



Designing a University-Based Living Lab for Frugal Innovation: A Social Enterprise Model for SME Development

Renita Kawuryan^{1*}, Zhara Marchelina Laurentia², Andi Syarifuddin³, Fauziah Lily Anggraeni S⁴

¹Management, Multimedia University, Malaysia
²Management, Universitas Bakrie, Indonesia
³Digital Business, Politeknik Negeri Samarinda, Indonesia
⁴Managerial Accounting, Politeknik Negeri Samarinda, Indonesia
 *Corresponding author: RENITA.KAWURYAN@student.mmu.edu.my

Article History

Received:
 17 August 2026
Accepted:
 27 August 2026
Published:
 31 August 2026

Abstract

Micro, small, and medium enterprises (MSMEs) play a vital role in Indonesia's economy but continue to face challenges in adopting affordable innovation, digital technologies, and sustainable business practices. Although frugal innovation has been widely recognized as an effective approach for resource-constrained environments, existing studies predominantly emphasize conceptual discussions rather than practical implementation. This study proposes FrugalTech Living Lab (FTLL), a university-based social enterprise designed to bridge this gap by integrating research commercialization, student experiential learning, and SME development within a collaborative Living Lab ecosystem. The proposed business model was developed based on a bibliometric analysis of 519 Scopus-indexed publications (2015-2025) on frugal innovation, sustainability, inclusive innovation, and the circular economy, complemented by the authors' research, community engagement, and technology development initiatives conducted since 2023. The Business Model Canvas (BMC) was employed to design a sustainable model that delivers affordable innovation consulting, student-led digital marketing services, IoT-enabled solutions, business incubation, and capacity-building programmes. FTLL demonstrates how universities can transform research outputs into practical solutions while strengthening SME competitiveness, enhancing student employability, and fostering collaboration among academia, industry, government, and communities.

Keywords: *Frugal Innovation; Living Lab; Social Enterprise; Business Model Canvas; Research Commercialization; Sustainability*

1. Introduction

Micro, small, and medium enterprises (MSMEs) constitute the backbone of Indonesia's economy, representing more than 99% of all business entities, comprising approximately 64.2 million enterprises, contributing over 61% of the national gross domestic product (GDP), and employing nearly 97% of the national workforce (Biro Data dan Teknologi Informasi, 2025; Departemen Komunikasi Bank Indonesia, 2023). Their substantial contribution highlights the strategic importance of MSMEs in fostering inclusive economic growth, employment generation, and regional economic resilience (Lubis et al., 2025; Maharani & Mukhlis, 2024; Malik et al., 2022). Nevertheless, despite their economic significance, many Indonesian MSMEs continue to encounter considerable challenges in adopting digital technologies, improving operational efficiency, and implementing innovation due to limited financial resources, inadequate technological capabilities, and restricted access to innovation support services. Although internet penetration reached 72.8% of the Indonesian population in 2024 (Statistik Telekomunikasi Indonesia 2024, 2025), the digital transformation of MSMEs remains uneven. While digital financial services have expanded rapidly, evidenced by 26.7 million QRIS merchants, of which 91.4% are MSMEs (Departemen Komunikasi Bank Indonesia, 2023), broader adoption of digital technologies, including e-commerce, Internet of Things (IoT), data analytics, and research-based innovation remain relatively limited. This disparity illustrates that digital infrastructure alone is insufficient to enhance MSME competitiveness without complementary innovation support mechanisms (Hidayat et al., 2025; Hisyam & Hadiah Fitriyah, 2024).

The increasing demand for sustainable and inclusive innovation has stimulated growing scholarly interest in frugal innovation, Living Lab ecosystems, and research commercialization. Frugal innovation emphasizes the development of affordable, resource-efficient, and contextually appropriate solutions capable of generating value under conditions of resource constraints (Moleka, 2024). Similarly, the Living Lab approach promotes collaborative innovation through the active participation of universities, industry, government, and communities, enabling the co-creation, testing, and validation of innovations within real-life environments (Hossain et al., 2019). Concurrently, universities have increasingly been recognized as key actors within regional innovation ecosystems due to their capacity to generate knowledge, technological innovations, and highly skilled human capital (Markkula & Kune, 2015). More recently, the concept of the entrepreneurial university has further emphasized the responsibility of higher education institutions to translate research outputs into economic and societal value through commercialization, entrepreneurship, and stakeholder engagement (Majeed, 2025).

Despite these theoretical developments, existing studies have largely examined frugal innovation, Living Labs, university-industry collaboration, and research commercialization as separate streams of research. Although these studies have substantially advanced theoretical understanding, relatively limited attention has been devoted to developing an integrated operational framework capable of simultaneously supporting research commercialization, student experiential learning, SME capacity building, and community engagement within a university-based innovation ecosystem. Furthermore, previous research has predominantly focused on conceptual discussions, technology transfer mechanisms, or commercialization strategies, while providing limited practical guidance regarding institutional models that enable universities to deliver affordable innovation services for resource-constrained enterprises. This limitation is consistent with the findings of the present bibliometric analysis of 519 Scopus-indexed publications published between 2015 and 2025, which identified four recurring research

gaps: (1) limited practical implementation of frugal innovation, (2) weak university–industry collaboration, (3) insufficient integration of social impact into innovation ecosystems, and (4) low technology adoption among SMEs.

The identified research gaps are further reflected in the practical landscape of Indonesian MSMEs. Despite continuous government investment in innovation, digitalization, and entrepreneurship programmes, many MSMEs continue to experience limited access to affordable innovation consulting, digital transformation services, IoT implementation, business incubation, and long-term technical mentoring (Hendrawan et al., 2024). Existing commercial consulting services are frequently inaccessible to resource-constrained enterprises because of financial limitations, whereas university research outputs often remain confined to academic publications or prototype development without progressing toward sustainable commercialization or community implementation (Busch & Barkema, 2021). Consequently, substantial university research capacity, technological expertise, and student competencies remain underutilized despite increasing demand for affordable innovation solutions, particularly in regions undergoing rapid socio-economic transformation such as Indonesia's new capital city (IKN) (Susantono Bambang, 2024). These conditions demonstrate the need for an intermediary platform capable of connecting academic knowledge, technological innovation, and SME development through a sustainable collaborative ecosystem.

To address both the identified research and market gaps, this study proposes the FrugalTech Living Lab (FTLL), a university-based social enterprise designed to integrate research commercialization, student experiential learning, affordable innovation consulting, digital transformation, and multi-stakeholder collaboration within a Living Lab ecosystem. The proposed model adopts the Business Model Canvas (BMC) as a strategic framework for designing a sustainable organizational model that transforms university research outputs into practical solutions capable of improving SME competitiveness while simultaneously generating educational, economic, and social value.

Accordingly, this study aims to develop a conceptual business model for FTLL by synthesizing evidence derived from bibliometric analysis and the authors' previous research, innovation, and community engagement initiatives. The study contributes theoretically by extending the application of frugal innovation and Living Lab concepts into an integrated university-based social enterprise model for research commercialization. From a practical perspective, the proposed model provides universities, policymakers, and SME support organizations with a systematic framework for strengthening university and industry collaboration, accelerating research commercialization, enhancing SME competitiveness, and fostering inclusive regional innovation ecosystems in resource-constrained environments.

2. Research Methodology

2.1 Research Design

This study employed a conceptual design research approach to develop the FrugalTech Living Lab (FTLL), a university-based social enterprise model for supporting SME innovation and research commercialization. Conceptual design research is appropriate for developing new frameworks by synthesizing existing theoretical knowledge with practical evidence to address complex real-world problems (Jaakkola, 2020). Rather than testing hypotheses, this study aims to construct an integrated organizational model capable of strengthening university–industry collaboration and facilitating affordable innovation for resource-constrained SMEs.

2.2 Data Collection

Two complementary sources of evidence were utilized in this study. First, a bibliometric analysis was conducted using 519 Scopus-indexed publications published between 2015 and 2025. The bibliometric review was undertaken to identify research trends, thematic evolution, and existing knowledge gaps (Huang et al., 2020) concerning frugal innovation, Living Labs, research commercialization, university and industry collaboration, and SME innovation. The findings provided the theoretical foundation for the proposed FTLL model.

Second, practical evidence was synthesized from the authors' previous research projects, innovation activities, and community engagement programmes involving SMEs in East Kalimantan. These projects included digital transformation initiatives, IoT implementation, business mentoring, and research commercialization activities. The integration of theoretical and practical evidence enabled the proposed model to reflect both academic knowledge and real-world implementation challenges.

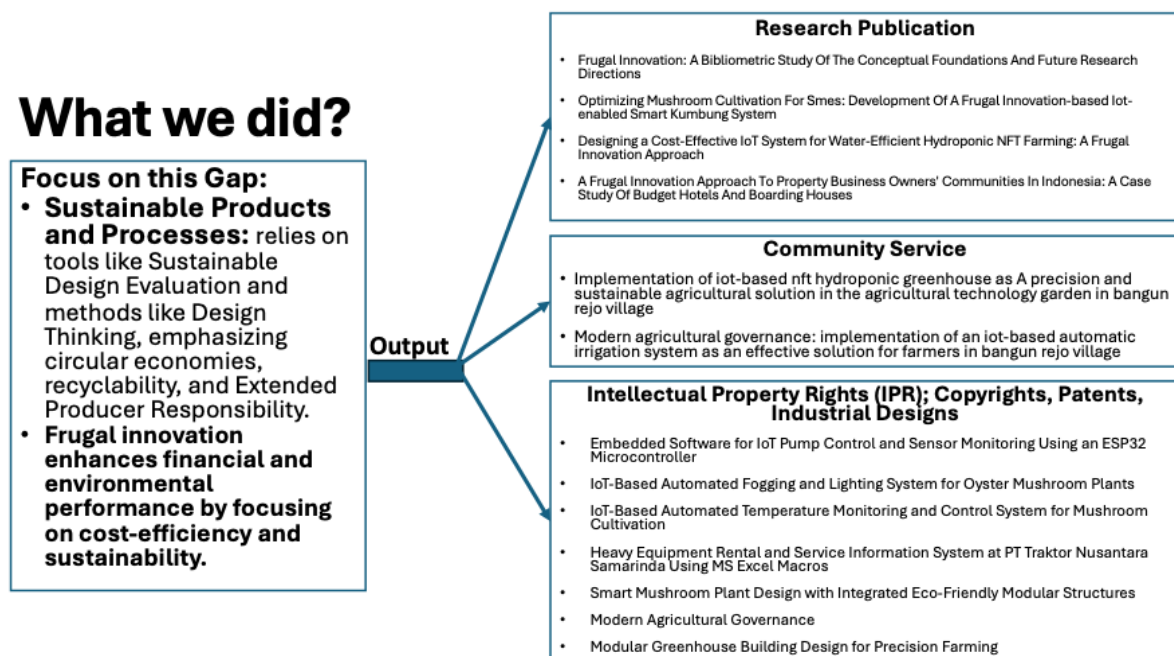


Figure 1. Research, Community Engagement, and Innovation Outputs Supporting the Development of FrugalTech Living Lab

2.3 Model Development

The FTLL model was developed through a three-stage conceptual synthesis process. First, findings from the bibliometric analysis were analysed to identify recurring research gaps and future research directions. Four principal gaps were identified, namely limited practical implementation of frugal innovation, weak university–industry collaboration, insufficient integration of social impact, and low technology adoption among SMEs.

Second, these findings were compared with practical challenges observed during SME development programmes conducted by the authors. This comparative analysis enabled the alignment of theoretical gaps with actual needs encountered by resource-constrained enterprises.



Figure 2. Research Framework for Developing the FrugalTech Living Lab (FTLL) Model

Consequently, the Business Model Canvas (BMC) was adopted as the analytical framework for translating the identified opportunities into an operational business model. The nine BMC components; Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure (Garcia Altafin et al., 2025) were systematically designed to establish an integrated Living Lab ecosystem that supports research commercialization, student experiential learning, innovation consulting, and SME development.

3. Result

3.1 Bibliometric Findings and Research Gaps

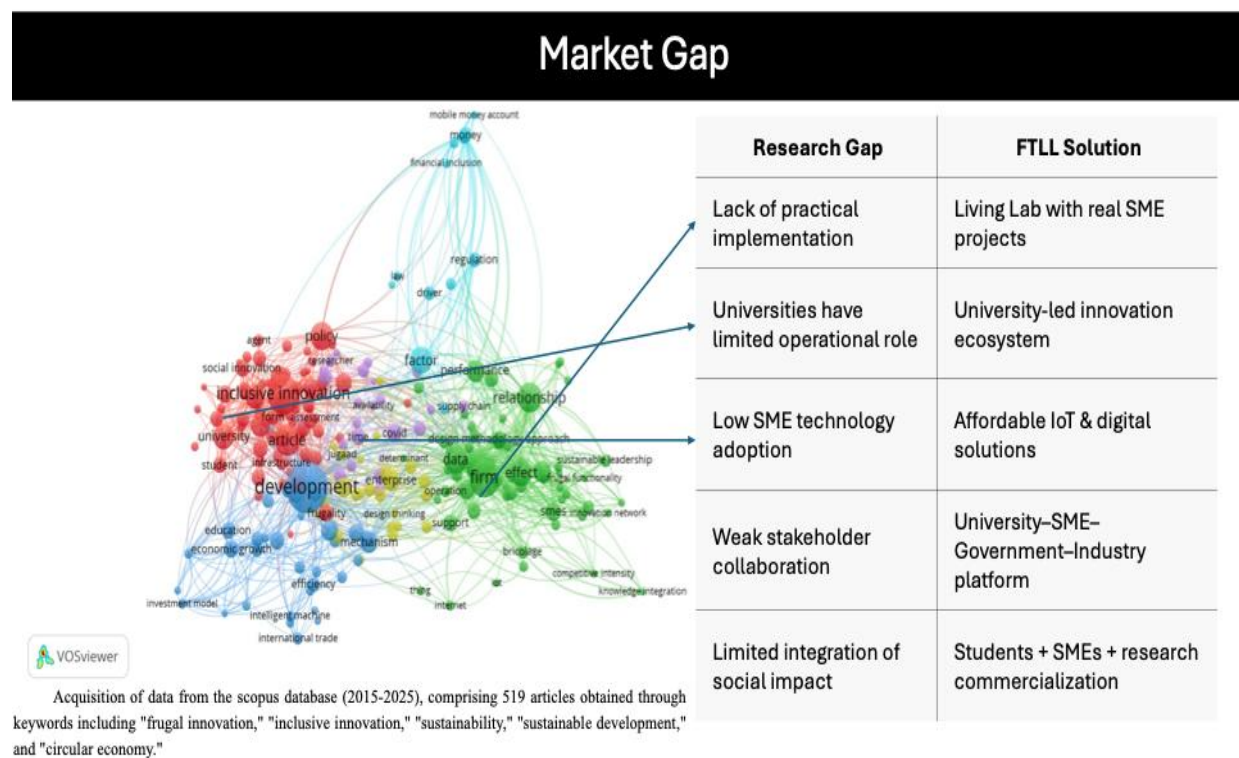


Figure 3. Research Gaps in Frugal Innovation Literature and FTLL's Proposed Solutions Based on a Bibliometric Analysis of 519 Scopus Publications (2015–2025).

The bibliometric analysis of 519 Scopus-indexed publications published between 2015 and 2025 demonstrates a substantial increase in scholarly interest in frugal innovation, Living Labs, university–industry collaboration, research commercialization, and SME development. This trend indicates that these topics have become increasingly important within innovation management and entrepreneurship research. However, despite the growth in publications, the

literature remains fragmented, with most studies investigating these concepts independently rather than integrating them into a comprehensive innovation ecosystem (Hossain et al., 2019).

The analysis identified four recurring research gaps. First, although frugal innovation has been widely discussed as an approach for developing affordable and resource-efficient solutions, many studies remain conceptual and provide limited guidance for practical implementation within organizational settings (Moleka, 2024). Second, while university and industry collaboration has been recognized as an essential mechanism for knowledge transfer and innovation, existing research provides relatively few operational models capable of translating academic research into practical solutions for SMEs (Cunningham et al., 2020). Third, the integration of social impact into innovation ecosystems remains insufficiently explored, particularly regarding the active participation of students and local communities in research commercialization activities (Markkula & Kune, 2015). Finally, although digital transformation has accelerated across many sectors, SMEs continue to experience low technology adoption because of financial constraints, limited technological capabilities, and inadequate access to innovation support services (Calopa, 2025).

The findings are consistent with the practical challenges identified through the authors' community engagement and SME development initiatives in East Kalimantan, where SMEs frequently require affordable innovation consulting, digital transformation assistance, and long-term mentoring to improve their competitiveness. The convergence between bibliometric findings and field observations provides the theoretical justification for developing the FrugalTech Living Lab (FTLL) model.

3.2 The Proposed FrugalTech Living Lab (FTLL)

Based on the synthesis of bibliometric evidence and practical implementation experience, this study proposes the FrugalTech Living Lab (FTLL) as a university-based social enterprise designed to bridge the gap between academic research and SME innovation. The proposed model adopts the Living Lab concept, which emphasizes collaborative innovation through the active participation of universities, industry, government, and communities within real-world environments (Hossain et al., 2019).

Unlike conventional university technology transfer offices that primarily focus on intellectual property commercialization, FTLL integrates research commercialization, student experiential learning, affordable innovation consulting, digital transformation, and community engagement into a single operational ecosystem. This integrated approach reflects the entrepreneurial university concept, whereby universities create not only academic knowledge but also tangible economic and societal value through collaboration with external stakeholders (Majeed, 2025).

Within the FTLL ecosystem, universities function as knowledge providers by contributing research outputs, technological innovations, and student expertise (Unger & Polt, 2021). SMEs act as innovation partners by providing real-world business challenges that enable the co-creation and validation of practical solutions (Ghezzi et al., 2022). Government institutions contribute policy support and funding programmes, while industry partners facilitate commercialization, technological expertise, and market access (Wessner, 2003). This collaborative ecosystem reflects the quadruple-helix model of innovation (Cai & Lattu, 2022), which emphasizes continuous interaction among academia, industry, government, and society to accelerate sustainable innovation (Markkula & Kune, 2015).

3.3 The Business Model Canvas of FrugalTech Living Lab (FTLL)

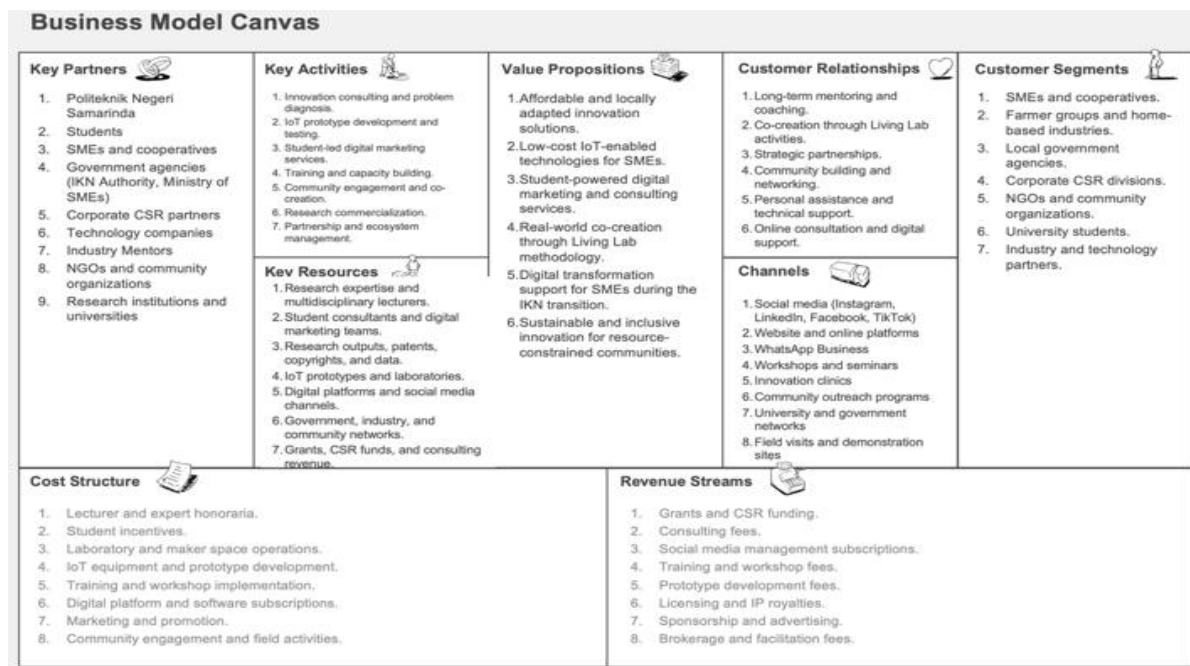


Figure 4. Business Model Canvas of FrugalTech Living Lab (FTLL)

To operationalize the proposed concept, the Business Model Canvas (BMC) developed by (Osterwalder & Pigneur, 2010) was employed as the strategic design framework. The BMC enables the translation of conceptual ideas into a coherent organizational model through nine interconnected building blocks (Garcia Altafin et al., 2025). The proposed FTLL serves multiple customer segments, including SMEs, universities, government agencies, industries, researchers, students, and community organizations. Its primary value proposition lies in providing affordable innovation consulting, research commercialization, digital transformation services, IoT implementation, business incubation, entrepreneurship training, and student consultancy programmes. These services are delivered through hybrid channels comprising digital platforms, Living Lab facilities, workshops, field implementation, and collaborative innovation projects.

Customer relationships are sustained through continuous mentoring, co-creation activities, innovation projects, and long-term partnership programmes. Revenue is generated from consultancy services, research grants, commercialization agreements, training programmes, incubation services, and collaborative research projects, thereby supporting the financial sustainability of the social enterprise. Key resources include multidisciplinary researchers, university laboratories, intellectual property, digital infrastructure, students, and strategic partnerships, while key activities involve innovation consulting, applied research, prototype development, technology transfer, and community engagement. This organizational design aligns with previous studies suggesting that sustainable research commercialization requires integrated collaboration among multiple stakeholders rather than isolated technology transfer activities (Meissner, 2019).

4. Discussion

The proposed FTLL model addresses the four research gaps identified through the bibliometric analysis by integrating the concepts of frugal innovation, Living Labs,

entrepreneurial universities, and research commercialization into a single operational framework. First, FTLL extends frugal innovation beyond theoretical discussions by providing an implementable organizational model capable of delivering affordable innovation services for resource-constrained SMEs, consistent with the principles described by (Moleka, 2024). Second, the model strengthens university–industry collaboration through structured partnerships among universities, SMEs, industries, government agencies, investors, and communities, supporting previous findings that collaborative innovation enhances knowledge transfer and commercialization outcomes (Meissner, 2019). Third, FTLL incorporates social impact into innovation activities by embedding student experiential learning, community engagement, and regional development within the commercialization process.

This approach aligns with the Living Lab philosophy, which emphasizes user participation and co-creation throughout the innovation lifecycle (Hossain et al., 2019). Finally, the model contributes to SME digital transformation by providing affordable access to innovation consulting, IoT implementation, and technology adoption support, addressing barriers previously identified by the OECD (Asa et al., 2026) and the Indonesian government.

The originality of FTLL lies in its integration of multiple theoretical perspectives into a university-based social enterprise model. Whereas previous studies have generally examined frugal innovation, Living Labs, research commercialization, or entrepreneurial universities independently, the proposed framework combines these perspectives within a practical ecosystem that simultaneously generates educational, economic, technological, and social value. Consequently, FTLL provides a replicable model that may assist universities, policymakers, and SME support organizations in strengthening regional innovation ecosystems, particularly in resource-constrained environments such as East Kalimantan and the development of Indonesia's new capital city (IKN).

5. Conclusion

This study developed the FrugalTech Living Lab (FTLL), a university-based social enterprise model designed to bridge the gap between academic research, innovation commercialization, and the needs of resource-constrained SMEs. Based on the analysis of 519 Scopus-indexed publications and the authors' practical research and community engagement activities, four key gaps were identified: limited practical implementation of frugal innovation, weak university–industry collaboration, insufficient social impact integration, and low SME technology adoption. The proposed FTLL addresses these gaps by integrating frugal innovation, Living Lab, research commercialization, student experiential learning, digital transformation, and SME development within a collaborative ecosystem.

The originality of FTLL lies in integrating these perspectives into a single university-based social enterprise model that generates educational, economic, technological, and social value. The model provides universities with a practical framework to commercialize research while supporting SME innovation and strengthening collaboration among academia, industry, government, and communities. However, FTLL remains conceptual and requires empirical validation through pilot implementation. Future research should evaluate its effectiveness in improving SME innovation adoption, research commercialization, student learning, and regional social impact.

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