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Unlocking resource access for startups via the sharing economy

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Background: In recent years, the sharing economy (SE) has garnered increasing attention for its potential to enable businesses to access resources that would otherwise be difficult or costly to acquire. This is expected to be particularly beneficial for startups that face resource constraints.

Aim: This research aimed to explore how the SE principles can be applied to help startups gain access to resources for prototype development, testing and verification.

Setting: This study investigated how two empirical cases (one in South Africa and another in Norway) apply the SE principles to provide startups with access to resources for prototype development, testing and verification.

Methods: This study employed an embedded multiple case study design, drawing on in-depth interviews with key actors associated with the two cases. Interview data were combined with additional data sources, including field visits, observations and secondary data.

Results: The research findings demonstrate how the SE principles can be applied to enable startups to access both tangible (e.g. specialised prototyping and test equipment) and intangible resources (e.g. technical and market knowledge, networks and pilot customers) through centralised resource pools and peer-to-peer intermediation.

Conclusion: The significance of hands-on engagement with startups is emphasised, as intangible resources (e.g. technical and industry knowledge) are shown to be necessary to facilitate the sharing of tangible resources (e.g. specialised equipment).

Contribution: This study contributes to the growing body of knowledge on the SE, particularly in the context where startups participate in the SE as resource users.

Keywords: sharing economy; startups; networks; resourcing startup enterprises; resource access; prototyping; technology development; multiple case study.

Introduction

Over the past decade, the sharing economy (SE) has developed into an increasingly integral part of contemporary economic and social structures. According to Belk, Eckhardt and Bardhi (2019), the rise of the SE has reshaped marketplaces and led many to reconsider the key concepts associated with industrial capitalism, such as 'ownership', 'property' and 'assets'. Developments in the SE have sparked a growing curiosity among scholars, resulting in a surge in research in this area. A study by De las Heras et al. (2021) analysed the research output on the SE from 2010 to 2019 and found that the number of publications increased from 2 in 2010 to 705 in 2019. Although the literature identifies several SE models, consumer-based models, including consumer-to-consumer (C2C) and business-to-consumer (B2C), have thus far been the most prevalent in both research and practice (Benoit et al. 2025; Grondys 2019; Melander & Arvidsson 2021). In recent years, however, increasing attention has been directed towards the potential for businesses to participate in the SE as resource users (e.g. Ciulli & Kolk 2019; Grondys 2019; HDI Global 2022; Kolaczkowski et al. 2021; Melander & Arvidsson 2021; Radjou 2021; Tsvetkova 2020).

The operational efficacy of every business is dependent on the acquisition of resources, both tangible (e.g. premises, technology and equipment) and intangible (e.g. human capital and social networks) (Barney 1991; Jones, Macpherson & Jayawarna 2014). Yet, many firms face resource constraints, and some resources in particular (such as expensive and specialised equipment or technologies) are out of reach for many businesses (Grondys 2019). This challenge is particularly pronounced for small and medium enterprises (SMEs) (Nheta et al. 2020; Zulu & Ngwenya 2023), and especially for startups (Albano & Lubello 2018). In industries with high barriers to entry,

where significant upfront investments in specialised equipment and facilities are required, startups may face even greater entry barriers. In recent years, the SE has been noted as a wise resource management strategy for businesses (Grondys 2019; Radjou 2021; Soltysova & Modrak 2020). Gaining access to resources *via* the SE is expected to offer several advantages for businesses, including cost reduction, increased operational flexibility and more sustainable resource use (Antikainen, Aminoff & Heikkilä 2018; Chuah et al. 2021; Hong et al. 2014; Niederhauser et al. 2022). While some scholars argue that the SE may offer benefits for firms of all sizes and maturity levels (Radjou 2021), it is expected to be particularly beneficial for resource-constrained small businesses and startups (Choi et al. 2014; Grondys 2019; Soltysova & Modrak 2020). Despite growing recognition of these potential benefits, there remains a notable gap in research on businesses as resource users within the SE, particularly in industrial markets (Melander & Arvidsson 2021). In such contexts, startups often struggle to access expensive technologies and equipment required for prototype development, testing and verification, which are key stages in the innovation process. The primary objective of this research is to explore how an SE approach can facilitate startups' access to critical resources for prototype development, testing and verification. In doing so, the study aims to shed light on how the SE can support startups in addressing resource constraints, particularly by enabling access to high-cost and specialised resources such as industrial equipment. The findings of this study are expected to contribute to the academic literature while also offering practical insights for SE facilitators, industry practitioners and policymakers. To accomplish this, the study addresses the following two research questions:

RQ1: *How can the principles of the SE be applied to facilitate startups' access to resources for prototype development, testing and verification?*

RQ2: *What resources can startups access via the SE to support their prototype development, testing and verification?*

To answer these research questions, this study examines two empirical cases (one in South Africa and another in Norway) that apply the SE principles to support startups in accessing resources for prototype development, testing and verification. Both cases operate in capital-intensive industrial sectors (photonics and ocean industries, respectively) and aim to reduce entry barriers for startups by facilitating temporary access to specialised and costly resources. The analysis explores how SE models are operationalised, the types of resources made available to startups, and the similarities and differences between the two cases.

The article is organised as follows: it begins with a review of pertinent literature on the SE and entrepreneurship. The following section outlines the research methods and context. The research findings are then presented and discussed. The concluding section addresses the implications of the research, highlights its limitations, and suggests avenues for future research.

Theoretical background

The sharing economy phenomenon

The SE is a socio-economic model that facilitates shared access to underutilised assets, enabling market participants to exchange goods, services and resources. The concept is based on the idea that underutilised assets can be put to better use by sharing them with others, thereby reducing waste and maximising efficiency (Sundararajan 2016). Definitions of the SE vary significantly across authors, making them challenging to reconcile (Acquier, Carbone & Massé 2019; Haqqani, Elomri & Kerbache 2022). Moreover, many of the existing definitions for the SE have been proposed by researchers, specifically researching the SE in the consumer sharing context, and therefore may not be directly applicable to the business-sharing context, which is the focus of this study. This study adopts the definition proposed by Acquier et al. (2019:7), who define the SE as 'a set of initiatives that increase the availability and efficiency of sub-utilised resources in society by organising peer-to-peer exchanges or promoting access over ownership or both'. This represents a broad definition of the SE and is thus also suitable for the business-sharing context. The definition captures the essence of the SE as a system that enables individuals and organisations to share resources, either through peer-to-peer exchanges or through access to a centralised pool of shared resources. This definition also aligns with other definitions, for example, those used by Munoz and Cohen (2017), Botsman (2013) and Schor (2016).

Over the past two decades, the SE has emerged as a major disruptor of traditional industries, with Uber and Airbnb frequently cited in the literature for their transformative effects on the taxi and hospitality sectors (Acquier et al. 2019; Benoit et al. 2025; Chuah et al. 2021; Grondys 2019; Mont et al. 2020). For instance, Airbnb has had a dramatic impact on the accommodation sector in South Africa, with Cape Town hosting more listings in 2023 than Singapore, San Francisco and Amsterdam combined (Brederode 2023). Similarly, in Norway, Airbnb is estimated to provide nearly half of the country's hotel room capacity (Halvorsen, Lutz & Barstad 2021). Owing to its innovative business model and transformative impact, the SE has garnered growing attention from both researchers and practitioners (De las Heras et al. 2021; Rathnayake et al. 2024), not only for its applications in consumer markets, which have thus far dominated scholarly discourse (Grondys 2019; Melander & Arvidsson 2021; Rathnayake et al. 2024) but also for its growing potential in business and industrial contexts (Antikainen et al. 2018; Belhadi et al. 2023; Benoit et al. 2025; Ciulli & Kolk 2019; HDI Global 2022; Kolaczkowski et al. 2021; Radjou 2021; Tsvetkova 2020). In Norway, the government has highlighted opportunities for the SE in business contexts (Regjeringen 2017), while in South Africa, it is recognised for its potential to support SMEs and promote economic development (Ntshona 2018; Olunloyo 2023). Although several recent studies have considered SMEs in the context of the SE, including works by

Abebe and Twinomurinzi (2019), Choi et al. (2014), Lestantri et al. (2022), Niederhauser et al. (2022) and Soltysova and Modrak (2020), none of these studies focused specifically on startups. This study seeks to address this gap in the literature by investigating startups as resource users within the SE.

Resource-constrained startups

A startup is a newly established company or business that is typically in the early stages of its development. Startups are often characterised by their focus on innovation, growth and the pursuit of new and unique business ideas. Although lacking a universally accepted definition, Kim, Kim and Jeon (2018:2) suggested that a startup is commonly defined as 'a new business that entrepreneurs initiate by combining business ideas and resources'. It is widely acknowledged that, although startups play a crucial role in driving employment and innovation (Albano & Lubello 2018), their failure rates remain very high (Mlotshwa & Msimango-Galawe 2020; Nheta et al. 2020; Zulu & Ngwenya 2023). Although many factors may contribute to the early demise of these businesses, access to resources has been considered as a key challenge for new ventures (Jones et al. 2014; Nheta et al. 2020; Sullivan & Ford 2014; Zulu & Ngwenya 2023).

The operational efficacy of every business is dependent on the acquisition of resources, both tangible (e.g. premises, technology and equipment) and intangible (e.g. human capital and social networks) (Barney 1991), yet many firms face resource constraints. This is especially true for SMEs (Nheta et al. 2020; Zulu & Ngwenya 2023) and particularly startups (Albano & Lubello 2018). Startups face many challenges similar to those encountered by SMEs, but these issues are intensified because of the newness, high risk and uncertainty associated with the startups (Albano & Lubello 2018). It is well established in the literature that startups face both liabilities of smallness and newness (Albano & Lubello 2018; Freeman, Carroll & Hannan 1983; Gimenez-Fernandez, Sandulli & Bogers 2020), which may inhibit their innovation efforts. Startups have limited access to both tangible and intangible resources, putting them at a disadvantage compared to larger companies (Jones et al. 2014). Startups also encounter significant disadvantages because of their lack of experience, often described as the 'liability of newness' (Albano & Lubello 2018; Tornikoski 2009). Although previous studies suggested that startups can mitigate resource limitations by accessing external resources (Albourini et al. 2020; Hite & Hesterly 2001; Huang, Lai & Lo 2012; Partanen et al. 2020; Witt 2004), their limited business experience remains a principal challenge. This often results in a lack of credibility and legitimacy in the market (Jones et al. 2014; Tornikoski & Newbert 2007), which in turn impedes their ability to effectively engage in networked entrepreneurial activities.

In recent years, the SE has been proposed as a wise resource management strategy for businesses (Grondys 2019; Radjou 2021; Soltysova & Modrak 2020). Although sources suggested that the SE may offer benefits for companies of all ages and sizes (Radjou 2021), it is expected to be particularly beneficial for SMEs (Abebe & Twinomurinzi 2019; Choi et al. 2014; Lestantri et al. 2022; Niederhauser et al. 2022; Soltysova & Modrak 2020) and resource-constrained startups. However, despite the potential benefits, little is known about how startups can participate in the SE as resource users. Moreover, there remains a notable gap regarding the SE in industrial markets, especially studies that consider the shared use of complex technological products (Melander & Arvidsson 2021). This study seeks to address these shortcomings in the literature by investigating how the SE can facilitate startup access to resources for prototype development, testing and verification within industrial markets. Improved access to such resources through the SE can enhance startups' capacity for innovation, accelerate product development cycles, reduce time-to-market and increase their chances of survival and competitiveness in resource-intensive industrial markets.

Access to resources *via* the sharing economy

The SE offers firms an innovative way to gain access to, and extract value from, resources that they do not own. It represents a novel approach to economic thinking, emphasising the preference for sharing, borrowing and leasing resources instead of owning them (Mont et al. 2020; Soltysova & Modrak 2020). According to Acquier et al. (2019), the SE is centred around the idea of enabling shared use of both tangible resources, such as dormant or underutilised assets like machinery, as well as intangible resources such as skills and knowledge. The key principles of the SE derived from SE literature (e.g. Acquier, Daudigeos & Pinkse 2017; Baumber, Scerri & Schweinsberg 2019) include:

- facilitating shared access to resources (promoting access instead of ownership)
- exchange enabled by a facilitator (also referred to as a platform, intermediary, matchmaker or service enabler)
- a community-based dimension, rooted in the formation of new social connections (networks).

Although there are different SE models, the key principles typically remain the same. The literature identifies several SE models based on the type of supply and demand participants (Benoit et al. 2025; Rathnayake et al. 2024). Among these, the C2C and B2C models are still the most prevalent in both the literature and practice (Benoit et al. 2025; Chuah et al. 2021; Tetrevova & Kolmasova 2021; Tsvetkova 2020). However, in order to create new value for businesses, attempts are being made to implement the SE model in industrial sectors (Grondys 2019; Melander & Arvidsson 2021). The literature also commonly describes three core actors involved in SE exchanges: resource users, resource providers and SE facilitators (Benoit et al. 2017; Kumar, Lahiri & Dogan 2018). In a typical SE exchange,

an owner of a resource would share that resource with a user on a short-term basis, and this interaction would be enabled by a SE facilitator. These SE exchanges can be organised in different ways. As indicated in Figure 1, SE initiatives can either create value by providing access to a centralised resource pool (a centralised pool of resources such as machines or testing equipment) or by organising decentralised peer-to-peer[1] transactions (connecting peers through networks to coordinate the decentralised exchange of products and services).

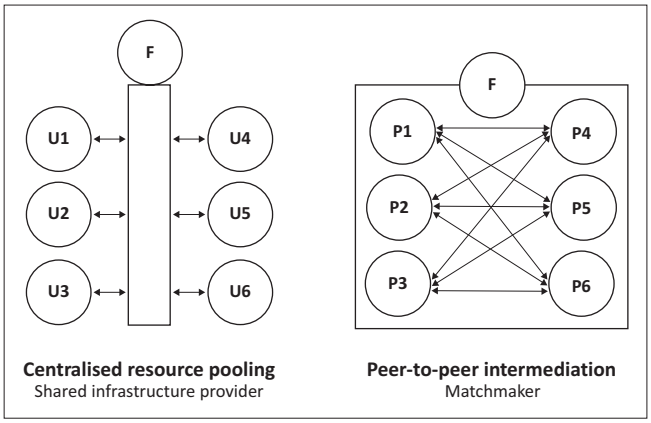
In both of the SE approaches presented in Figure 1, the SE facilitators enable resource users (whether individuals or, as emphasised in this study, businesses) to access and extract value from resources they do not own. Gaining access to resources in this way is expected to have several benefits for businesses, including lowering expenses, achieving greater flexibility and enabling more sustainable use of resources (Antikainen et al. 2018; Belhadi et al. 2023; Chuah et al. 2021; Grondys 2019; Hong et al. 2014; Niederhauser et al. 2022; Tetrevova & Kolmasova 2021). However, scholars caution that the SE may involve greater complexity and uncertainty, as it is often associated with higher levels of risk compared to traditional business models (Chuah et al. 2021). Moreover, several institutional barriers, such as regulatory challenges, a lack of interorganisational trust, and concerns regarding privacy and security, have been identified as obstacles to SE adoption (Chuah et al. 2021; Grondys 2019). These factors may hinder the implementation of SE in industrial contexts.

Research methods and design

Embedded multiple case study design

For this study, an explorative and qualitative methodology was chosen because of the lack of prior literature on the SE phenomenon focusing on startups as resource users, especially in contexts involving the shared use of complex technological products. An embedded multiple case study design (Yin 2018) was employed, as it is well-suited for capturing and describing the complexity of novel phenomena (Stake 1995; Yin 2018). The selection of an exploratory multiple case study design is further justified by the 'what and how' nature of this study's research questions (Yin 2018). Including multiple cases of the same phenomenon made it possible to compare similar and contrasting findings across cases (Ridder 2017). While a single case study focuses on one unit of analysis per case, an embedded case study incorporates several units of analysis (Yin 2018). The embedded case study approach made it possible to triangulate data from several stakeholder perspectives (Yin 2018). In this study, each case comprises three distinct subunits of analysis: the SE facilitators, the startups (resource users) and the partners (resource providers).

1.In the context of this study, the term 'peers' refers to organisations and businesses.



Source: Adapted from Acquier, A., Carbone, V. & Massé, D., 2019, 'How to create value(s) in the sharing economy: Business models, scalability, and sustainability', *Technology Innovation Management Review* 9(2), 5–24. https://doi.org/10.22215/timreview/1215

U, Resource user; P, Peer; F, Facilitator.

FIGURE 1: Sharing economy facilitation approaches.

Research context

Two cases were selected for this study, one in Norway and another in South Africa. The cases were purposefully selected based on replication logic (Yin 2018), using a dual criterion: (1) a core operational reliance on the SE principles and (2) a focus on enabling startups to access critical resources. In addition, the selection process prioritised the selection of cases that focused on the provision of highly specialised and costly prototyping and testing equipment. This criterion aimed to spotlight cases operating in industries with high entry barriers for startups. The selection of startups was guided by the definition provided by Kim et al. (2018), which emphasises the early-stage nature of these companies. Although these cases were selected because of their similarities, as outlined in the description of the research cases, they are located in different regional contexts and operate in different industries, making it possible to explore similar and contrasting results (Eisenhardt & Graebner 2007; Ridder 2017). A description of the two research cases, including a description of each of their respective subunits of analysis, is provided in Table 1.

Data collection

This research was conducted as part of the INTPART project, which aimed to foster cooperation between Norway and South Africa in the areas of research, higher education and innovation. A primary goal of the project was to facilitate comparative research between the two nations, and this study was conducted within that context. Purposeful sampling was used to select research participants in both Norway and South Africa. In-depth, semi-structured interviews were conducted with SE facilitators, resource users (startups), resource providers and key informants (regional ecosystem specialists) associated with the two empirical cases. Secondary data played a crucial role in guiding the data collection process by assisting in the identification of relevant research cases, providing contextual insights into the cases and supporting purposeful sampling (Yin 2018). Furthermore, sources such as industry

TABLE 1: Description of research cases.

The Norwegian case	The South African case
Industry and regional context	**Industry and regional context**
The Norwegian case is located in Bergen on the west coast of Norway. Norway is one of the world's leading ocean nations and the ocean industries, such as seafood, maritime, offshore energy and transportation, form an integral part of the country's economy. These industries, however, are asset-heavy and have high barriers to entry, making it challenging for startups without access to advanced testing facilities or costly equipment to break into these sectors.	The South African case is situated in Pretoria in the Gauteng province, one of the country's key hubs for high-tech industries, including the emerging photonics sector. Photonics, the technology of generating and manipulating light, drives innovations in defence, communications, energy and manufacturing. Despite its potential, South Africa has a limited presence in the global photonics market, largely because of the significant challenges startups face in accessing necessary infrastructure and facilities.
SE Facilitator NO	**SE Facilitator SA**
The Norwegian SE facilitator selected for this study (henceforth referred to as SE Facilitator NO) aims to support SMEs in navigating entry barriers to the ocean industries. A primary goal of the facilitator is to accelerate innovation and technology development by enabling SMEs and startups to access specialised infrastructure and competencies. They provide access to equipment and facilities for testing and verifying new technologies. They also offer access to expertise in design and prototyping to help businesses develop their innovations from concepts to market-ready products. Sharing economy Facilitator NO receives both public and industry funding to provide this support to startups and SMEs.	The South African SE Facilitator selected for this study (henceforth referred to as SE Facilitator SA) supports the development of photonics-based products by making specialised equipment and technical support available to startups. Sharing economy Facilitator SA seeks to bridge the gap between invention and commercialisation by providing access to specialised equipment and expert knowledge in optics and photonics. Their goal is to support the development of photonics-based products, particularly during the prototype development stage and assist startups in assessing market acceptance for their products. They receive both public and industry funding to provide this support to startups and SMEs.
Partners (resource providers)	**Partners (resource providers)**
SE Facilitator NO partners with a variety of resource providers to offer startups in the ocean industries access to leading expertise and infrastructure essential for prototyping, technology verification and launching innovative products. For instance, through its resource provider partners, SE Facilitator NO can offer access to a diverse range of prototyping and testing equipment, including wave tanks and aquaculture test facilities.	SE Facilitator SA partners with a range of stakeholders, including academic institutions, businesses and technology experts to support startups. By leveraging these partnerships, they can provide startups with access to specialised knowledge, technology and networks. These resources can be leveraged to help startups develop, prototype and test their innovations.
Startups (resource users)	**Startups (resource users)**
All of the Norwegian startups included in this study have received support from SE Facilitator NO and its partners during the development of their prototypes. Startups NOa and NOb are both developing innovative products for the land-based aquaculture industry, with NOa focusing on sustainable farming systems and NOb enhancing water purification and nutrient recycling. Meanwhile, Startup NOc provides digital services for the ocean industries to increase their ability to share data over organisational boundaries. Lastly, Startup NOd was developing a product aimed at facilitating the transportation of live fish from their source to market destinations.	All of the South African startups included in this study have received support from SE Facilitator SA and its partners during the development of their prototypes. South African Startup SAa was developing innovative hardware and software solutions for the additive manufacturing industry. While Startup SAb focused on enhancing South Africa's aerospace capabilities by developing a large-scale titanium printer. Startup SAc produces high-precision optical components and was developing a low-cost system for metric scanning. While Startup SAd was developing 3D printed microwave components for aerospace and defence applications.

SE, sharing economy; SA, South Africa; NO, Norway; SMEs, small and medium enterprises.

reports and company websites provided valuable background information that informed both the selection of interview participants and the design of the interview guide. The interview guide covered topics such as actor roles, types of shared resources and support provided, perceived benefits and challenges, specific examples of sharing practices, and the factors facilitating or hindering these practices. A total of 22 interviews were conducted: 13 in Norway and 9 in South Africa. The duration of the interviews ranged from 45 minutes to 120 minutes. An overview of the research participants and data that were collected is provided in Table 2.

Primary data from the interviews were supplemented with additional data gathered through field visits and observations at both the SE facilitator facilities and the facilities of their resource provider partners. Furthermore, the researcher participated in relevant industry events and meetings to gain further insights. Secondary data, comprising 35 digital documents (totalling 522 pages), were also included in the analysis. All interview recordings were transcribed, and the complete dataset, including transcripts, field notes and secondary materials was uploaded to MAXQDA 2022 for analysis.

To ensure data quality, the study adhered to Lincoln's (1995) criteria for trustworthiness in qualitative research. Credibility was addressed through the purposeful selection of cases and participants. Transferability was supported by providing rich contextual detail of the cases. Dependability was maintained by systematically documenting the research process, and confirmability was achieved through triangulation of multiple data sources.

TABLE 2: Data collection overview.

Data type	Norway (NO)	South Africa (SA)
Interviews	SE Facilitator NO	SE Facilitator SA
	Partner NOa	Partner SAa
	Partner NOb	Partner SAb
	Partner NOc	Startup SAa
	Partner NOd	Startup SAb
	Startup NOa	Startup SAc
	Startup NOb	Startup SAd
	Startup NOc	Key Informant SAa
	Startup NOd	Key Informant SAb
	Key Informant NO	-
Documents	Websites, news articles, industry reports and presentations	Websites, news articles, industry reports and presentations
Observations	Time spent observing operations at SE Facilitator NO's and Partner NOa's premises, in Norway. As well as attending industry events associated with the case	Time spent observing operations at SE Facilitator SA's premises in Gauteng, South Africa, as well as at the premises of Startup SAa, Partner SAa and Partner SAb

SE, sharing economy; SA, South Africa; NO, Norway.

Data analysis

Thematic analysis, a widely recognised method for qualitative data analysis, offers a flexible yet structured approach to identifying, analysing and interpreting patterns of meaning within datasets (Braun & Clarke 2006). In this study, the six-step process outlined by Braun and Clarke (2006) provided a systematic framework for guiding the thematic analysis. To enhance the analysis of the two cases, the cross-case analysis technique suggested by Eisenhardt (1989) was also employed. This process involved conducting a within-case analysis in the first step, followed by a cross-case analysis in the second step. The secondary data, including industry reports, company websites, presentations and news articles, were coded and analysed alongside the primary data, such as interview transcripts and field notes from observations. Emerging

themes were continuously compared across cases and data types, enabling a dynamic exploration of patterns and insights. This multi-source strategy, as recommended by Yin (2018), strengthened the validity and depth of the research findings. In line with the abductive approach to case study research and systematic combining (Dubois & Gadde 2002), data collection and analysis were iterative, allowing for a continuous dialogue between empirical observations and theoretical frameworks. In particular, the theoretical framework derived from the existing literature on the SE (Acquier et al. 2017; Choi et al. 2014; Grondys 2019; Kumar et al. 2018) and entrepreneurship literature (Barney 1991; Freeman et al. 1983; Hite & Hesterly 2001; Tornikoski 2009; Tornikoski & Newbert 2007) played a key role in guiding this process.

The empirical findings are organised into five key themes that emerged through the iterative abductive analysis: (1) the role of SE facilitators in enabling shared access to resources, (2) leveraging partnerships to enhance resource provision, (3) the importance of sharing knowledge and experience, (4) the significance of hands-on engagement and (5) barriers to resource sharing. These themes reflect recurring patterns identified across the two cases. Each theme is supported by illustrative quotes, providing examples of the rich source material that validates the research findings. Consistent with the replication logic of the multiple case study approach adopted in this research (Yin 2018), the research findings are presented thematically, emphasising the similarities and differences between the two cases within each theme.

Ethical considerations

Ethical clearance to conduct this study was obtained from the Norwegian Centre for Research Data (No. 288553).

Research findings

The sharing economy facilitators – Enabling shared access to resources

This study focuses on two SE facilitators, one in Norway and another in South Africa (SE Facilitator NO and SE Facilitator SA), both of which aim to accelerate innovation and technology development in their respective industries and regions by supporting startups during the prototype development, testing and verification process. To achieve this, both SE Facilitator NO and SE Facilitator SA enable startups to gain access to specialised infrastructure, equipment and expertise to conduct prototype development and testing. This is exemplified by the following quotes:

> 'The gap sits at the proof-of-concept stage. There aren't really instruments to help people at the early proof-of-concept stage. … so that is why we focus on product development and prototyping.' (SE Facilitator SA)

> '… the whole idea here is that … the big companies can build up their own testing capacity and their own infrastructure for testing and prototyping, but they [*the startups*] cannot. They cannot afford to invest in their own infrastructure for testing and prototyping. … the centre then joins forces with industry to make these test facilities available to SMEs.' (SE Facilitator NO)

Sharing economy Facilitator SA has invested in and enables startups access to a central pool of resources, including photonics infrastructure and tools, optical and workshop facilities, diagnostic equipment and other specialised components:

> 'There is a lot of high-value equipment that can be accessed. We've got a couple of labs downstairs with class 1000 clean rooms, there is all sorts of advanced equipment. We also provide access to engineers, scientists and technicians.' (SE Facilitator SA)

> 'When they came to us, they were just starting up, so they didn't have access to a higher-power laser. … they needed access to the clean rooms and some of the equipment, and then our technical support.' (SE Facilitator SA)

Sharing economy Facilitator NO, alternatively, is referred to as a centre for resource sharing of equipment and expertise. Its goal is to function similarly to an Airbnb for the ocean industries, enabling companies to offer their equipment and facilities for short-term use. Sharing economy Facilitator NO enables startups to access a diverse range of prototyping and testing equipment relevant to the ocean industries. This includes wave tanks, recirculating aquaculture systems (RAS), hyperbaric pressure testing facilities, as well as specialised industry and technical expertise.

Resource partners – Leveraging partnerships for enhanced resource provision

Both SE Facilitator NO and SE Facilitator SA leverage their networks to provide startups with access to a broader range of tangible and intangible resources. This includes specialised testing equipment, industry knowledge and even access to pilot customers. For instance, illustrated by the following quote, Facilitator NO is committed to identifying regional infrastructure and expertise that can enhance its service offerings by expanding its network of resource provider partners:

> 'We will start a project to map what infrastructure is available in [*the region*] that is empty most of the time because there are many who run test infrastructure for their use, both by industry partners but also research institutes, for example. We aim to both identify where these are and make them available.' (SE Facilitator NO)

> '… if they need to make a prototype … often the entrepreneur or the company lacks the capacity to do this themselves. Then we try to find [*someone*] in our network we think might be a good fit for this and connect them.' (SE Facilitator NO)

In Norway, SE Facilitator NO can leverage a range of laboratories and test facilities through partnerships with resource providers, including additive manufacturing equipment, aquaculture facilities, RAS and wave tanks. As exemplified by the following quotes from their resource provider partners:

> 'We supply the RAS infrastructure. We also carry out the science. Under the terms of the contract, we are required to allocate 25% of our facility for use by SMEs.' (Partner NOa)

> 'We contribute with general technology and development expertise, and the network we have around us in production and testing.' (Partner NOb)

Similarly, in South Africa, SE Facilitator SA enables the startups to have access to their industry, business and funding networks if they require business development or incubation support. In addition, access to co-working spaces and competence is also leveraged from a network of resource provider partners:

> 'Within this model, we have a network of people that can actually support us in terms of product development. We can cover most aspects of the additive manufacturing value chain and collaborate with partners if we need to fill any gaps.' (SE Facilitator SA)

> 'Because we know specialists in different areas, and if someone comes to us, we are able to connect them through our network based on their specific needs.' (SE Facilitator SA)

Tapping into the network of resource providers enables both SE Facilitator NO and SE Facilitator SA to offer startups access to a broader range of resources. This extends beyond tangible resources to encompass intangible resources such as industry knowledge, social capital and connections to potential partners and customers.

Knowledge and experience sharing – Sharing expertise provides great value

The findings from both cases reveal how the sharing of intangible resources, such as technical and industry knowledge, is essential to facilitate the sharing of tangible resources, for example specialised testing equipment. As emphasised by Partner NOa, 'you can't provide shared access to specialised equipment without providing the appropriate guidance and support'. According to Partner NOa, this is partly because specialised equipment often requires the expertise of trained personnel for operation. Moreover, equipment use is generally highly customised to individual users and tasks, often requiring adaptations before use. As exemplified by the following quotes from both the South African and Norwegian cases, startups often lack technical expertise, which makes hands-on technical support particularly important when supporting them during the prototype development and testing process:

> 'We find a lot of our customers really don't know anything about the RAS technology. [*They*] have no idea about running RAS systems. So, they need our expertise to help in that process.' (Partner NOa)

> 'It's working, but I'm uncertain about the exact reasons why. So [*SE Facilitator NO*] connected us to [*Partner NOa*], who had the technical expertise to conduct the scientific part and run the necessary tests to answer our questions. They are the verification part of it. And the scientists who can say, scientifically, this is what needs to be done. I use them for their knowledge and know-how.' (Startup NOd)

> 'We had zero experience with optical systems, and there were special developments needed to make the optical system work for us. So, we approached [*SE Facilitator SA*] because of their optical expertise. They are the leaders in South Africa for those types of systems.' (Startup SAb)

In addition to technical assistance, the sharing of industry and market knowledge was also found to play a crucial role in supporting startups during the prototyping and testing process. The SE facilitators in both cases have access to industry and market experts, both internally and through their network of resource providers, who can help the startups enhance the design, quality and market relevance of the prototypes. As highlighted by the following quotes:

> 'We also make available the type of expertise that you need, … It covers everything from concept development and industrial design. … Our partner is good at design and industrial design. They don't have any physical infrastructure, but they are still a very important support system.' (SE Facilitator NO)

> 'We also share our knowledge and skills. Often, we encounter competent business people eager to develop their businesses, but they don't have a technical background, so that is where we come in. We can share that knowledge with them.' (Partner SAa)

> 'There is, of course, a large range of expertise that you would need to realise the idea, but if the startup itself is to have all that expertise in-house, it is often impossible. I think it's much better to use people and an environment who are competent and have experience in that, which makes it far more efficient and more correct.' (Partner NOb)

The startups from both Norway and South Africa emphasised the importance of the technical and industry knowledge they received from the facilitators and resource provider partners. For instance, Startup NOa was able to use both the expertise from Partner NOa and the design knowledge from Partner NOb. Incorporating this knowledge during the prototyping processes enabled Startup NOa to adapt its prototype to better ensure industry and market fit. The importance of such support is additionally highlighted by the following quote from Startup SAa: 'That was a major advantage of working with [*SE Facilitator SA*] […], we are connected with highly skilled professionals. So, we have access to the knowledge and skills that we need'.

The human factor – The importance of hands-on engagement with the startups

Both the South African and Norwegian SE facilitators, along with their resource partners, emphasise the importance of direct, hands-on engagement with the startups. In both cases, the engagement with the startups commences with a comprehensive needs assessment to identify their unique needs so that they can be effectively matched with the appropriate resources and support:

> 'We spend quite a lot of time rigging the project in the beginning. Understanding the company and their needs. Based on their needs, we help define the service they actually require from our partners, whether it's industrial design, a physical prototype, or whether it's a test or verification case. That service is important to our customers.' (SE Facilitator NO)

> 'It's about understanding what they really need – not just what they say they want – so, we can determine if we can actually help them.' (SE Facilitator SA)

In both cases, the SE facilitators and resource partners have observed that startups are committed to the development of

their ideas and want to be closely involved in the development and testing processes:

> 'Generally, the small companies and the startups really want to be engaged in what's going on.' (Partner NOb)

> 'And it's all relationship based …. The better the relationship is, the better the collaboration will be. If you want to have an arm's length type of interaction, it doesn't work like that with SMEs. It requires a much more relational type of engagement. It needs to be hands-on.' (Partner SAa)

Although the startups are eager to be deeply engaged in their projects, they sometimes lack a thorough understanding of the technical aspects of the technology or processes they are working with. This gap in technical knowledge can make it challenging to guide them effectively and to provide the appropriate support they need to steer their projects in the right direction. This challenge is highlighted by the following quotes from both cases:

> 'Often you get startups come in bringing something and say, can you analyse this? Just do some tests. So, we very often have to work closely with the companies to try to help them get the answers to the questions they want to know. And that's a very big part of the job, trying to actually find out what it is that they need.' (Partner NOa)

> 'Some of the startups are working with technology that they don't fully understand. And they don't understand the industry. In which case, we have to be more involved.' (Partner NOa)

> 'They often come in with a concept but not a full understanding of what it takes to actually implement it from a technical standpoint.' (SE Facilitator SA)

> 'We find that many of them have not thought through the technical constraints. They know what they want the outcome to be, but not how to get there.' (Partner SAa)

The SE facilitators and resource partners work closely with startups, often extending their support beyond contractual obligations. While this can be demanding and carries certain risks, they highlight that it is more inspiring and rewarding to work on such projects. As illustrated by the quotes from Partner NOb and Partner SAa:

> 'We want to go beyond just doing the work to get paid, so we are certainly interested in what we work with. We invest more resources, so there is a somewhat higher risk and it's more demanding, but it's more inspiring and rewarding with such projects.' (Partner NOb)

> 'On paper, we provide the technical support. But then in reality, it's really about the other stuff. It's not a formal thing. That's just part of what I do to help the startups.' (Partner SAa)

Improved access to resources – Yet barriers persist

Although the findings demonstrate how the SE facilitators in both South Africa and Norway support startups in accessing tangible and intangible resources for prototype development and verification, it was also discovered that several barriers may persist. For instance, the cost of gaining access to the equipment and facilities may still be a barrier for startups with limited financial resources. As illustrated by the following quote:

> … 'We had a lot of interaction with [*the resource provider*] at the start, but it was too expensive for us. Even with [*financial assistance from SE Facilitator NO*], it was still [*too high a price*] for half a year. For that price, we would rather build our own lab instead.' (Startup NOb)

In the case presented above, the startup built its own equipment to avoid paying the fees associated with accessing the testing equipment *via* the resource provider. This cost-related challenge was echoed by Partner NOa and Partner NOc, as well as by SE Facilitator SA and Partner SAa. Thus, pricing appears to be an important factor for startups in both Norway and South Africa when assessing the feasibility of using such services. Alongside pricing concerns, trust also emerged as an important theme and one of the most notable differences between the two cases. Sharing economy Facilitator NO acknowledges that they benefit from being embedded within an existing ecosystem with a history of sharing and a strong foundation of inter-organisational trust. In contrast, Key Informant SA highlights that the South African context lacks such a history of inter-organisational trust and that a culture of secrecy permeates among companies in South Africa. Notably, perceived risks, particularly regarding intellectual property rights, emerged as a concern in the South African context. According to the ecosystem informant from South Africa:

> '… when it comes to forming relationships and building trust, you have to be a lot more intentional about it.' (Ecosystem Informant SA)

> 'I think that they will trust each other if there is a formal agreement. So, then they will say, okay, because there's a formal agreement, then we'll share with you. So, they will trust.' (Ecosystem Informant SA)

Ecosystem Informant SA noted that the business culture in South Africa is characterised by a tendency towards secrecy governed by formal contracts and arrangements. The prevailing sentiment is that without the proper documentation, companies find it challenging to share information about their projects, hindering the potential for collaboration. For example, SE Facilitator SA highlighted a case where a startup had concerns regarding intellectual property and ultimately decided not to proceed with the project:

> '… they were too risk averse, and they walked away from it. So that's the other thing that you have to think about is the psyche of this startup or SME.' (SE Facilitator SA)

The SE facilitators are responsible for managing negotiations and contractual agreements with both resource users and providers. SE Facilitator NO and SE Facilitator SA both employ formal contracts, including non-disclosure agreements, to lower risks and safeguard the startups' intellectual property, as indicated by the following quotes:

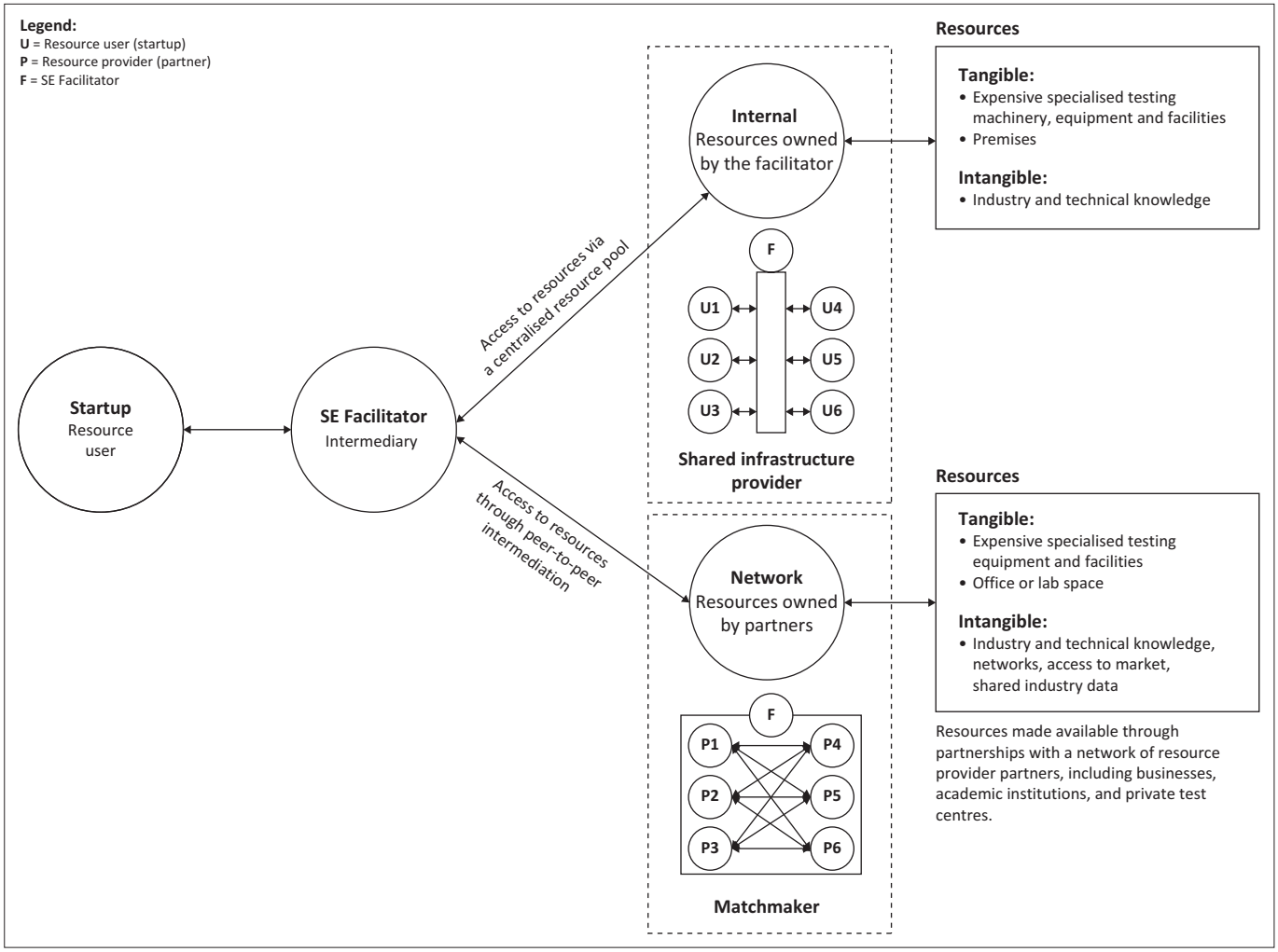
'We're trying to make it as accessible as possible to reduce the barriers to entry for SMEs as much as possible and to structure our agreements so that the risk for the SME is as low as possible.' (SE Facilitator SA)

'If there is something that should be kept secret, as it is a new patent case, we always write an NDA, and so do the partners.' (SE Facilitator NO)

Discussion

This study aimed to explore how the SE principles can be applied to help resource-constrained startups gain access to resources for prototype development, testing and verification. The research findings demonstrate how the cases in South Africa and Norway implement the SE principles to facilitate startups' access to both tangible resources (e.g. prototyping and testing equipment, as well as premises such as laboratories and workshop space) and intangible resources (e.g. technical and market knowledge, networks, industry data and pilot customers). The resources in each case are closely aligned with the needs of their respective industries – for instance, the Norwegian case supports ocean industry startups to gain access to wave tanks, aquaculture test sites, prototyping laboratories and maritime expertise. In contrast, the South African case enables photonics startups to access specialised optical equipment, cleanroom facilities, laser systems and expert knowledge in photonics. The research findings further highlight the significance of sharing intangible resources, including technical and industry knowledge, as well as access to networks and pilot customers, all of which were found to be crucial in supporting the startups during the stages of prototype development, testing and verification.

By providing shared access to a broad range of tangible and intangible resources, the cases investigated in this study align with the key principles of the SE, where resources are accessed rather than owned, exchanges are enabled by a facilitator (intermediary), and the facilitators actively engage in the development of new social connections between resource users and resource providers (e.g. Acquier et al. 2017; Baumber et al. 2019). Drawing on the perspectives presented by Acquier et al. (2019) and the empirical findings of this study, Figure 2 illustrates how the SE facilitators in both Norway and South Africa enable shared access to resources for startups *via* centralised resource pools and peer-to-peer intermediation.



Source: Original contribution based on the study's empirical findings and incorporating insights from Acquier, A., Carbone, V. & Massé, D., 2019, 'How to create value(s) in the sharing economy: Business models, scalability, and sustainability', *Technology Innovation Management Review* 9(2), 5–24. https://doi.org/10.22215/timreview/1215

SE, sharing economy; U, resource user (startup); P, resource partner; F, sharing economy facilitator.

FIGURE 2: Research model.

As illustrated in Figure 2, the SE facilitators leverage centralised resource pools and peer-to-peer intermediation to enable the startups to access a range of tangible and intangible resources. The centralised approach enabled the facilitators to strategically invest in resources for their centralised resource pool. Investing in resources wherein facilitators have ownership offers the advantage of easier management and control (Acquier et al. 2019). Moreover, this approach enables the facilitators to invest in resources that fill regional or industry resource gaps. Strategic investments can also be leveraged to catalyse development in targeted areas of interest. However, this approach also has inherent financial and spatial constraints. In contrast, the decentralised (network) approach involves the utilisation of existing resources accessed *via* a network of resource providers. While this approach holds the potential for enhanced scalability, sustainability and social benefits (Acquier et al. 2019), the coordination and management of the network may grow increasingly complex as it expands. However, as demonstrated in both the Norwegian and South African cases in this study, these two forms of value creation can coexist and, when combined, may form a blended model. This observation from the two empirical cases aligns with the description provided by Acquier et al. (2019). A blended model, as presented in Figure 2, enables the facilitators to leverage a centralised pool of resources as well as resources from a network of resource-provider partners. This hybrid approach enables the SE facilitators to expand their resource offerings and more effectively align with the needs of both startups and the industry in which they operate.

This study focuses on resource-constrained startups as resource users in the SE. The findings reveal how the SE facilitators in both Norway and South Africa help startups gain access to resources to expedite the development of prototypes, testing and verification, reducing time-to-market. These findings align with previous research that has also highlighted how the SE can be particularly beneficial for SMEs (Choi et al. 2014; Grondys 2019; Soltysova & Modrak 2020). In addition, the findings from this study demonstrate how the SE facilitators and resource partners act as reputation partners, conferring legitimacy to the startups. Creating an image of attractiveness, credibility or legitimacy is vital, as legitimate organisations are seen as more meaningful, predictable and trustworthy (Lechner, Dowling & Welpe 2006; Tornikoski 2009; Tornikoski & Newbert 2007). The SE facilitators play a key role in connecting startups to networks, providing access to a shared network of trust and social capital, especially valuable for startups that lack experience and legitimacy (Hite & Hesterly 2001; Jones et al. 2014; Tornikoski & Newbert 2007). The startups were able to leverage the reputations and established networks of the SE facilitators and resource partners to access resources and pilot customers, enabling them to validate their products in real-world scenarios. This can help the startups to gain visibility, legitimacy and credibility in the market.

Despite these potential benefits, the research findings also highlighted several potential barriers and challenges. Identified factors, including potential risks and trust issues, align with several previous studies (e.g. Chuah et al. 2021; Grondys 2019; Kumar et al. 2018; Soltysova & Modrak 2020). A lack of interorganisational trust, in particular, emerged as a key challenge and one of the most significant differences between the two cases, with perceived risks related to intellectual property rights being identified as a notable concern in the South African context. Prior research, along with the findings of this study, have highlighted the central role of the facilitators in managing processes such as matching resource supply and demand, handling formal agreements and contracts, and building trust (Benoit et al. 2017; Kumar et al. 2018; Melander & Arvidsson 2021; Puschmann & Alt 2016). However, while previous studies have primarily focused on the consumer-based SE models, this study provides insight into the role of the SE facilitator within the business-sharing context. This research underscores the importance of hands-on engagement with startups, supporting Melander and Arvidsson's (2021) assertion that specialised equipment typically requires trained personnel for operation and needs to be tailored to individual users and tasks, often necessitating adaptations before use. Thus, it is evident that resource access on its own is insufficient in this context. Facilitators must play an active role in engaging with both resource users and resource providers to build relationships, mitigate risks and support the startups by matching them with relevant resources for prototype development, testing and verification.

Conclusion

Contribution

This study contributes to the expanding body of literature on the SE, particularly in the context where businesses participate in the SE as resource users (Antikainen et al. 2018; Chuah et al. 2021; Grondys 2019; Melander & Arvidsson 2021; Soltysova & Modrak 2020; Tetrevova & Kolmasova 2021; Tsvetkova 2020). Within this growing field of research, there remains a notable gap regarding the SE within industrial markets, especially studies that consider the shared use of complex technological products (Melander & Arvidsson 2021). The findings of this study help address this research gap by specifically examining the shared use of specialised equipment and facilities within the capital-intensive photonics and ocean industries. Furthermore, this study adds to the SE literature by demonstrating how the two cases included in this study apply the SE value-creation mechanisms described by Acquier et al. (2019). This research also provides insight into the role of the SE facilitators in the context where businesses participate in the SE as resource users, which builds on the prior literature conducted in the consumer SE context (Benoit et al. 2017; Kumar et al. 2018; Melander & Arvidsson 2021; Puschmann & Alt 2016). Finally, this study contributes to the entrepreneurship literature by investigating how the SE principles can

be applied to facilitate startups' access to resources for prototype development, testing and verification. Specifically, the research findings demonstrate how, through the application of SE principles, the SE facilitators can assist the startups in gaining legitimacy and overcoming resource constraints by enabling them to gain access to external resources and networks, a topic of interest in entrepreneurship literature (Jones et al. 2014; Mlotshwa & Msimango-Galawe 2020; Tornikoski 2009; Tornikoski & Newbert 2007).

The research findings also offer practical insights for resource-constrained startups, SE facilitators and policymakers. This research highlights the tangible benefits of the SE for startups, illustrating its potential to enable access to resources that would otherwise be inaccessible. This can enable startups to avoid substantial capital investments in equipment and facilities during the prototype development and testing phase, allowing for faster, better and less risky idea development, and ultimately accelerating the process from idea to market. The research findings also provide specific insight for SE facilitators, particularly regarding the mechanisms that they can use to implement the SE principles. This research highlights the central role that the SE facilitators play in managing processes such as matchmaking, contracting and relationship management. In addition, the significance of hands-on engagement with startups is emphasised, as intangible resources (e.g. technical and industry knowledge) are shown to be necessary to facilitate the sharing of tangible resources (e.g. specialised equipment). In recent years, the SE has also attracted growing interest from policymakers because of its expected economic and sustainability benefits for businesses, as well as its potential to assist resource-constrained startups in gaining access to resources. To unlock this potential, policymakers should consider fostering the SE in industrial contexts through clear regulatory frameworks, targeted financial incentives and the integration of SE principles into startup support programmes.

Limitations

Despite these valuable contributions, this research is not without its limitations. For instance, this study is limited to two empirical cases, and it is expected that the findings may differ in other regional and industry contexts. Thus, it is recommended that future studies be conducted in different contexts. Overall, the SE remains an underexplored phenomenon that requires further investigation, and this is especially true in contexts where startups participate in the SE as resource users. This is just one attempt to address this gap in the literature, underscoring the need for additional studies to further investigate the subject.

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Data availability

The data that support the findings of this study are available on reasonable request from the corresponding author, K.W.I. The data are not publicly available as they contain information that could compromise the privacy of research participants.

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