Journal of Open Innovation: Technology, Market, and Complexity 11 (2025) 100616

Contents lists available at ScienceDirect

Journal of Open Innovation: Technology, Market, and Complexity

journal homepage: www.sciencedirect.com/journal/journal-of-open-innovation-technology-market-and-complexity

Frugal innovation framework for micro-entrepreneurs' sustainable performance: From design thinking approach

Prita Ayu Kusumawardhany [a,*], Imam Baihaqi [b], Putu Dana Karningsih [c]

[a] School of Interdisciplinary Management and Technology, Institut Teknologi Sepuluh Nopember Management Department, Universitas Surabaya Surabaya, Indonesia
[b] Business Management Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
[c] Industrial and Systems Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

ARTICLE INFO

Keywords:
Frugal innovation
Design thinking
MSMEs
Micro-entrepreneurs
User-centered design
Sustainable innovation

ABSTRACT

Frugal Innovation (FI) offers cost-effective, value-creating solutions that are especially relevant for Micro, Small, and Medium Enterprises (MSMEs) operating under significant resource constraints. Despite the growing interest in FI, micro-entrepreneurs (micropreneurs) often lack a clear, actionable framework to guide their implementation. While prior studies have explored various enablers of FI, there is limited focus on how MSMEs can practically navigate the innovation process under financial, managerial, and operational limitations. This study addresses this gap by designing a FI framework tailored for micropreneurs. Utilizing an Action Design Research (ADR) methodology integrated with the Design Thinking (DT) approach, this research has five stages: empathy, define, ideation, prototype, and test. The first two stages involve semi-structured interviews with 12 Indonesian fashion micropreneurs, analyzed using NVivo 14 to construct user personas and identify core problems. The final stage is conducted through a collaborative DT workshop with 30 fashion micropreneurs. The findings reveal that micropreneurs can co-create a practical FI guideline aligned with contextual realities. This research contributes to the field of open innovation by offering a participatory, user-centered framework that supports sustainable and competitive innovation in a resource-limited environment. This study also provides insights for policymakers and practitioners seeking to strengthen innovation ecosystems for MSMEs in emerging economies.

Introduction

Innovation is needed in the business environment, especially in increasing competitive micro, small, and medium enterprises (MSMEs). Frugal Innovation (FI) is a concept of the disruptive innovation phenomenon that is oriented toward affordable solutions to answer the needs of companies that have limited resources and serve markets in developing countries (Dima et al., 2022; Hossain, 2018; Lange et al., 2023; Sarkar and Mateus, 2022; Usman Shehzad et al., 2023). Innovation management practices in developing countries differ from those in developed countries. Massive economic growth in developing countries has led to significant scholarly interest in innovation management practices, with the strongest positive impact in cultural environments characterized by collectivism, as found in many developing countries, especially Asia. (Bruton et al., 2015; Rosenbusch et al., 2011).

Micro, Small, and Medium-Sized Enterprises (MSMEs) play a major role in employment, exports, and entrepreneurship in emerging economies with minimal capital investment (John William et al., 2023; Mittal and Raman, 2021). MSMEs need to invest in innovation because they have the advantage of adapting to environmental changes more quickly and have agility and shorter hierarchies, thus they are more flexible and faster in decision-making compared to large companies (Cai et al., 2019; Rosenbusch et al., 2011). MSMEs, especially micro-enterprises, need to focus on FI to survive and expand their business with affordable solutions under limited resources (Dabić et al., 2021; Shahid, Hossain, Karami, et al., 2023). FI can support micro-enterprises with an emerging market orientation to compete with large-scale companies that have more financial support and knowledge (Brem and Wolfram, 2014; Majchrzak et al., 2004).

There are several studies that identify FI enablers and FI drivers. FI solves urgent local problems, the solution approach should consider specific contexts such as local market, culture, materials, research and development, and labor. (Arlinghaus et al., 2016; Hossain, 2018; Nirumand et al., 2020; Weyrauch and Herstatt, 2017). Prior studies indicate that the topic of FI and sustainability has evolved, and each study has different enablers. Some enablers underlie micro-entrepreneurs to

* Corresponding author.
E-mail addresses: pritaayu.k@gmail.com (P.A. Kusumawardhany), ibaihaqi@mb.its.ac.id (I. Baihaqi), putu.karningsih@gmail.com (P.D. Karningsih).

https://doi.org/10.1016/j.joitmc.2025.100616
Received 5 May 2025; Received in revised form 9 August 2025; Accepted 12 August 2025
Available online 15 August 2025

implement FI, such as financial support from the government, policies, and regulations (Dubey et al., 2022). Hossain (2021) explains value creation by using low-cost materials, used materials, and simple technology to generate local jobs to produce low-cost products. Meanwhile, Cuevas-Vargas and Parga-Montoya (2021), state that the use of information and communication technology (ICT) has a positive effect on FI because it can reduce costs and make communication more reliable and faster, so small firms can achieve competitive advantages. Niroumand et al. (2020) suggest that world-class design, human aspect, marketing, support, knowledge, social aspect, prototyping, cultural aspects, environmental aspect, creating a differentiated brand, core function focus, local R&D, business model cost leadership, and low-cost production as FI enablers.

Several studies have advanced the theoretical foundation of FI about sustainability and resource constraints. As MSMEs experience high constraints of resources, they are more likely to innovate frugally because they often seek solutions that cut costs through various strategies, including substituting input materials for cheaper alternatives, as well as energy efficiency measures, and further vertical integration (Brem and Wolfram, 2014; Hossain, 2021; Ploeg et al., 2021). Although numerous studies have identified enablers and drivers of FI, a critical gap remains in actionable frameworks that guide MSMEs, particularly micropreneurs, to implement FI practically. Hossain (2021) emphasized that FI is closely tied to the development of sustainable business models that maximize value creation while minimizing resource usage. His work provides a broad theoretical lens on how firms can align sustainability with frugality, primarily at a strategic level. However, while these studies offer valuable conceptual insights, they remain general and do not specify how micropreneurs in developing economies can operationalize these strategies under severe constraints of finance, management capacity, and market competition. Similarly, Niroumand et al. (2020) and Ploeg et al. (2021) Highlight that resource constraints can indeed stimulate FI, positioning scarcity not as a barrier but as a driver of innovation. The findings show that constraints encourage firms to adopt more efficient processes and creative solutions. Nonetheless, it focuses largely on the conditions that foster FI within organizational settings without providing practical tools tailored to micropreneurs. Thus, despite these theoretical advancements, a significant gap remains in translating these broad concepts into actionable frameworks for micropreneurs' operations in highly competitive and resource-limited environments. The researcher emphasized that the majority of the current FI frameworks were created for the context of large and small industries or developed countries, assuming resources and organizational structures that are not compatible with the conditions of Indonesian micropreneurs. Therefore, a new, more contextual framework is needed to address the limitations of existing frameworks for informal practices, limited access to digitalization, and the operational complexities faced by micropreneurs.

This study advances the existing literature by bridging that gap, offering a structured, design-based approach that transforms enablers into a practical, user-driven roadmap tailored to the real-world constraints and opportunities faced by micropreneurs. Existing FI frameworks are largely developed for firms in developed economies, overlooking the severe financial, managerial, and market constraints faced by Indonesian micropreneurs. While prior studies offer valuable conceptual foundations, they rarely translate into concrete, context-specific tools that can be applied to navigate micropreneurs overcoming intense pressures. Without such actionable guidance, micropreneurs risk falling behind in both competitiveness and sustainability. This urgent need for a localized, practical framework drives the research problem: How to guide MSMEs to implement innovation frugally?

The fashion sector is among the most competitive, primarily due to the low cost of imported products and the growing presence of large-scale global fashion brands that offer high-quality products at affordable prices, which puts intense pressure on local, micro-scale producers. According to the Ministry of Industry of Indonesia, the textile, apparel, and footwear sectors grew by 7 % in early 2024, reflecting increased expansion and renewed investor interest. As reported by the Indonesian Chamber of Commerce and Industry (KADIN), MSMEs contribute 61 % to Indonesia's GDP, with the food sector leading, and the fashion sector as the second-largest contributor. However, the fashion industry faces more intense global competition and rapid trend shifts. While food consumption is essential and relatively stable, the fashion sector is highly dynamic, requiring micropreneurs to compete with mass-produced, low-cost imports and dominant fast fashion brands. This highlights the urgent need for a localized frugal innovation framework in the fashion sector, where market dynamics are comparatively less volatile. Therefore, the existing FI framework may not be effective in addressing the unique challenges faced by Indonesian micropreneurs. The FI approach must be adapted to Indonesia's local context and entrepreneurial culture to ensure practical relevance and impact. Thus, a localized FI framework is needed to help sustainable development and resource-efficient innovation strategies that are adaptable to the specific conditions.

This paper aims to develop a FI framework that is specifically designed to guide Indonesian micropreneurs in implementing sustainable and resource-efficient innovation strategies. Innovation challenges between developing and developed countries are due to the frugal mindset, culture, attitudes, and decision-making steps of micro-preneurs in each country being different. Therefore, In-depth knowledge of micropreneurs in developing countries, especially Indonesia, is needed to find affordable solutions by presenting valuable value propositions for customers. Previous studies mostly identified key factors that influence FI but did not offer clear guidance on how micropreneurs can take action, especially when facing financial, managerial, and operational limitations. The FI framework developed in this study aims to fill this gap by not only identifying relevant factors but also offering a practical pathway, a step-by-step guide that enables micropreneurs to identify appropriate actions and implement sustainable innovation effectively within their resource constraints.

The methods used by previous researchers also vary depending on the problem; however, FI research that uses a human-centered approach to frame the local problem using a local solution-fit is not available yet. The method used in this study is action design research (ADR) with a design thinking approach. Design thinking is a human-centered approach to problem-solving in the context of the early stage of the innovation process that focuses on the user by adding in-depth consideration of the user's perspective to understand their needs (Campese et al., 2018; Patrício et al., 2020; Santa-Maria et al., 2022). Deepening empathy through persona or empathy map is the first stage in design thinking that can help designers see through the eyes of their users to understand users and their needs (Campese et al., 2018; Lewrick et al., 2018).

Following an action design research method (Santa-Maria et al., 2022), this research applies an in-depth interview taken from twelve (12) micro-preneurs in the fashion industry based in Indonesia and followed by a workshop approach to 30 MSMEs. This research identifies the root of these problems and supporting factors as the basis for developing FI framework as a guideline for Indonesian MSMEs.

Theoretical background

Frugal innovation

FI is an innovation approach that focuses on creating solution-fit and integrated solutions through the development, production, and management of new products and services by saving costs and resources for optimal performance (Upadhyay and Punekar, 2023; Brem and Wolfram, 2014; Dabić et al., 2021; Hossain, 2021; Weyrauch and Herstatt, 2017). At the same time, the availability of resources needed to fulfill demand is limited. Frugal Innovation (FI) is the net positive outcomes created in a social context by implementing new, low-resource

products and services that provide appropriate solutions at much lower costs and with fewer resources (Hossain, 2022; Upadhyay and Punekar, 2023; Zeschky et al., 2014). This is a main challenge for MSMEs due to today's severe business competition.

Innovators in developing countries with limited knowledge and skills, develop innovations using out-of-the-box thinking. They also transfer knowledge to provide sustainable solutions using local materials and reusing discarded materials.FI can be defines a phenomenon about how to innovate with a process efficiency approach in conditions of limited resources. (Santos et al., 2020; Shepherd et al., 2020). In addition, frugal innovator explains that the meaning of frugal does not mean cheap but at a price that may be considered cheap but without sacrificing performance or quality can provide high performance (Bhatti et al., 2018; Harris et al., 2017).

The implementation of FI has a positive impact on the economy. It contributes to efficient energy consumption with minimal resource consumption and enables organizations to increase their revenues with cost-effective products and services for the target market (Albert, 2019; Lange et al., 2023). Previous research results show that there is a positive relationship between FI and sustainability, including increasing sustainability performance, the ability to face sustainability challenges, improving business competitiveness, as well as creating economic, social, and environmental value (Arlinghaus et al., 2016; Khan et al., 2021; Pansera and Sarkar, 2016).

Companies can produce and sell environmentally friendly products and services because innovation tends to influence ecological, financial, and environmental performance by utilizing resource constraints so overall it can influence sustainable performance (Albert, 2019; Horn and Brem, 2013; Iqbal et al., 2022; Khan et al., 2021; Wohlfart et al., 2016). FI generates revenue for organizations and manages social problems by alleviating poverty and improving the quality of life for consumers by making life-enhancing basic products with affordable value-added services (Albert, 2019; Khan et al., 2021). FI involves sustainable activities such as recycling, low carbon footprint, waste management, and minimization of resource use, thereby creating a positive impact on ecological performance (Hossain, 2021; Wohlfart et al., 2016).

Micro-entrepreneurs and sustainable performance

Micropreneurs play a key role in achieving sustainable performance, especially in low-resource settings, through sustainability strategies such as eco-efficiency and local engagement that can strengthen microenterprise resilience (Pardo Martínez and Cotte Poveda, 2022). FI allows grassroots entrepreneurs in micro-small businesses at the base of the pyramid to address sustainability through low-cost, adaptive solutions that respond to local needs while contributing to sustainable development and become locally relevant support frameworks to help micropreneurs improve their sustainability outcomes (Borchardt et al., 2022; Pansera and Sarkar, 2016).

Design thinking

Schleinkofer et al, (2019) have identified three criteria for frugal products: (1) substantial cost reduction, (2) focus on core functionalities, and (3) optimized performance level in the needs of price-sensitive customers. One of the problems in the innovation process is the failure to recognize user needs, so that an in-depth understanding of users is needed, which is considered the main component in developing economical products by considering the appropriate local environment. A design thinking approach is required to shape a new way of thinking, especially in developing countries.

Design Thinking (DT) is an appropriate method for supporting innovative, complex, and uncertain business environments through the process of designing sustainable and innovative business models to face an increasingly uncertain business climate (He and Ortiz, 2021; Patrício et al., 2020). Design thinking is a human-centered approach that brings together a set of creative and analytical tools and techniques to support innovation capabilities, namely customer-focused thinking and problem-solving, by inviting others to join in and tell stories and learn through experimentation (Lewrick et al., 2018; Oliveira et al., 2024). Companies that apply a design thinking approach engage in developing a responsive, flexible, and human-centered organizational culture toward innovation by emphasizing engagement, dialogue, and learning (Patrício et al., 2020). This process involves five DT phases: (1) Empathize, (2) Define, (3) Ideate, (4) Prototype, and (5) Test. These five phases are very effective for solving unclear or unknown problems (Greeson et al., 2021; Lomborg et al., 2022).

Empathy is the foundation of the human-centered DT process needed. This first stage aims to understand people who are potential users by observing what they do and how they interact with the environment, giving clues about what they are thinking and feeling, and providing insight into what they do and say (Meinel et al., 2011) A key component of the empathy phase is generating qualitative data by listening to their life experiences (Greeson et al., 2021). The second stage, the define stage in design thinking, organizes information collected at the Empathize stage. This stage helps the design team to propose a problem statement from the perception of user needs, gather great ideas to define features, functions, and other elements to identify 'pain points' in the process, solve the problems encountered to enable real users to solve their problems by minimizing difficulties (Greeson et al., 2021; Lewrick et al., 2018). The ideation stage is the third step for generating ideas after understanding users and their needs in the empathize stage and analyzing observations in the define stage to create a user-centered problem statement. A team-oriented approach is required for problem-solving that is discussed in person or virtually with the help of unique visual aids to spark creativity. For example, brainstorming sessions, process mapping, and storytelling (Greeson et al., 2021; Lewrick et al., 2018). Prototyping is the experimental phase, and the goal is to identify the best possible solution to each problem identified during the first three stages. The solutions implemented in the prototype need to be tested. The decision to accept, correct, or reject is based on the user's direct involvement and experience (Greeson et al., 2021; Meinel et al., 2011). The testing phase is the final phase of the five-stage model. The team can continue with further iterations and make changes and improvements to the solution. The goal is to gain a deep understanding of the product and its users and redefine one or more problems further. Feedback based on the prototype is useful for the development and improvement of new processes and products (Lewrick et al., 2018; Meinel et al., 2011).

Research methodology

An action design research method (ADR) was selected due to its ability to drive significant overall organizational progress. According to Dresch et al. (2015), design science research (DSR) originates from the design science paradigm, which aims to develop prescriptive design knowledge by creating and assessing innovative artifacts designed to solve categories of problems, while action research (AR) originates from the natural and social sciences, which seeks to solve problems. or explaining the problems of a system by involving researchers and practitioners in an iterative, cooperative, and participatory manner, thereby producing knowledge for practice and theory (Bender-Salazar, 2023). ADR combines two compatible research methods, namely design science research (DSR) with action research (AR), which aims to advance scientific understanding and solve real-world problems (Santa-Maria et al., 2022).

This research is conducted in two phases: (1) exploration and (2) implementation, which uses a DT approach. In the exploration phase, researchers conduct empathy and define through in-depth interviews to address the wicked problems of MSME actors and make observations related to the current conditions of MSMEs. The tools used for analyzing interview and observation results are user persona tools. During the

implementation phase, all DT stages include ideation, prototyping, and testing are conducted to provide deeper insights into the challenge faced by MSMEs.

All informants and participants were selected through purposive sampling based on their active involvement in the local fashion MSME ecosystem. To ensure the credibility and trustworthiness of the data, all participants were verified in collaboration with the Indonesian government, the Cooperative and SME Service of East Java Province, and official local fashion communities. This collaboration helped confirm the legitimacy of fashion micropreneurs' involvement and perspectives.

Exploration phase

The interview aims to identify the FI factors supporting MSME sustainability performance. Based on transcribed data collected from interviews, coding was done using NVivo 14, a widely utilized program to examine widely used software to analyze heterogeneous qualitative data sets (Abbas and Liu, 2022).

According to User Interview UX Research for DT, there is an art to deciding how many people to interview. In general, more informants can bring more information, but the number of new insights to be gained about a topic may decrease with each subsequent interview as responses begin to repeat themselves. Interviews can start with 5 people first, then the researcher can always recruit more people later based on needs, according to the complexity of the situation to be investigated. Researchers may recruit 6–10 participants, depending on the complexity (Bender-Salazar, 2023).

In this research, researchers use purposive sampling to select 12 (twelve) people as informants who represent Indonesian fashion micro-entrepreneurs. The selected informants comply with these criteria, namely: (1) fashion micro-entrepreneurs who have been running the business for at least 1 year, (2) have conducted innovation project, (3) come from various areas in Indonesia, specifically East Java and have different levels of experience in running their business both in terms of business sector and length of time. efforts to access a diversity of perspectives. The aspects explored are problems and challenges, the role of innovation, scarcity of resources (Weyrauch and Herstatt, 2017), value creation with economic innovation, and business sustainability (Dubey et al., 2022; Hossain, 2021a; Iqbal et al., 2020; Shibin et al., 2018).

Implementation phase

Data collection for implementing DT was by collecting (1) 30 fashion micro-entrepreneurs, and (2) 3 DT practitioners. Participants are invited to take part in the three and half hours of DT workshop. The researcher acts as a facilitator, assisted by 3 (three) assistants as facilitators. The characteristics of the invited DT participants are fashion MSMEs that have been running for at least 1 year. Data was collected through photos, observations, field notes, and prototypes.

Table 1 shows the DT workshop outline. This workshop is tailored to the needs of fashion MSME players, so there are mentoring activities while exploring their insights. The interactive media is utilized in the workshop, such as using video, canvas, brainstorming, and pitching.

Table 1
Design thinking workshop outline.

Session	Stages	Activity	Description	Duration
Welcoming		Participant Registration and Networking, Coffee morning	Participants completed the registration process and were encouraged to familiarize themselves with fellow participants to foster collaboration and peer engagement.	
1	Introduction	Overview of fashion issues and ideas for fashion innovation 2024	The speaker explains the problems of local and global industry, challenges, and trends. Examples of successful world-famous local brands are also shared as an inspiration for participants.	40 min
2	Empathize	Questionnaire completion session	Participants are guided to answer the questionnaire by ticking (√) the problems and needs options that are relevant to their real experience. They are also encouraged to write down additional issues or needs that are not listed.	50 min
3	Define	Formulate problem statements and form teams (1 team with 7 members)	Participants review key challenges faced by fashion MSMEs and confirm their understanding. They are then provided with an A4 sheet to outline the strengths and weaknesses of proposed solutions to these challenges, encouraging critical analysis and practical reflection.	30 min
4	Ideation	Creating ideas as solutions to problems	Each participant receives an A3-sized Crazy 8 s canvas, sticky notes, and a marker. Participants rapidly sketch eight distinct ideas. Participants map and prioritize their ideas to determine those most critical and feasible for immediate implementation	40 min
5	Prototype	Collaborative idea visualization session	Each team collaboratively develops and visualizes their proposed idea or solution on a cardboard display, allowing for a tangible representation of their collective design concept.	20 min

(*continued on next page*)

Results and discussion

Result of phase 1: exploration

Twelve (12) selected fashion micro-entrepreneurs (Table 2) members of the Indonesian Fashion Chamber, the Association of Indonesian Fashion Designers and Entrepreneurs, the East Java Creative Business Community, and Ethnic Nusantara Indonesia. These informants are selected to strengthen the validity of the eligibility criteria for micro-entrepreneurs, such as legality and the activities of the fashion micro industry in carrying out innovation. The interviews is conducted in person and by phone. The interview result exploration of initial

Table 1 (*continued*)

Session	Stages	Activity	Description	Duration
6	Test	Pitching solutions for prototype testing	Each team delivers a 3-minute pitch by highlighting their proposed solution. Then each team took turns offering constructive feedback on the solutions presented by their peers, fostering a collaborative and reflective learning environment.	30 min
Closing		Closing and lunch	The workshop concludes with a lunch session, providing participants with the opportunity to engage in light conversation and informal networking.	

problems, which is then followed by problem validation by a group of informants (fashion MSMEs) in the DT workshop implementation.

After the interviews with informants, the responses then is categorized according to interview guide, which are: (1) problems faced by fashion MSMEs; (2) the perceived role of innovation from the informants' perspectives; (3) strategies for addressing resource scarcity; (4) value creation through economical innovations already implemented; and (5) strategy related to business curiosity and exploration. Next, the user persona is developed, as shown in Fig. 1, to describe the persona in real conditions from the point of view of fashion micro-entrepreneurs of East Java, Indonesia. The real condition that describes the informant's persona includes needs, positive trends, opportunities, hopes, negative trends, headaches, and fears. Identification of user persona problems and needs is then described in Table 3.

Fig. 1 shows the personas of 12 fashion micro-entrepreneurs. User personas are described by micro business owners, both men and women, who have the same needs, to stay in competition by using limited resources. Micro-entrepreneurs believe that positive trends in fashion include premium prices due to niche market, production and colouring techniques that are always progressing, providing excellent service as value, and optimizing digital marketing. Opportunities for fashion business development that are seen by micro-entrepreneurs are mentoring and business incubation organized by the government and agencies, various fashion associations, opportunities to get investor funding, as well as free fashion exhibition and event facilities from the government. These positive trends and opportunities give hope to fashion micro-entrepreneurs, to sustainable fashion efficiently, have wider collaboration opportunities, increase knowledge about the fashion business, and get legal support (i.e., assistance in obtaining brand rights, design patents, and halal fashion certificates).

On the other hand, there are negative trends according to fashion microentrepreneurs that can hinder business, namely price competition between MSMEs and imported products, lack of government support regarding the sustainability of the programs offered, lots of imitation products, and fashion waste that hurts the environment. These negative trends bring problems for fashion micro-entrepreneurs in determining competitive prices, especially in the marketplace, a lack of production capacity for large orders, and inconsistent production techniques due to handmade production. Fashion microentrepreneurs feel that unable to compete. As a result, they have unstable income, a weak entrepreneurial mindset, difficulty in determining product uniqueness, and rely too much on government support.

The results of in-depth interviews with 12 informants are the identification of problems and needs for fashion MSMEs in East Java. These problems were then used as the basis for developing a questionnaire to be validated by the DT workshop participants. According to Table 3, roles of fashion micro-entrepreneurs are: (1) functional related namely: achieving sales turnover targets, increasing business scale and production efficiency with good quality; (2) social related, include number of networks or partners and support from the government, (3) emotional related: that their daily life is fulfilled as well as comfort and self-confidence. Roles that fashion micro-entrepreneurs plan to achieve can bring negative experiences or risks (pain) and expected benefits (gain).

Result of phase 2: implementation

The next stage is empathy through DT workshop activities. The workshop's theme is 'Ideations for Fashion Innovation 2024', which is held in 3.5 h (210 min). The workshop was attended by 30 owners or CEOs of East Java fashion micro-entrepreneurs and representatives from the Cooperative and SME Service of East Java Province. The facilitators for this DT workshop are researcher, fashion practitioner, and DT expert.

Table 4 shows the list of workshop participants, consisting of fashion micropreneurs who are members of the fashion community in East Java. Participants are invited through the East Java Cooperative and MSME Department to ensure they meet the criteria: legally registered fashion micro-entrepreneurs, operating for at least one year, and have implemented innovations. There are 30 fashion micro-entrepreneurs who attend this event. They are coming from the eight largest fashion communities in East Java, as well as two representatives from the government, the Cooperative and MSME Department of East Java Province. Three facilitators are supporting this event, they are: researcher, fashion practitioner, design-thinking expert.

The result from interviews or in-depth exploration in the empathize stage is problems (pain) and needs (gain) are then reconfirmed in

Table 2
Informants' profile.

Informant ID number	Brand	Year Established	Business Location	Number of employees	Sales per year (in IDR)	Description
1	A	2014	Sidoarjo	5–10	$\geq$ 2 billion	Modest fashion with traditional fabric
2	B	2014	Surabaya	3–18	200–400 million	Batik, custom uniforms, and ready-to-wear
3	C	2009	Surabaya	3–10	200–400 million	Women's clothing, ready-to-wear, made from local fabric
4	D	2016	Banyuwangi	10–15	$\geq$ 2 billion	Fashion made from traditional fabric, custom-made and ready-to-wear
5	E	2013	Madura	7	200–400 million	Ready-to-wear *kebaya,* a traditional dress
6	F	2012	Nganjuk	5	96–120 million	Ready-to-wear *kebaya,* a traditional dress and gown
7	G	2019	Surabaya	3	300 million	T-shirt
8	H	2017	Gresik	4–20	$\geq$ 2 billion	Modest fashion and ready-to-wear
9	I	2008	Malang	3–5	50–100 million	Batik, uniform, and ready-to-wear
10	J	2018	Mojokerto	4	48–120 million	Batik, dress, and ready-to-wear
11	K	2016	Surabaya	9	100–350 million	Traditional-local made fabric (shibori, eco-print, batik, paint)
12	L	2017	Surabaya	2	50–120 million	Traditional-local made fabric 'shibori' and eco-print, uniform sewing service

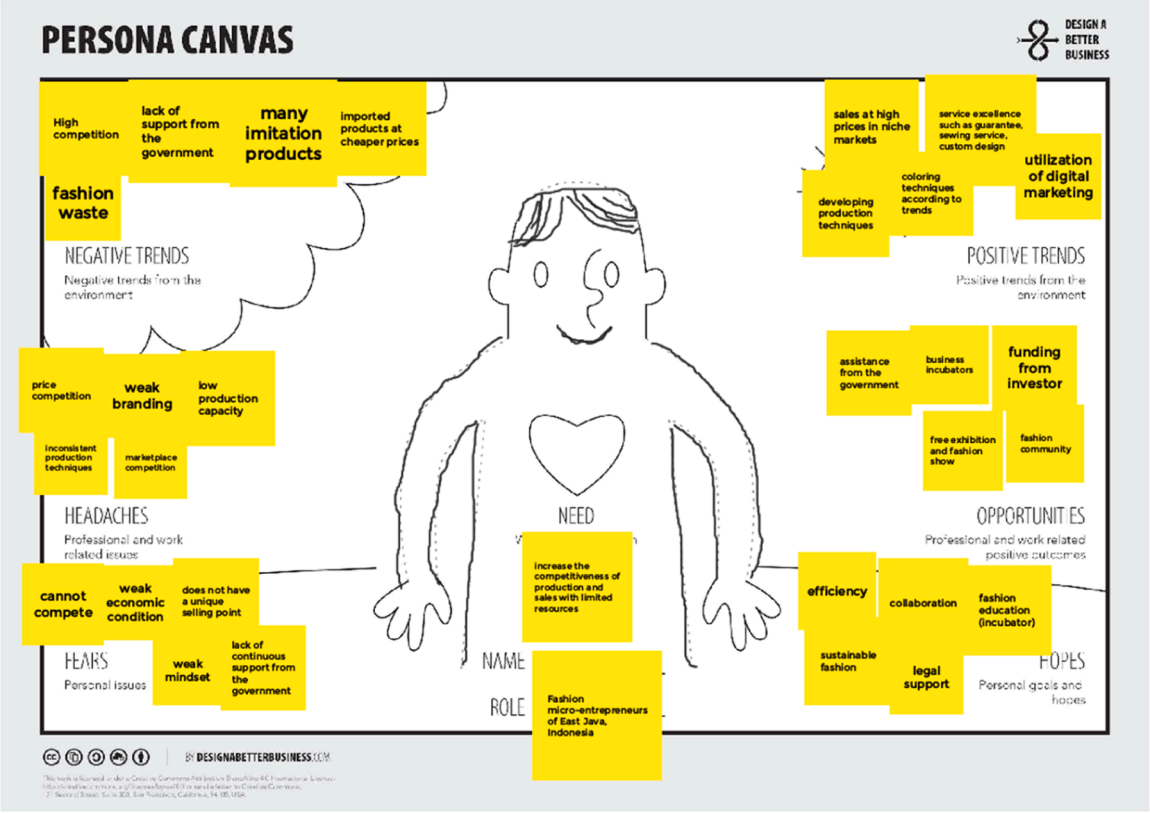


Fig. 1. Fashion micro-entrepreneurs persona.

workshop sessions to challenge the researcher's assumptions as a design thinker. The next stage is identifying the main problem, the defining stage.

Fig. 2 shows the classification of interview information files and code that is processed using NVivo. The transcribed data is coded into 18 categories to identify active FI supporting factors. Based on the empathize stage result, there are 18 active supporting factors fashion micro-entrepreneurs to apply FI. It is then sorted based on the most relevant references provided by the informants, they are follows: (1) marketing; (2) mindset; (3) collaboration; (4) sustainable products; (5) product value; (6) local employment; (7) new design; (8) government funding & support; (9) manufacturing; (10) market segment; (11) mentoring; (12) service; (13) local community; (14) local supply chain; (15) products; (16) technology; (17) raw materials; (18) government policy & regulation.

The information gathered from interviews, surveys, and observations conducted during the empathy, define, and ideation stages through exploration and workshops serves as the foundation for identifying the root causes of persistent challenges faced by fashion MSMEs in East Java. This comprehensive approach enables researchers to gain deeper insights into underlying issues of achieving sustainable growth and innovation.

Root cause analysis using a fishbone diagram is utilized to explore the root cause of fashion MSMEs (i.e., failure to innovate). There are four main groups of causes, namely (1) Fixed mindset, (2) Limited finances, (3) One-man-show management, and (4) Limited time and energy.

A fixed mindset is the first root cause of difficulty in innovating a problem. In a fixed mindset, people believe that human traits are fixed, in contrast to a growth mindset, which believes that human traits can be molded, so that this difference in mindset can greatly influence the behavior and response of MSMEs in facing managerial problems (Papadopoulou et al., 2023). Post-pandemic drives entrepreneurs into a stressful condition due to economic pressure and uncertainty, so psychological well-being is very important to maintain and realize a frugal entrepreneurial mindset (Hossain, 2021a; Shahid et al., 2023a, 2023b; Xu et al., 2021).

Based on the findings from interviews and observations, fashion MSME actors are not yet adequately prepared to compete with domestic MSME competitors, established brands in digital marketplaces, or international players. The primary challenge identified is the reluctance of East Java Fashion MSME actors to engage in price-based competition, particularly against the lower pricing strategies commonly found in online marketplaces. Several informants from MSMEs also realized that a growth mindset is needed to adapt to new trends and not be too dependent on the government. The following are 10 (ten) statements from informants regarding mindset:

> "Going back to our mental strength, we have our market segment, you don't need to look at the comparison with hand-drawn batik, it's so different."
>
> "What is needed is changing our mindset; we have to upgrade ourselves."
>
> "How can we maintain our branding so that we can continue to our business, so that if we lose the competition, we don't have to go out of business, in other words, we still have to find a solution, so whether we like it or not, our resilience has to be strengthened."
>
> "Right now, most SMEs are too spoiled, so if they are partnered with the government, they want to ask for continued support."
>
> "The mindset is that if you want to be like that if you play the set you will be paid for all the terms, the answer is an easy term, you don't want capital, that's what it means, if you want to be good, you have to wait to be pushed first, you have to wait to be funded first, so they don't take the initiative to find their own identity to develop, in my opinion, It's like that, what needs education is the mindset to want to develop"

Table 3
Jobs, pain & gain of fashion micro-entrepreneurs informants.

Customer Jobs	*Pain*	*Gain*
Achieving sales turnover targets (Functional)	Self-work in production, management, and marketing	Innovation in digital marketing (market access, brand, content of promotion, sales) (20)
Business scale-up (functional)	weak and low existence of branding and promotion strategy	Assistance with online marketing
Market development (functional)	Limited capital	Innovation for Collaboration
Efficient production with good quality (functional)	Low production capacity	Education on fashion waste processing
Building networking (social)	The product does not yet have a unique selling proposition	Expansion of overseas markets/exports
Government support (social)	High competition in product and price with other MSMEs, imported products (e.g., China, Korea, Bangkok, etc.), marketplaces, or online stores	Education for collaboration, product development, and marketing
Certainty in economic condition (emotional)	Economic conditions have not yet recovered due to the COVID−19 pandemic	Education and assistance for production (looking for quality but affordable materials; reducing production costs and designs that match the characteristics)
Comfort and confidence (emotional)	Lack of collaboration	product innovation (design, model, pattern)
	Lack of government support in marketing (exhibition, export)	Reducing fashion waste
	When a product sells well, many imitation products appear	

Table 4
List of fashion micropreneurs workshop participants.

Community/ Organization	Number of participants	Product type	Omset/ moth (in IDR)	Number of employees
East Java Embroidery Entrepreneurs Association	4	Embroidery fashion	< 5 - > 25 million	2–9
East Java Batik Craftsmen Association	4	Batik craftmanship	< 5 – 10 million	2–3
Indonesian Creative Entrepreneurs Association of East Java	6	Creative fashion	< 5 – 10 million	2–4
East Java Fashion Entrepreneurs Association	3	Ready to wear fashion	20 – 25 million	8
East Java Creative Business community	6	Creative fashion	< 5 – 25 million	2–8
East Java One Center of Entrepreneurship	2	Fashion business and development	< 5	1
East Java Cooperative Trading House	3	Business trading	< 5	2
Indonesia Etnic Fashion	2	Etnic fashion	5–10	3

"You need a mindset and courage to move forward. Courage for this, you know. Not arrogant. But this and confidence in our products. We must be sure that our product is good, good. Continuously improving quality"

"Yes, that's the mindset, I'm still a small SME, I have to be encouraged".

"Year after year, usually if you wait for the department, it stays like that, so for example, if you are given exhibition facilities of all kinds, it will still stop there, without any innovation or other additions."

"Yes, it's very adaptive like that, so for example, to expand the market, we have to prepare everything we need to be strong."

"Sorry, yes, in the safe zone, they are just like this, they have taken it, how do they want to develop, so, in the end, it's just like that?"

The second root cause is limited financial capital. This constraint underscores the critical need for FI. Due to restricted financial resources, MSMEs should adopt cost-effective strategies and utilize resources efficiently. This includes minimizing material, reducing dependency on scarce inputs, optimizing production, marketing, distribution processes, and the creation of resource-saving products (Santos et al., 2020; Weyrauch and Herstatt, 2017). Such practices enable MSMEs to remain competitive despite financial limitations. Limited financial capital is a significant constraint that hinders fashion MSMEs from pursuing and implementing innovation effectively, as shown in Fig. 3.

The third root cause is 'one-man show' management, all key business functions, production, operations, and marketing are handled by a single individual. This centralized approach limits the capacity of East Java Fashion MSMEs to operate efficiently and scale to meet market demand. Contributing factors include limited financial capital and a shortage of skilled human resources across regions. Furthermore, there is a notable gap between the available workforce and the competency standards required by micropreneurs, further constraining business performance and growth. Based on Figure 3.4, the majority of MSMEs participating in the workshop acknowledged that it is the most critical root cause impeding their ability to develop and implement innovation strategies in the future. The following are 4 (four) examples of statements from fashion MSME players.

"I am doing everything by myself, making dyed fabric. Continue making the fabric myself. I also do marketing for myself."

"I handle all the obstacles, from management to production, I handle them myself."

"My human resources are still minimal, I said minimal, so one day one child can get one, that's extraordinary."

"For production, I am constrained by helper support because most of the time, after the helper excels in the process, they leave my business to set up their own brand."

The final root cause is the limitation of time and energy, which is closely linked to the previously discussed issue of self-management and the lack of adequate manpower. Many fashion MSMEs in East Java are overwhelmed by the need to manage multiple aspects of their business independently. As a result, they have insufficient time and capacity to focus on product development or strategic planning. This operational burden restricts their ability to adapt to emerging trends and inhibits long-term innovation. This condition can cause micro business actors to have high levels of stress because they feel a lot of pressure to reduce costs and manage uncertainty, so they need to develop relevant strategies to deal with stress, such as paying more attention to their needs, thinking and appropriate guidance (Lei et al., 2020; Xu et al., 2021).

After identifying active supporting factors for FI, a reframing process was conducted using synthesized information from observations and participants' insights. This resulted in key 4 (four) problem statements, which were posed to all workshop participants to guide the development

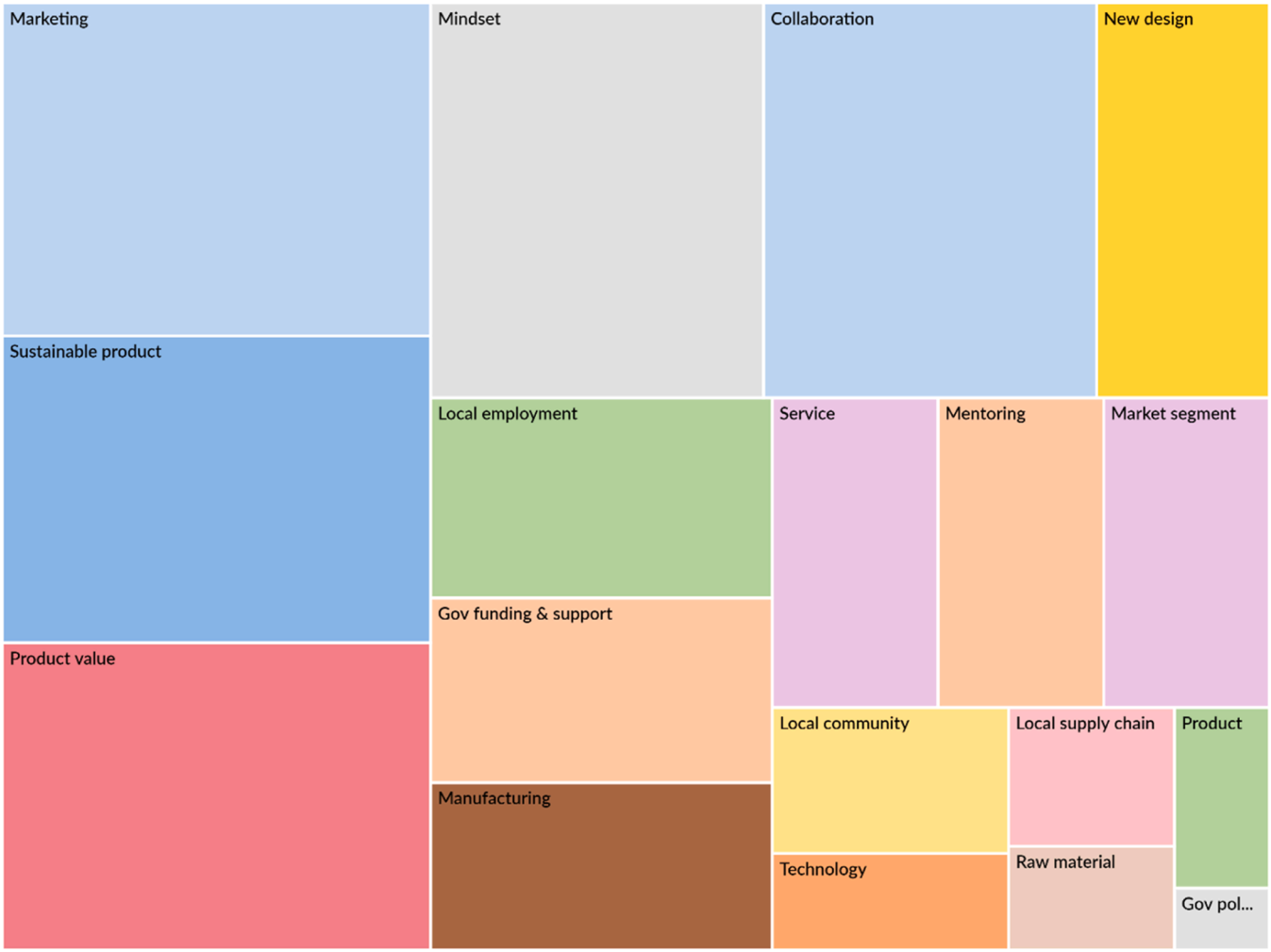


Fig. 2. Active supporting factor of fashion micro-entrepreneurs.

of relevant solutions, as follows: (1) How can fashion micro-entrepreneurs improve the characteristics or uniqueness of their brand to be more attractive to customers? (2) How can fashion micro-entrepreneurs highlight the advantages of their products so that price is no longer a problem for customers? (3) How can fashion micro-entrepreneurs innovate products with limited capital? (4) How can fashion micro-entrepreneurs anticipate meeting production capacity for large orders?

Workshop participants are divided into 4 teams; each team consists of 7–8 people. Each team solves problems according to their number, for example, team 1 will solve problem number 1, team 2 will find a solution to problem number 2, and so on. After the group problem-sharing session, it is then followed by a lightning demo session.

Lightning demo sessions are teamwork sessions with members show and share ideas and inspiration. First, each team is given 20 min to develop solutions to the assigned problem. Participants were allowed to propose solutions based on personal experience. After documenting their ideas, they identified the strengths and weaknesses of each solution. These insights were then shared within teams to inspire further discussion, leading into the ideation stage.

The ideation stage is the third stage of DT, which aims to stimulate out-of-the-box thoughts or ideas to follow up on the brainstorming process in the previous session, namely the lightning demo. The crazy eight (8's) ideation method is used at this stage. Participants are asked to sketch eight different ideas in eight minutes to produce various alternative ways to solve problems.

A sheet of paper is handed to everyone in the team. Each participant needs to make a sketch for 1 min, guided and supervised by the workshop facilitator, with a total of 8 min duration. The Sketch should be able to communicate the meaning of the idea depicted. Each team generates between 54 and 64 solution ideas. These are refined through brief brainstorming sessions where members share feedback and evaluate each idea's effectiveness. Each team is then asked to integrate ideas from 7 to 8 members into one main work program as their proposed solution.

Table 5 shows 4 solutions from the ideation of 4 teams: (1) Digital Fashion; (2) digital marketing: go retail, go modern, go export; (3) sustainable fashion (recycling and reuse); (4) production, circulation, and simulation. These results are then used as input for the audience to solve the problems.

After the root of the problem has been identified through the ideation then it is used as the basis for developing a prototype FI guide for MSMEs. From the brainstorming session with participants after the ideation stage, a model guide is required to apply the idea. Frugally accessible resources are needed by micropreneurs to realize value creation, marketing channels, and technology to produce sustainable products. A prototype of a Frugal Innovation (FI) model is developed.

Business model canvas (BMC) created by Ash Maurya is adopted to develop the Frugal Innovation model. Lean canvas is a tool for creating actionable business plans and focusing on entrepreneurship that focuses on problems, solutions, key metrics, and competitive advantages in 11 (eleven) elements, namely problems, customer segments & early adopters, unique value propositions, solutions, existing alternatives, channels, unfair advantages, key metrics, revenue streams, cost

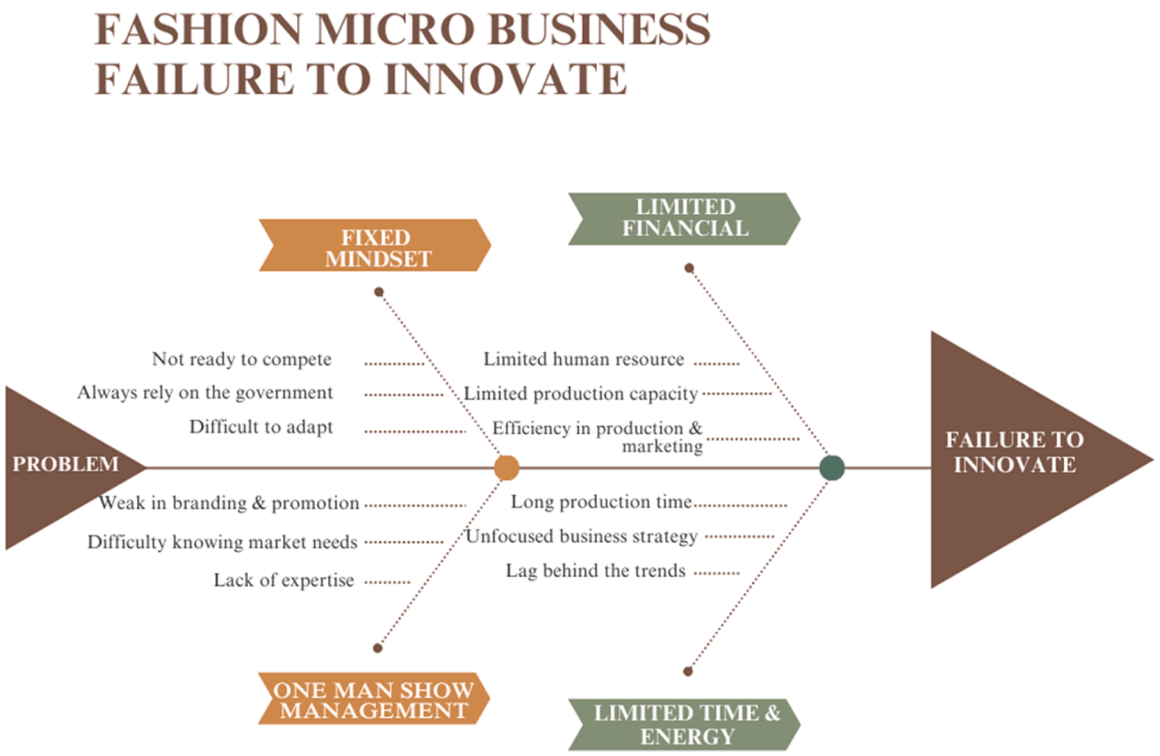


Fig. 3. Root problems of East Java Fashion Micro-entrepreneurs.

structures, short concepts (Lewrick et al., 2018; Maurya, 2012). This Frugal Innovation (FI) model will guide fashion MSMEs in implementing FI. The FI model (Fig. 4) consists of 9 (nine) elements, they are (1) Customer Segment; (2) Problem & Existing Solution; (3) Frugal Mindset; (4) Frugal Solution; (5) Unique Value Proposition; (6) Frugal Ecosystem; (7) Channels; (8) Frugal Cost; (9) Revenue streams.

The stages of developing the Frugal Innovation (FI) model are as follows:

Stage 1. Customer segment & early adopters: one of the key elements in the lean canvas, which is used to detail and understand who the target market or customers will be served by the business. Companies need to have a clear understanding of who will be the main users or customers of their products or services to help the company focus on developing relevant value and ensure that resources are allocated effectively to meet the needs of these customer segments. The method used to fill this element is customer profiling and persona (Lewrick et al., 2018; Osterwalder et al., 2014). Micropreneurs must at least be able to answer the questions: Who is the target market? what is the customer profile? Who is expected to adopt products and services first? Micropreneurs are first required to identify their target customers. The empathy approach revealed that many micropreneurs develop products before understanding customer needs. This misalignment often leads to weak market fit, causing MSMEs to rely heavily on price-based competition and feel disadvantaged against competitors.

Stage 2. Problem & Existing solution: problems or needs that a particular product or business wants to solve, and explains the problems faced by a particular market segment or potential customers. Businesses develop solutions or products based on identifying problems in this element. The method used to fill this element can be through problem interviews, stakeholder maps, six why and how (6WH) (Lewrick et al., 2018). While existing solutions are elements added by researchers, namely solutions that are currently available, either from current strategies, competitors, or from developing trends. In lean canvas, this term is called existing alternatives, which can aim to identify competitors and understand existing market bases so that companies can provide better, more innovative, or more efficient solutions than those already on the market (Lewrick et al., 2018).

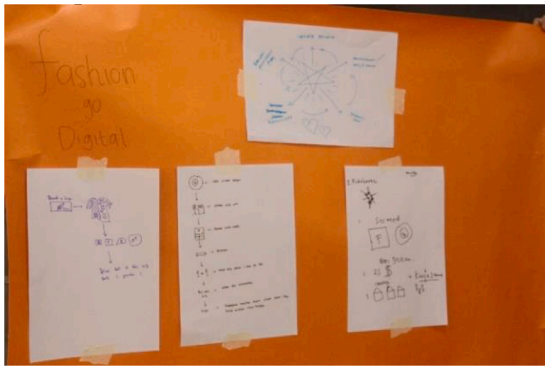
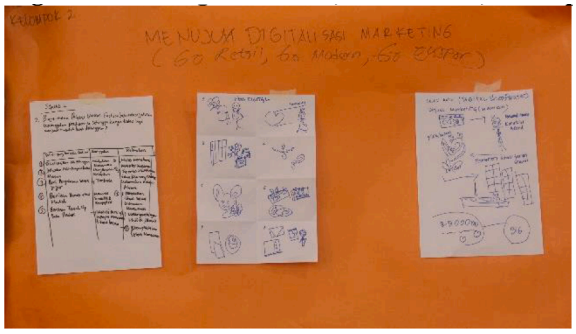
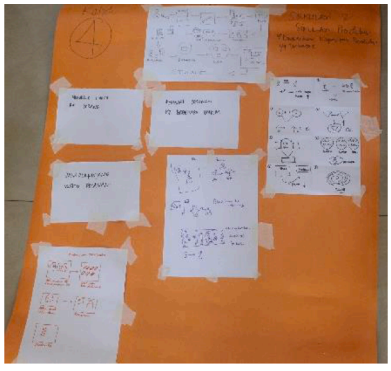
Stage 3. Frugal Mindset: a mindset that is oriented towards developing affordable products for new markets or potential customers. This mindset needs to be developed and become a company culture (Hossain, 2018; Hossain et al., 2022). This element is essential due to the fixed mindset still prevalent among micropreneurs. Shifting toward a growth mindset is critical, enabling MEMEs to develop strategies for cost reduction, capital efficiency, and waste minimization.

Stage 4. Frugal Solution: how business actors can solve the problems identified in the problem block, and how the product or service will meet customer or market needs. The methods used to fill this element are creative techniques, solution interviews, and benchmarking (Lewrick et al., 2018). Prepared solutions must prioritize frugality by leveraging the limited resources available to micropreneurs, ensuring that innovations remain practical, efficient, and sustainable.

Stage 5. Unique Value Proposition (UVP): an attractive message that states why a product is different and deserves to be purchased by customers. The method that can be used to fill this element is with value proposition design (Lewrick et al., 2018). This element was included in the FIM as it emerged as a critical insight during the empathy development phase, supported by informant feedback. Micropreneurs in East Java struggle to compete due to price wars and the ease of design imitation. Therefore, developing a strategy to create unique, market-aligned products is essential. Most micropreneurs also acknowledged a lack of clear added value or differentiation. Defining a UVP is crucial to enhancing their competitive advantage.

Stage 6. Frugal Ecosystem: concern for environmental sustainability, increasing partnerships with local companies in operational processes to support efficient & effective solutions to customers' social or environmental needs (Khattak et al., 2022; Lei et al., 2020; Usman Shehzad et al., 2023). This element was included based on the aspirations of fashion micropreneurs in East Java, who view collaborative innovation as a key strategy to overcome resource limitations and achieve efficient yet effective outcomes. Beyond efficiency, collaboration expands business networks and keeps MSMEs updated on industry trends. Joining the community or associations offers access to designers, artisans, and

Table 5
Problem-solution ideas proposed by workshop participants.

No	Ideation	Description
1		Digital fashion thrives through collaboration among microentrepreneurs, where they co-create and showcase unique fashion designs via social media platforms. These collaborations not only highlight the distinctiveness of each design but also enhance visibility and engagement with potential customers. By fostering joint efforts in design, micropreneurs can contribute to the advancement of fashion in digital space. Moreover, strategic branding and promotional activities are essential to capture the interest of a broader audience and support the sustainable growth of digital fashion initiatives.
2		To capitalize on emerging market opportunities, particularly in local markets, digital marketing serves as a strategic tool for transformation. This approach involves collaboration with the *batik* community and participation in incubator programs to strengthen market presence through digital channels. By embracing digitalization in the retail sector, businesses aim not only to modernize their operations but also to establish a strong foundation for future expansion into international markets. Ultimately, the goal is to drive growth from local retail success toward global export readiness
3		This initiative promotes sustainable fashion by empowering micropreneurs through partnerships with local sub-districts. Utilizing local resources, such as affordable tailors and fashion students' designs are created using recycled materials sourced from online community groups. Textile waste, including negligees and patchwork sold by weight, is repurposed into marketable fashion products. By involving multiple communities, this model enables low-cost production with high-profit potential while supporting both environmental sustainability and local economic growth.
4		This concept emphasizes handmade, inimitable products driven by unique ideas, materials, and techniques such as traditional *canting*. To address the limited production capacity, collaboration is essential. Rather than producing independently, mass production is achieved through partnerships with micro-preneur associations, each contributing to their distinctive formulations. This model ensures scalability while preserving the uniqueness of each product.

relevant programs like halal certification. This element captures micropreneurs' strategies for collaborative growth and goal achievement.

Stage 7. Channel: Describes how a company communicates with its customer segments and reaches them to provide value propositions by creating and finding significant channels to be used as marketing flows or distributions to reach customers appropriately (Lewrick et al., 2018; Osterwalder et al., 2014). This element addresses the primary challenge faced by micropreneurs in marketing by emphasizing the need for effective strategies to deliver products and services to the right target customers.

Stage 8. Frugal Cost: significant cost reduction in the operational

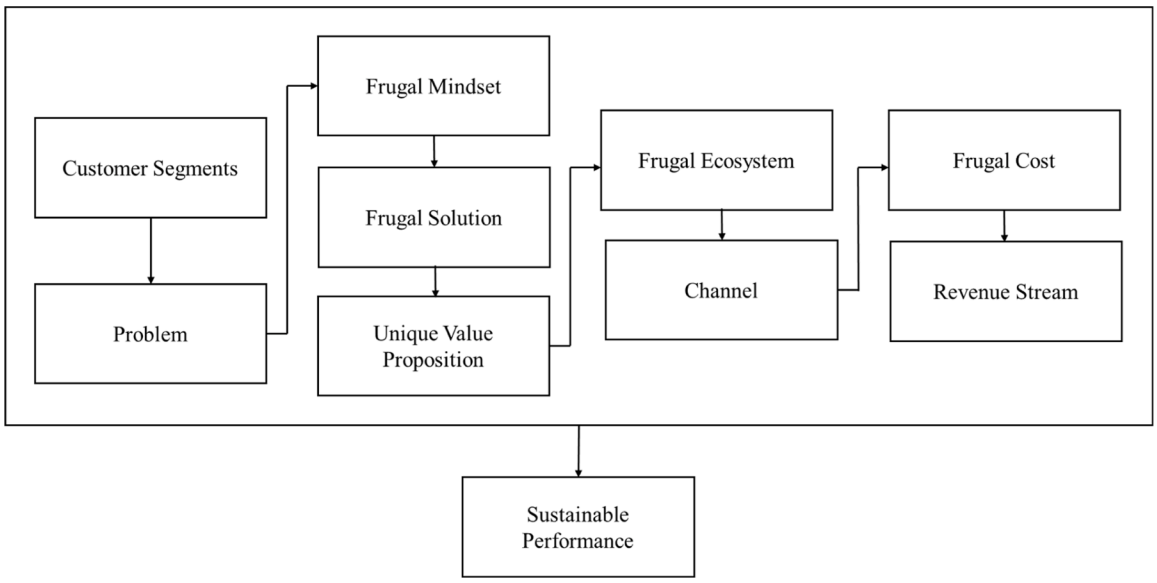


Fig. 4. Frugal innovation model.

process so that it can reduce the final price of products/services significantly so that business actors can introduce new solutions that offer good and cheap products/services (Khattak et al., 2021; Lei et al., 2020). This element is a development of the cost structure element in the lean canvas and business model canvas (BMC) which describes all costs (fixed costs and variable costs) incurred to operate the business model (Lewrick et al., 2018; Osterwalder et al., 2014). These elements align with the concept of frugality by guiding fashion micropreneurs to identify essential innovation costs that have been optimized through savings. The goal is to enable the offering of economically priced products without compromising quality. It also considers cost reductions stemming from potential environmental or social impacts.

Stage 9. Revenue Streams: how business planning generates money and profits from goods or services provided to customers (Osterwalder et al., 2014) supports micropreneurs to plan for generating profits from savings achieved through FI. It also captures the environmental and social benefits for MSMEs.

Findings

This study is conducted using the action design research method with a design thinking approach. 18 active enabling factors for the implementation of frugal innovation (FI) is identified, and the frugal innovation model (FIM) is proposed as a framework for innovating under resource-constrained conditions. Moreover, effective implementation of this model requires a clear understanding of the root causes that hinder micropreneurs from engaging in innovation. While previous studies have extensively identified enablers and drivers for FI, this research reveals a critical insight. Micropreneurs, particularly in developing countries, struggle to innovate due to four root problems: a limited mindset, restricted financial resources, insufficient managerial capabilities, and a lack of time and energy. These fundamental barriers must be addressed before innovating effectively. Therefore, this study proposes the integration of these four root constraints into the refinement of business models tailored for resource-constrained environments. Existing models have not considered these specific limitations. FIM introduces the concept of a frugal mindset as a foundational element to foster the development of frugal solutions and to identify a unique value proposition that aligns with market needs. Furthermore, the model emphasizes the importance of a frugal ecosystem enabled through collaboration, enabling cost-effective yet impactful channels for marketing and promotion, ultimately enhancing both efficiency and business sustainability.

Most of the frugal innovation literature focuses on defining the concept and process around the discovery of frugal innovations. However, in the case of frugal innovation deployment, the need for active supporting factors and the role business model becomes more important and can also be an alternative way to introduce frugality (Howell et al., 2018). The proposed FIM guides frugal innovations that not only rely on one element, such as the problem-solution fit, but also other necessary elements, such as mindsets, ecosystems that reduce complexity, and ultimately reduce overall costs.

The findings of this study have significant implications for both theory and practice. The FIM provides a structured approach for micropreneurs to innovate within resource-constrained environments, addressing key limitations in mindset, finance, managerial capability, and operational capacity. By integrating these constraints into a business model framework, the study extends the current understanding that FI can be systematically applied, particularly in developing country contexts.

Discussion

This study contributes to the evolving discourse on FI by offering a framework that is not only conceptual but also actionable for micropreneurs. To highlight this study's distinctive contribution, a comparison is made with existing FI frameworks, particularly pattern-based and process-oriented models. Compared to Shahid et al. (2023) who propose a conceptual framework positioning FI as a driver of sustainable entrepreneurship to tackle broad social and environmental challenges, and Girija et al. (2024) bring a more targeted and inclusive lens by arguing that FI can only be truly impactful if it consciously includes women and addresses gendered barriers. Building on prior studies, this FIM addresses three distinct factors that differentiate the proposed framework from earlier models. First, in terms of mindset, the FIM explicitly defines it as the foundation for decision-making under extreme resource constraints, emphasizing user-centered problem-solving and a cost-value balance. While prior studies address the innovation mindset broadly. Second, the ecosystem factor maps the localized network of stakeholders who support FI practices, including informal market actors. Third, the innovation process, the FIM adopts an adaptive and iterative approach to micropreneurs, allowing flexible sequencing in line with local realities, whereas previous models tend toward structured, linear, or inclusive but non-frugal processes. In application guidance, this

framework offers actionable steps, tools, and decision points for implementing FI compared to the prior models that often adopt standardized innovation sequences, which can be misaligned with the realities of micropreneurs operating under severe financial, managerial, and operational limitations. This research is uniquely structured to provide a practical guide to micropreneurs by focusing on user-centered problem-solving and ensuring the framework is grounded in real needs and local contexts. it can be a more actionable and implementable tool for guiding sustainable innovation at the grassroots level.

The FIM, developed in this study, integrates a human-centered, iterative problem-solving and local problem-fit approach through DT that emphasizes the need for a localized and adaptive FI framework that bridges the practical gap between theoretical models and everyday micropreneurial practices. Moreover, this research provides an explicit step-by-step guide that translates theoretical enablers of FI into practical strategies tailored to micropreneurs' capabilities. Additionally, the localization of the FIM is crucial given the socio-economic conditions in Indonesia, where micropreneurs contend with both structural and market-level challenges.

FI can be strengthened through open innovation, especially in resource-limited settings. Intellectual capital and shared knowledge allow firms to co-create affordable solutions through open frugal innovation. In open frugal innovation. Diverse actors such as entrepreneurs, researchers, policymakers, and end-users collaborate to co-create solutions for societal challenges, where knowledge-sharing and social intelligence are key enablers of this collaborative effort (Jayabalan et al., 2024). The role of circular open innovation is to help businesses remain sustainable and innovative despite constraints, and to highlight how collaboration, digital tools, and openness support frugal innovation (Hadi et al., 2025). This study's FI framework aligns with this view by encouraging local collaboration and shared learning among micropreneurs.

Conclusion and implications

This paper develops an FI framework to guide micropreneurs in adopting sustainable and resource-efficient innovation strategies. The proposed Frugal Innovation Model (FIM) is grounded in localized market realities, starting from user-centered problem identification to make a frugal solution, optimizing existing resources, and testing low-cost prototypes to enable micropreneurs to innovate effectively without excessive capital and offering a pathway for sustainable growth within competitive environments. The model's uniqueness lies in its integration of two critical factors: frugal mindset, which fosters creativity and value creation under revenue constraints, and frugal ecosystem, which strengthens collaboration among stakeholders to support innovation continuity. Beyond its theoretical contribution, FIM offers tangible guidance that can be directly applied in practice, bridging the gap between conceptual models and real-world innovation strategies.

Design thinking for innovation, which was originally designed as a methodology for product development, has now been adapted and adopted to a wider scope in the innovation process. (Wilkerson and Trellevik, 2021). DT effectively identified core challenges faced by micropreneurs, particularly in mindset, self-management, and resource limitations. While 18 FI active support factors were revealed during the empathy stage, addressing these root problems is essential for enabling innovation. The DT workshop served as a platform to shift perspectives and foster peer collaboration. Resulting ideas, such as digital and sustainable practices, marketing, and collaborative production, formed the basis for the FI Model. These initial prototypes present an opportunity for further testing and refinement, highlighting the need for continued capacity-building and support systems tailored to micropreneurial needs.

Overall, the study results reveal that FI business models can benefit micropreneurs in developing countries and contribute to sustainable development. Entrepreneurs not only meet customer needs but also can stimulate other businesses. According to the previous MSME research, management's growth mindset can reflect the strategy, characteristics, leadership, flexibility, and challenge-seeking nature to increase its performance (Dubey et al., 2022; Papadopoulou et al., 2023; Rajala and Tidström, 2022).

Theoretical implications

The outcomes derive from the empathize stage of the design thinking process, through deep interviews and workshops, identify 18 active supporting factors, and offer a theoretical contribution. While previous studies have identified various enablers and drivers of FI, this study reveals additional enablers, such as mindset, collaboration, which are found to be significant factors in actively supporting the implementation of FI.

In addition to the emphasis on a frugal mindset, a key theoretical implication of this study is the importance of fostering a supportive frugal ecosystem that enables micropreneurs to innovate within their constraints. This includes formal and informal rules, market access, and family support, which can improve knowledge sharing, networking, and access to resources. However, it also faces potential challenges such as digital exclusion and increased complexity for end users, especially when frugal solutions are not fully adapted to the local context and user capacities (Albert, 2019; Igwe et al., 2020)

Practical implications

This study offers a practical contribution through the development of guidelines using FIM, which provides micropreneurs with a step-by-step framework to implement innovation effectively under resource constraints. By adapting and refining existing business model frameworks, FIM enables more cost-efficient and sustainable innovation, particularly in developing countries, especially as Indonesia.

Practically, FIM serves as a guide to support MSMEs in optimizing limited resources while maintaining innovation and ensuring business sustainability. It is recommended that micropreneurs adopt FIM and that policymakers and support institutions incorporate its principles into relevant development programs.

Limitations and future agenda

A limitation of this study is that the primary informants were fashion micropreneurs, which may limit the contextual specificity of the findings. However, the resulting guidelines through FIM have the potential to be applied across various MSME sectors beyond fashion.

This study adopted a DT approach, focusing on the initial development of a FIM through the exploration and partial implementation of the early testing phase. However, the implementation phase has not yet been fully comprehensively examined in practice. A follow-up study is planned to evaluate the FIM's long-term use and its impact across different regions and sectors. Future research should focus on applying FIM in real MSME contexts to assess its effectiveness in guiding micropreneurs through the FI process. Further validation across various sectors and regions is also recommended to enhance the model's generalizability and impact.

CRediT authorship contribution statement

Prita Ayu Kusumawardhany: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Imam Baihaqi:** Supervision. **Putu Dana Karningsih:** Supervision.

Funding source

This research was supported by a doctoral scholarship from the University of Surabaya (No. 0772/PKD-SL/SDM/VI/2021). The doctoral study was conducted at the School of Interdisciplinary Management and Technology, Institut Teknologi Sepuluh Nopember Surabaya.

Author contributions

The research was conducted by the first author as part of her PhD studies. The second and third authors provided supervision, guidance, and critical feedback throughout the research process and manuscript preparation. Both authors reviewed and approved the final version of the manuscript.

Ethical statement

The authors affirm that the research presented in this manuscript was conducted ethically. No sensitive personal data was involved. All sources are properly cited, and there are no conflicts of interest. The authors confirm the manuscript is original, not published elsewhere, and not under consideration by another journal.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abbas, S.M., Liu, Z., 2022. Orchestrating frugal eco-innovation: the plethora of challenges and diagnostics in lean startups of emerging economies. Innov. Manag. Rev. 19 (4), 339–367. https://doi.org/10.1108/INMR-11-2020-0171.

Albert, M., 2019. Sustainable frugal innovation - the connection between frugal innovation and sustainability. J. Clean. Prod. 237. https://doi.org/10.1016/j.jclepro.2019.117747.

Arlinghaus, J.C., Rosca, E., & Bendul, J. (2016). *Frugal and Lean Engineering: A Critical Comparison and Implications for Logistics Processes Production Planning and Control 4.0 View project Value creation at the Bottom of the Pyramid View project Frugal and Lean Engineering: A Critical Comparison and Implications for Logistics Processes.* ⟨https://www.researchgate.net/publication/303279263⟩.

Bender-Salazar, R., 2023. Design thinking as an effective method for problem-setting and needfinding for entrepreneurial teams addressing wicked problems. J. Innov. Entrep. 12 (1). https://doi.org/10.1186/s13731-023-00291-2.

Bhatti, Y., Basu, R.R., Barron, D., Ventresca, J.M., 2018. Frugal Innovation: Models, Means, Methods, First Ed. Cambridge University Press, New York.

Borchardt, M., Chiappetta Jabbour, C.J., Belém, J. de F., Mani, V., Pereira, G.M., Ritter, Á.M., 2022. Germinating seeds in dry soil: examining the process of frugal innovation in micro- and small-enterprises at the base of the pyramid. Eur. Bus. Rev. 34 (3), 297–320. https://doi.org/10.1108/EBR-12-2020-0325.

Brem, A., Wolfram, P., 2014. Research and development from the bottom up - Introduction of terminologies for new product development in emerging markets. J. Innov. Entrep. 3 (9), 1–22. https://doi.org/10.1186/2192-5372-3-9.

Bruton, G.D., Ahlstrom, D., Si, S., 2015. Entrepreneurship, poverty, and Asia: moving beyond subsistence entrepreneurship. Asia Pac. J. Manag. 32 (1), 1–22. https://doi.org/10.1007/s10490-014-9404-x.

Cai, Q., Ying, Y., Liu, Y., Wu, W., 2019. Innovating with limited resources: the antecedents and consequences of frugal innovation. Sustain. (Switz.) 11 (20). https://doi.org/10.3390/su11205789.

Campese, C., Vanegas, C.A.L., Costa, J.M.H. da, 2018. Benefits of the empathy map method and the satisfaction of a company with its application in the development of concepts for a White glue tube. Prod. Manag. Dev. 16 (2), 104–113. https://doi.org/10.4322/pmd.2018.008.

Cuevas-Vargas, H., Parga-Montoya, N., 2021. How ICT usage affect frugal innovation in Mexican small firms. The mediating role of entrepreneurial orientation. Procedia Comput. Sci. 199, 223–230. https://doi.org/10.1016/j.procs.2022.01.028.

Dabić, M., Stojčić, N., Simić, M., Potocan, V., Slavković, M., Nedelko, Z., 2021. Intellectual agility and innovation in micro and small businesses: the mediating role of entrepreneurial leadership. J. Bus. Res. 123, 683–695. https://doi.org/10.1016/j.jbusres.2020.10.013.

Dima, A., Bugheanu, A.M., Dinulescu, R., Potcovaru, A.M., Stefanescu, C.A., Marin, I., 2022. Exploring the research regarding frugal innovation and business sustainability through bibliometric analysis. Sustainability (Switzerland) 14 (3). https://doi.org/10.3390/su14031326.

Dresch, A., Lacerda, D.P., Miguel, P.A.C., 2015. Uma análise distintiva entre o estudo de caso, a pesquisa-ação e a design science research. Rev. Bras. De. Gest. De. Neg. 17 (56), 1116–1133. https://doi.org/10.7819/rbgn.v17i56.2069.

Dubey, R., Bryde, D.J., Foropon, C., Tiwari, M., Gunasekaran, A., 2022. How frugal innovation shape global sustainable supply chains during the pandemic crisis: lessons from the COVID-19. Supply Chain Manag. 27 (2), 295–311. https://doi.org/10.1108/SCM-02-2021-0071.

Girija, S., Banerji, B., Batra, N., Paruchuru, M., Yeediballi, T., 2024. Making frugal innovations inclusive: a gendered approach. J. Clean. Prod. 434. https://doi.org/10.1016/j.jclepro.2023.140182.

Greeson, J.K.P., Gyourko, J., Ortiz, A.J., Coleman, D., Cancel, S., 2021. One hundred and ninety-four got licensed by Monday": application of design thinking for foster care innovation and transformation in rhode island. Child. Youth Serv. Rev. 128. https://doi.org/10.1016/j.childyouth.2021.106166.

Hadi, N.U., Almessabi, B., Imran Khan, M., 2025. Leveraging industry 4.0 and circular open innovation for digital sustainability: the role of circular ambidexterity. J. Open Innov.: Technol. Mark. Complex. 11. https://doi.org/10.1016/j.joitmc.2025.100545. Elsevier B.V.

Harris, M., Marti, J., Watt, H., Bhatti, Y., Macinko, J., Darzi, A.W., 2017. Explicit bias toward high-income- country research: a randomized, blinded, crossover experiment of English clinicians. Health Aff. 36 (11), 1997–2004. https://doi.org/10.1377/hlthaff.2017.0773.

He, J., Ortiz, J., 2021. Sustainable business modeling: the need for innovative design thinking. J. Clean. Prod. 298. https://doi.org/10.1016/j.jclepro.2021.126751.

Horn, C., Brem, A., 2013. Strategic directions on innovation management - a conceptual framework. Manag. Res. Rev. 36 (10), 939–954. https://doi.org/10.1108/MRR-06-2012-0142.

Hossain, M., 2018. Frugal innovation: a review and research agenda. J. Clean. Prod. 182, 926–936. https://doi.org/10.1016/j.jclepro.2018.02.091. Elsevier Ltd.

Hossain, M., 2021. Frugal innovation and sustainable business models. Technol. Soc. 64. https://doi.org/10.1016/j.techsoc.2020.101508.

Hossain, M., 2021a. Frugal innovation: unveiling the uncomfortable reality. Technol. Soc. 67. https://doi.org/10.1016/j.techsoc.2021.101759.

Hossain, M., 2022. Frugal entrepreneurship: resource mobilization in resource-constrained environments. Creat. Innov. Manag. 31 (3), 509–520. https://doi.org/10.1111/caim.12502.

Howell, R., van Beers, C., Doorn, N., 2018. Value capture and value creation: the role of information technology in business models for frugal innovations in Africa. Technol. Forecast. Soc. Change 131, 227–239. https://doi.org/10.1016/J.TECHFORE.2017.09.030.

Igwe, P.A., Odunukan, K., Rahman, M., Rugara, D.G., Ochinanwata, C., 2020. How entrepreneurship ecosystem influences the development of frugal innovation and informal entrepreneurship. Thunderbird Int. Bus. Rev. 62 (5), 475–488. https://doi.org/10.1002/tie.22157.

Iqbal, Q., Ahmad, N.H., Li, Z., 2020. Frugal-based innovation model for sustainable development: technological and market turbulence. Leadersh. Organ. Dev. J. 42 (3), 396–407. https://doi.org/10.1108/LODJ-06-2020-0256.

Iqbal, Q., Ahmad, N.H., Li, Z., Li, Y., 2022. To walk in beauty: sustainable leadership, frugal innovation and environmental performance. Manag. Decis. Econ. 43 (3), 738–750. https://doi.org/10.1002/mde.3415.

Jayabalan, J., Dorasamy, M., Kaliannan, M., 2024. Thriving in scarcity: harnessing intellectual capital for open frugal innovation. J. Open Innov. Technol. Mark. Complex. 10 (2). https://doi.org/10.1016/j.joitmc.2024.100300.

John William, A., Suresh, M., Subramanian, N., 2023. Examining the causal relationships among factors influencing SMEs' competitive advantage: a TISM-neutrosophic MICMAC approach. Benchmarking. https://doi.org/10.1108/BIJ-08-2022-0529.

Khan, I.S., Ahmad, M.O., Majava, J., 2021. Industry 4.0 and sustainable development: a systematic mapping of triple bottom line, circular economy and sustainable business models perspectives. J. Clean. Prod. 297. https://doi.org/10.1016/j.jclepro.2021.126655. Elsevier Ltd.

Khattak, A., Tabash, I.M., Yousaf, Z., Radulescu, M., Nassani, A.A., Mohamed, H., 2021. Towards Innovation Performance of SMEs: Investigating the role of digital platforms, innovations culture and frugal innovation in emerging economies. J. Entrep. Emerg. Econ. 2053–4604. https://doi.org/10.1108/JEEE-08-2021-0318.

Lange, A., Hüsig, S., Albert, M., 2023. How frugal innovation and inclusive business are linked to tackle low-income markets. J. Small Bus. Manag. 61 (6), 2588–2621. https://doi.org/10.1080/00472778.2021.1924380.

Lei, H., Leaungkhamma, L., Le, P.B., 2020. How transformational leadership facilitates innovation capability: the mediating role of employees' psychological capital. Leadersh. Organ. Dev. J. 41 (4), 481–499. https://doi.org/10.1108/LODJ-06-2019-0245.

Lewrick, M., Link, P., Leifer, L., 2018. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems. John Wiley & Sons, Inc.

Lomborg, K., Munch, L., Krøner, F.H., Elwyn, G., 2022. Less is more": a design thinking approach to the development of the agenda-setting conversation cards for people with type 2 diabetes. PEC Innov. 1. https://doi.org/10.1016/j.pecinn.2022.100097.

Majchrzak, A., Cooper, L.P., Neece, O.E., 2004. Knowledge reuse for innovation. Manag. Sci. 50 (2), 174–188. https://doi.org/10.1287/mnsc.1030.0116.

Maurya, A., 2012. Running Lean: Iterate from Plan A to a Plan That Works. United States of America: O'Reilly edition.

Meinel, C., Leifer, L., Plattner, H. (Eds.), 2011. Design Thinking. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-13757-0.

Mittal, V., Raman, T.V., 2021. Examining the determinants and consequences of financial constraints faced by micro, small and medium Enterprises' owners. World J. Entrep.

Manag. Sustain. Dev. 17 (3), 560–581. https://doi.org/10.1108/WJEMSD-07-2020-0089.
Niroumand, M., Shahin, A., Naghsh, A., Peikari, H.R., 2020. Frugal innovation enablers: a comprehensive framework. Int. J. Innov. Sci. 12 (1), 1–20. https://doi.org/10.1108/IJIS-10-2019-0099.
Oliveira, M., Zancul, E., Salerno, M.S., 2024. Capability building for digital transformation through design thinking. Technol. Forecast. Soc. Change 198. https://doi.org/10.1016/j.techfore.2023.122947.
Osterwalder, A., Pigneur, Y., Papadakos, P., Bernarda, G., Papadakos, T., Smith, A., 2014. Value proposition design. John Wiley & Sons.
Pansera, M., Sarkar, S., 2016. Crafting sustainable development solutions: frugal innovations of grassroots entrepreneurs. Sustainability (Switzerland) 8 (1). https://doi.org/10.3390/su8010051.
Papadopoulou, C., Theotokis, A., Hultman, M., 2023. Managerial mindset effects on international marketing strategy adaptation decisions. Ind. Mark. Manag. 115, 266–280. https://doi.org/10.1016/J.INDMARMAN.2023.09.014.
Pardo Martínez, C.I., Cotte Poveda, A., 2022. Strategies to improve sustainability: an analysis of 120 microenterprises in an emerging economy. Glob. Sustain. 5. https://doi.org/10.1017/sus.2022.3.
Patrício, R., Moreira, A.C., Zurlo, F., 2020. Enhancing design thinking approaches to innovation through gamification. Eur. J. Innov. Manag. https://doi.org/10.1108/EJIM-06-2020-0239.
Ploeg, M., Knoben, J., Vermeulen, P., van Beers, C., 2021. Rare gems or mundane practice? Resource constraints as drivers of frugal innovation. Innov. Organ. Manag. 23 (1), 93–126. https://doi.org/10.1080/14479338.2020.1825089.
Rajala, A., Tidström, A., 2022. Examining the effects of a coopetitive mindset on SME performance: the moderating role of growth. Ind. Mark. Manag. 105, 351–358. https://doi.org/10.1016/j.indmarman.2022.06.012.
Rosenbusch, N., Brinckmann, J., Bausch, A., 2011. Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. J. Bus. Ventur. 26 (4), 441–457. https://doi.org/10.1016/j.jbusvent.2009.12.002.
Santa-Maria, T., Vermeulen, W.J.V., Baumgartner, R.J., 2022. The circular sprint: circular business model innovation through design thinking. J. Clean. Prod. 362. https://doi.org/10.1016/j.jclepro.2022.132323.
Santos, L.L., Borini, F.M., Oliveira Júnior, M. de M., 2020. In search of the frugal innovation strategy. In: Review of International Business and Strategy, 30. Emerald Group Holdings Ltd, pp. 245–263. https://doi.org/10.1108/RIBS-10-2019-0142.
Sarkar, S., Mateus, S., 2022. Value creation using minimal resources – a meta-synthesis of frugal innovation. Technol. Forecast. Soc. Change 179. https://doi.org/10.1016/j.techfore.2022.121612.
Schleinkofer, U., Herrmann, T., Maier, I., Bauernhansl, T., Roth, D., Spath, D., 2019. Development and evaluation of a design thinking process adapted to frugal production systems for emerging markets. Procedia Manuf. 39, 609–617. https://doi.org/10.1016/j.promfg.2020.01.429.
Shahid, M.S., Hossain, M., Karami, M., Anwar, T., 2023. Frugal entrepreneurship: a way to seize business opportunities for low-income customers. Asia Pac. J. Manag. https://doi.org/10.1007/s10490-023-09899-0.
Shahid, M.S., Hossain, M., Shahid, S., Anwar, T., 2023. Frugal innovation as a source of sustainable entrepreneurship to tackle social and environmental challenges. J. Clean. Prod. 406. https://doi.org/10.1016/j.jclepro.2023.137050.
Shepherd, D.A., Parida, V., Wincent, J., 2020. The surprising duality of jugaad: low firm growth and high inclusive growth. J. Manag. Stud. 57 (1), 87–128. https://doi.org/10.1111/joms.12309.
Shibin, K., Dubey, R., Gunasekaran, A., Luo, Z., Papadopoulos, T., Roubaud, D., 2018. Frugal innovation for supply chain sustainability in SMEs: multi-method research design. Plan. Control. ⟨http://kar.kent.ac.uk/67373/⟩.
Upadhyay, P., Punekar, R.M., 2023. A framework for designing frugal innovations in marginalised contexts. J. Clean. Prod. 410, 137170. https://doi.org/10.1016/J.JCLEPRO.2023.137170.
Usman Shehzad, M., Zhang, J., Le, P.B., Jamil, K., Cao, Z., 2023. Stimulating frugal innovation via information technology resources, knowledge sources and market turbulence: a mediation-moderation approach. Eur. J. Innov. Manag. 26 (4), 1071–1105. https://doi.org/10.1108/EJIM-08-2021-0382.
Weyrauch, T., Herstatt, C., 2017. What is frugal innovation? Three defining criteria. J. Frugal Innov. 2 (1). https://doi.org/10.1186/s40669-016-0005-y.
Wilkerson, B., Trellevik, L.K.L., 2021. Sustainability-oriented innovation: improving problem definition through combined design thinking and systems mapping approaches. Think. Skills Creat. 42. https://doi.org/10.1016/j.tsc.2021.100932.
Wohlfart, L., Bünger, M., Lang-Koetz, C., Wagner, F., 2016. Corporate and grassroot frugal innovation: a comparison of top-down and bottom-up strategies. Technol. Innov. Manag. Rev. 6 (4), 5–17. https://doi.org/10.22215/timreview/977.
Xu, X. (Even), Huang, D., Chen, Q., 2021. Stress and coping among micro-entrepreneurs of peer-to-peer accommodation. Int. J. Hosp. Manag. 97. https://doi.org/10.1016/j.ijhm.2021.103009.
Zeschky, M.B., WinterhalterProf, S., Gassmann, O., 2014. From cost to frugal and reverse innovation: mapping the field and implications for global competitiveness. Res. Technol. Manag. 57 (4), 20–27. https://doi.org/10.5437/08956308X5704235.