index.php/admrevista/article/view/20>

38. Malmberg, K., Vaittinen, I., Evans, P., Schuurman, D., Ståhlbröst, A., & Vervoort, K. (2017). *Living lab methodology handbook*. U4IoT.

39. McPhee, C., Leminen, S., Schuurman, D., Westerlund, M., & Huizingh, E. (2016). Editorial: Living labs and user innovation (January 2016). *Technology Innovation Management Review*, 6(1), 3-6. <https://doi.org/10.22215/timreview/955>

40. Memon, A. B., Meyer, K., & Tunio, M. N. (2022). Toward collaborative networking among innovation laboratories: A conceptual framework. *International Journal of Innovation Science*, 14(2), 282-301. <https://doi.org/10.22215/timreview/955>

41. Meneghetti, F. K. (2011). O que é um ensaio? *Revista de Administração Contemporânea*, 15(2), 333-337. <http://www.spell.org.br/documentos/ver/1416/o-que-e-um-ensaio-teorico-i/pt-br>

42. Minayo, M. C. S. (2017). Cientificidade, generalização e divulgação de estudos qualitativos. *Ciência & Saúde Coletiva*, 22(1), 16-17. <https://doi.org/10.1590/1413-81232017221.30302016>

43. Nguyen, H. T., & Marques, P. (2022). The promise of living labs to the quadruple helix stakeholders: Exploring the sources of (Dis)Satisfaction. *European Planning Studies*, 30(6), 1124-1143. <https://doi.org/10.1080/09654313.2021.1968798>

44. Niitamo, V-P., Kulkki, S., Eriksson, M., & Hribernik, K. A. (2016). State-of-the-art and good practice in the field of living labs. *2006 IEEE International Technology Management Conference (ICE)*, p. 1-8. Retrieved from <https://ieeexplore.ieee.org/document/7477081>

45. Niitamo, V-P., Westerlund, M., & Leminen, S. (2012). A small-firm perspective on the benefits of living labs. *Technology Innovation Management Review*, 2(9), 44-49. [https://timreview.ca/sites/default/files/article\\_PDF/Niitamo\\_TIMReview\\_September2012.pdf](https://timreview.ca/sites/default/files/article_PDF/Niitamo_TIMReview_September2012.pdf)

46. Olavo, A. V. A., Beneyto, G. P., Nebot, C. P., & Emmendoerfer, M. L. (2022). Laboratórios de inovação no setor público em perspectiva comparada: Uma análise exploratória entre Brasil e Espanha. *Revista de Gestão e Projetos*, 13(2), 89-115. <https://doi.org/10.5585/gep.v13i2.21792>

47. Osorio, F., Giones, F., Dupont, L., & Camargo, M. (2025). Innovation labs strategy: Unfolding the multifaceted role of strategic intent. *Technovation*, 141. <https://doi.org/10.1016/j.technovation.2025.103170>

48. Palumbo, F., & Herbig, P. A. (2002). Trade shows and fairs. *Journal of Promotion Management*, 8(1), 93-108. [https://doi.org/10.1300/J057v08n01\\_09](https://doi.org/10.1300/J057v08n01_09)

49. Parodi, E. B., & Proenca, J. F. (2025). Trade fair and innovation: A systematic literature review. *International Journal of Marketing, Communication and New Media*, 13(24). <https://doi.org/10.54663/2182-9306.2025.v13.n.24.217-253>

50. Pathways Network. (2018). *T-Labs: A practical guide - Using Transformation Labs (T-Labs) for Innovation in Social-Ecological Systems*. Brighton: STEPS Centre.

51. Pino, M., Benveniste, S., Kerhervé, H., Picard, R.G., Legouverneur, G., Cristancho-Lacroix, V., Wu, Y., Damnée, S., Wrobel, J., & Rigaud, A. (2013). Contribution of the living lab approach to the development, assessment and provision of assistive technologies for supporting older adults with cognitive disorders. *Stud. Inform. Univ.*, 11(2), 34-62.

52. Power, D., & Jansson, J. (2008). Cyclical clusters in global circuits: Overlapping spaces in furniture trade fairs. *Economic Geography*, 84(4), 423-48. <https://doi.org/10.1111/j.1944-8287.2008.00003.x>

53. Rai, S., & Nayak, J. K. (2018). Role of event personality and exhibitors' eudaimonic and hedonic happiness in predicting event advocacy intentions: An empirical study. *International Journal of Event and Festival Management*, 9(1), 86-103. <https://doi.org/10.1108/IJEFM-09-2017-0056>

54. Rinallo, D., & Goltetto, F. (2006). Representing markets: The Shaping of fashion trends by French and Italian fabric companies. *Industrial Marketing Management* 35(7), 856-869. <https://doi.org/10.1016/j.indmarman.2006.05.015>

55. Rinallo, D., Bathelt, H., & Goltetto, F. (2017). Economic geography and industrial marketing views on trade shows collective marketing and knowledge circulation. *Industrial Marketing Management*, 61, 93-103. <https://doi.org/10.1016/j.indmarman.2016.06.012>

56. Rinallo, D., Borghini, S., & Goltetto, F. (2010). Exploring visitor experiences at trade shows. *Journal of Business and Industrial Marketing*, 25(4), 249-58. <https://doi.org/10.1108/08858621011038207>

57. Robles, A. G., Hirvikoski, T., Schuurman, D., & Stokes, L. (2016). Introducing Enoll and its living lab community. *European Network of Living Labs*. Retrieved from <https://issuu.com/enoll/docs/enoll-print>

58. Rosenow-Gerhard, O. (2020). Lessons learned–configuring innovation labs as spaces for intrapreneurial learning. *Studies in Continuing Education*, 43(3), 1-17. <https://doi.org/10.1080/0158037X.2020.1797662>

59. Rosson, P. J., & Seringhaus, F. H. R. (1995). Visitor and exhibitor interaction at industrial trade fairs. *Journal of Business Research*, 32(1), 81-90. [https://doi.org/10.1016/0148-2963\(94\)00012-4](https://doi.org/10.1016/0148-2963(94)00012-4)

60. Sarmento, M., & Farhangmehr, M. (2016). Grounds of visitors' post-trade fair behavior: An exploratory study. *Journal of Promotion Management*, 22(5), 735-750. <https://doi.org/10.1080/10496491.2016.1185496>

61. Sarmento, M., & Simões, C. (2018). The evolving role of trade fairs in business: A systematic literature review and a research agenda. *Industrial Marketing Management*, 73, 154-70. <https://doi.org/10.1016/j.indmarman.2018.02.006>

62. Sarmento, M., & Simões, C. (2019). Trade fairs as engagement platforms: The interplay between physical and virtual touch points. *European Journal of Marketing*, 53(9), 1782-1807. <https://doi.org/10.1108/EJM-10-2017-0791>

63. Sarmento, M., Farhangmehr, M. & Simões, C. (2015). A relationship marketing perspective to trade fairs: Insights from participants. *Journal of Business & Industrial Marketing*, 30(5), 584-593. <https://doi.org/10.1108/JBIM-01-2013-0024>

64. Schiuma, G., & Santarsiero, F. (2023). Innovation labs as organizational catalysts for innovation capacity development: A systematic literature review. *Technovation*, 123, 1-18. <https://doi.org/10.1016/j.technovation.2023.102690>

65. Shereni, N. C., Ncube, F. N., & Mazhande, P. (2021). Exhibitors' preference at trade fairs: The case of Zimbabwe International Trade Fair (ZITF). *Journal of Convention & Event Tourism*, 22(5), 363-383. <https://doi.org/10.1080/15470148.2021.1893241>

66. Silva, P. M. Paço, A. F. & Moutinho, V. F. (2023). The trend of omnichannel trade fairs. Are B2B exhibitors open to this challenge? A study on Portuguese exhibitors. *Journal of Business-to-Business Marketing*, 30(1), 15-31. <https://doi.org/10.1080/1051712X.2023.2174825>

67. Silva, P., Vale, V. T., & Moutinho, V. F. (2022). What is the value of entrepreneurial orientation on the network and performance? An examination in trade fairs context. *Innovation & Management Review*, 19(1), 62-83. <https://doi.org/10.1108/INMR-05-2020-0068>

68. Silva-Junior, A. C., & Emmendoerfer, M. L. (2021) Os Caminhos para o desenvolvimento de uma gestão pública inovadora no Brasil. *Revista Organizações em Contexto*, 17(33), 361-369. <https://doi.org/10.15603/1982-8756/roc.v17n33p361-369>

69. Silva-Junior, A. C., Emmendoerfer, M. L., & Silva, M. C. (2024). Innovation labs in the light of the New Public Service model. *RAM. Revista de Administração Mackenzie*, 25(3), 1-25. <https://doi.org/10.1590/1678-6971/eRAMC240079>

70. Silva-Junior, A. C., Emmendoerfer, M. L., Almeida, T. C., & Mediotte, E. J. (2024). Laboratórios de inovação, coprodução, desenvolvimento e territórios inteligentes: Potencialidades no contexto da América Latina. *Revista Tecnologia e Sociedade*, 20(59), 124-142. <http://dx.doi.org/10.3895/rts.v20n59.16580>

71. Tönurist, P., Kattel, R. & Lember, V. (2015). Discovering innovation labs in the public sector. *Technology Governance*, (61), 1-36. <http://hum.ttu.ee/wp/paper61.pdf>

72. Tönurist, P., Kattel, R. & Lember, V. (2017). Innovation labs in the public sector: What they are and what they do? *Public Management Review*, 19(10), 1455-1479. <https://doi.org/10.1080/14719037.2017.1287939>

73. United Nations. (2020). *Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation*. Retrieved from <https://www.un.org/sustainabledevelopment/infrastructureindustrialization>

74. Vecchio, P. D., Elia, G., Ndou, V., Secundo, G., & Specchia, F. (2017). Living lab as an approach to activate dynamic innovation ecosystems and networks: An empirical study. *International Journal of Innovation and Technology Management*, 14(5), 1-18. <https://doi.org/10.1142/S0219877017500249>

75. Veeckman, C., Schuurman, D., Leminen, S., & Westerlund, M. (2013). Linking living lab characteristics and their outcomes: Towards a conceptual framework. *Technology Innovation Management Review*, 3(12): 6-15. <https://doi.org/10.22215/timreview/748>

76. Westerlund, M., Leminen, S., & Rajahonka, M. (2018). A topic modelling analysis of living labs research. *Technology Innovation Management Review*, 8(7), 40-51. <https://doi.org/10.22215/timreview/1170>

77. Westwood, C., Schofield, P., & Berridge, G. (2018). Agricultural shows: Visitor motivation, experience and behavioural intention. *International Journal of Event and Festival Management*, 9(2), 147-165. <https://doi.org/10.1108/IJEFM-09-2017-0050>

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