Nayeem Rahman

Energy flexibility as a market shaping mechanism

A case study of the Finnish electricity ecosystem

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Tiivistelmä

Tämä väitöskirja tutkii, miten erilaiset toimijat muokkaavat Suomen sähkömarkkinoita energiajouston kautta. Energiajousto tarkoittaa loppukäyttäjien kykyä mukauttaa sähkönkulutustaan markkinasignaalien, verkon kuormitustilanteen tai kestävyystavoitteiden mukaan. Se on keskeinen uusiutuvan energian integroinnin mahdollistaja. Energiajousto on perinteisesti nähty sähköverkon suunnittelun operatiivisena osana, mutta sen käsittely kaupallisena markkinainstrumenttina — erityisesti tuottajakuluttajien osallistumisen kautta — on uudempi kehityssuunta. Näin väitöskirja sijoittuu teknologisen murroksen, sääntelymuutosten ja kuluttajien vaikutusmahdollisuuksien risteyskohtaan.

Tutkimus tarkastelee markkinamuutoksen mekanismeja ja dynamiikkaa kolmen teoreettisen näkökulman — liiketoimintamallien innovoinnin, alustojen hallinnan ja arvon yhteisluonnin — kautta. Kvalitatiiviseen ja abduktiiviseen otteeseen perustuva työ sisältää yhden monitapaustutkimuksen ja kaksi yksittäistapaustutkimusta. Niissä analysoidaan, miten sähkön vähittäismyyjät hyödyntävät liiketoimintamallien innovointia institutionaalisen logiikan soveltamisessa ja muokkaamisessa mikroperustaisen osaamisen avulla. Tutkimus tarkastelee myös digitaalisten alustojen roolia kollektiivisen koordinaation välineinä kehittyvillä joustomarkkinoilla sekä sitä, miten eri toimijat yhdistävät heterogeenisia resursseja yhteisarvon luomiseksi ja uusien markkinarakenteiden institutionalisoimiseksi.

Väitöskirja käsitteellistää markkinoiden muokkauksen moniulotteisena prosessina, jossa on useita toimijoita, tasoja ja aikajänteitä ja jota muovaavat sekä tavoitteelliset strategiat että lisääntyvä vuorovaikutus. Teoreettisesti se syventää ymmärrystä institutionaalisen muutoksen rekursiivisesta kerrostumisesta, tavoitteellisuuden roolista markkinoiden muokkauksessa ja resurssien orkestroinnin performatiivisesta vaikutuksesta yritys-, alusta- ja ekosysteemitasoilla. Käytännön tasolla tutkimus tarjoaa näkemyksiä siitä, miten yritykset, viranomaiset ja teknologiatoimijat voivat suunnitella ja sovittaa yhteen markkinoiden muokkaamisen strategioita liiketoimintamallien kokeiluista ja osallistavan hallinnan suunnittelusta tuottajakuluttajien osallistamiseen ja digitaalisen infrastruktuurin kehittämiseen. Tulokset ovat erityisen merkityksellisiä säännellyille, infrastruktuuri-intensiivisille aloille, jotka pyrkivät siirtymään järjestelmätasolla kohti kestävyyttä ja hajauttamista.

Asiasanat: markkinoiden muokkaus, markkinamuutos, liiketoimintamallien innovointi, alustojen hallinta, arvon yhteisluonti, energiajousto, kuluttajatuottajat, sähkömarkkinat, energiansiirtymä

Abstract

This dissertation explores how diverse actors contribute to market shaping within the Finnish electricity ecosystem through energy flexibility: the capacity of end-users to adjust electricity consumption in response to market signals, grid conditions or sustainability goals. While flexibility has long been treated as an operational element of grid management, its emergence as a tradable market instrument, particularly through prosumer participation, represents a more recent and transformative development. This shift places energy flexibility at the intersection of technological disruption, regulatory reform, and consumer empowerment.

To examine this transformation, the study employs three interrelated theoretical lenses: business model innovation (BMI), platform governance, and value co-creation. These perspectives respectively examine how focal firms reconfigure value creation logics, how platforms orchestrate multi-actor coordination, and how distributed actors integrate resources to establish new practices and institutions. The research employs a qualitative, abductive case study design, comprising one multiple-case of electricity retailers and two single-case studies focusing on platform governance and prosumer participation, respectively. This design enables analysis across different levels of the ecosystem while capturing both strategic intent and emergent dynamics.

The dissertation conceptualises market shaping as a multi-actor, multi-level and multi-temporal process shaped by both deliberate strategies and emergent interactions. Theoretically, it contributes by clarifying how BMI, platforms, and value co-creation function not in isolation but as mutually reinforcing mechanisms that together explain how markets are destabilised, reconfigured, and stabilised over time. Practically, it provides insights into how managers, regulators and technology developers can design and align market-shaping strategies ranging from BMI experimentation and inclusive governance design to prosumer engagement and digital infrastructure development. The findings are particularly relevant for regulated, infrastructure-intensive sectors undergoing system-level transitions toward sustainability and decentralisation.

Keywords: market shaping, market transformation, business model innovation, platform governance, value co-creation, energy flexibility, prosumers, electricity markets, energy transition

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This long journey is finally coming to an end.

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Abbreviations

BMI	Business Model Innovation
COVID-19	Coronavirus disease 2019
Datahub	Centralized platform for electricity market data exchange in Finland
DSM	Demand-Side Management
DSO	Distribution System Operator
EU	European Union
ICT	Information and Communication Technology
IEA	International Energy Agency
LFM	Local Flexibility Market
SDL	Service-Dominant Logic
TSO	Transmission System Operator

Publications

[I] Rabetino, R., Kohtamäki, M., Foss, N. J., Rahman, N., Huikkola, T. (2025) Microfoundations for Business Model Innovation: Exploring the Interplay Between Individuals, Practices, and Organizational Design. Journal of Product Innovation Management, https://doi.org/10.1111/jpim.12784. CC BY.

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1 INTRODUCTION

1.1 Markets as dynamic social constructs

Despite being a foundational concept of marketing, the idea of the market has often been taken for granted. Traditionally viewed through a neoclassical lens as an arena for exchange between buyers and sellers (Buzzell, 1999; Stigler & Sherwin, 1985), markets were long treated as fixed, objective realities (e.g., Sprong et al., 2021). However, a paradigmatic shift in recent years means markets are increasingly understood as dynamic, socially constructed systems rather than static constructs (Mele et al., 2015). This ontological movement from a positivist to an interpretivist worldview stresses the role of actors, institutions, and ongoing interactions in shaping market configurations (Pels et al., 2023). In this emergent view, the term market is seen not only as a noun—a stable structure— but also as a verb—a process constantly enacted and reconfigured through practice (Mele et al., 2015). Accordingly, scholars now describe markets as "self-adjusting systems of resource-integrating actors" embedded in institutional frameworks (Kindström et al., 2023) or as value-creating ecosystems where stability emerges through routinization and social construction (Nenonen & Storbacka, 2021). In line with this perspective, this dissertation approaches markets as ecosystems—*arenas of interdependent actors, practices, and institutions*—and employs the concept primarily as an empirical lens to capture these dynamics, rather than a distinct theoretical construct.

Nevertheless, despite the richness of this evolving discourse, the conceptual foundations of the market remain surprisingly ambiguous. Notably, the American Marketing Association's dictionary altogether omits a definition of markets (Möller et al., 2020). This ambiguity underlines the need for more holistic and flexible conceptualizations that reflect both the complexity and malleability of contemporary markets. A key aspect of this challenge lies in understanding how actor-driven transformations contribute to the ongoing shaping and reshaping of market structures. This dissertation explores this gap by examining how diverse stakeholders influence and redefine markets. It does so in the empirical context of the Finnish electricity market.

1.2 The electricity market in transition

The transformation of the electricity sector reveals a long history of technological shifts and strategic redirection. From the iconic *war of the currents* between Nikola

Tesla's alternating current system and Thomas Edison's direct current system in the late 1800s to milestones such as the development of the first gas turbine and the commissioning of the first commercial nuclear reactor in the mid-twentieth century, innovation has repeatedly reshaped the sector's trajectory (Patel, 2017). Concurrently, these shifts have also influenced and been influenced by regulatory frameworks and market structures (Rhodes, 2018). More recently, anthropogenic climate change has pushed renewable energy sources into prominence (Nijhof et al., 2022), while transient crises, such as the recent restriction of Russian gas supplies to Europe, have added further urgency to energy market reform (Nenonen & Storbacka, 2021).

One such structural transformation was the liberalization of the European electricity sector in the 1990s, which dismantled state-run monopolies, allowing consumers to choose between suppliers and contract types (Glachant, 2003). Today, consumers across liberalized markets can select between fixed or spot pricing, renewable or hydrocarbon-based sources, and increasingly have the opportunity to act as prosumers by generating some or all of the energy they use (Parag & Sovacool, 2016). As the market evolves, the roles of energy suppliers, grid operators, regulators, and consumers have transformed substantially (Smallbone, 2004). Traditional utilities—such as electricity sellers and distributors—are adapting their business models, while non-endogenous technology companies and novel service providers are entering the sector, contributing to increased competition and innovation (Hall et al., 2021; IEA, 2020). Regulators, in turn, are introducing policies emphasizing renewable energy integration, energy efficiency, and greater consumer participation via demand-side management initiatives (e.g., EU Directive 2019/944). However, these changes also pose significant challenges to the stability and coordination of the electricity grid, requiring fresh approaches to manage distributed and variable resources. The role of the consumer is evolving, too, with individuals becoming prosumers through technologies such as solar photovoltaics and electric vehicles, with mounting consequences for the traditional value chains (Ruostetsaari, 2020).

While the shifts in this market are manifold and complex, two particularly powerful trends are driving the ongoing restructuring of electricity markets: electrification and digitalization. Electrification, seen as a key pathway to decarbonization, is accelerating demand for low-carbon energy solutions (IEA, 2020). Concurrently, digitalization, seen in technologies such as smart meters, smart energy appliances, and mobile applications, enhances consumer engagement and enables new business models like peer-to-peer energy trading (Bahga & Madisetti, 2016; Mengelkamp et al., 2018). Moreover, sustainability instruments such as carbon credits incentivize both firms and consumers to reduce emissions, reshaping market logics, regulatory frameworks, and value creation processes in alignment with environmental

objectives (Tantau et al., 2021). This evolving landscape demands adaptive mechanisms to maintain system resilience, flexibility, and efficiency. One such mechanism, *energy flexibility*, has emerged as a critical enabler of a more responsive and consumer-driven electricity market, further encapsulating the technological, regulatory, and structural shifts reshaping the sector. The following section explores this concept in greater detail, particularly within the Finnish context.

1.3 Energy flexibility and the Finnish electricity market

Energy flexibility has attracted attention as a key mechanism to ensure grid stability and market responsiveness, which refers to the ability of an energy system to adjust consumption and production dynamically in answer to external signals such as price fluctuations, grid requirements, or carbon intensity (EURELECTRIC, 2014). Traditionally associated with industrial-scale operations (Gough et al., 2020), recent technological and regulatory shifts have expanded energy flexibility to households and businesses through demand-side management (DSM) initiatives (Sajjad et al., 2016). Such DSM programmes offer consumers economic or environmental incentives to modify their energy use patterns, aligning consumption with the availability of energy (Behrangrad, 2015). The shift is especially crucial in markets integrating variable renewable energy sources, like wind and solar, which introduce volatility in supply. Innovations in distributed energy resources, including rooftop solar, smart appliances, and electric vehicles, further enable flexible consumption and electricity storage, benefiting both end users and the grid (Giarmanà, 2023). Beyond technical optimization, energy flexibility contributes to the decentralization and democratization of energy systems. Consumers are leaving behind their passive roles and embracing active market participation, through peer-to-peer trading, local energy communities, or simply by responding to dynamic price signals (Ruostetsaari, 2020). Recognizing its potential, EU policy initiatives such as the *Clean Energy for All Europeans Package* increasingly promote consumer involvement in flexibility markets, viewing it as a lever for sustainability and efficiency (Tantau et al., 2021).

These dynamics are clearly visible in the Finnish electricity ecosystem, which mirrors broader global energy trends but also has some unique characteristics. The rise of wind power as a dominant variable energy source has introduced greater system unpredictability. At the same time, Finland's increased reliance on nuclear power has strengthened baseload capacity but reduced operational flexibility (Ruokamo et al., 2019). The market itself is highly fragmented, with more than 50 electricity retailers and 70 distributors (known as distribution system operators or DSOs) creating coordination challenges around scaling up flexibility services (Energiavirasto, 2023). Nevertheless, Finland is at the forefront of the energy transition. A climate-conscious

public and geopolitical developments (e.g., Russia's invasion of Ukraine) have accelerated efforts to achieve energy self-sufficiency (Numminen et al., 2022). The country's recent surge in prosumption, evidenced by a 63% annual increase in self-generation contracts (particularly through rooftop solar), illustrates a cultural and structural shift toward decentralized energy (Energiavirasto, 2023).

This shift is supported by the Finnish grid's advanced digital infrastructure. Smart meters, energy-optimized appliances, and a centralized electricity market data exchange platform (Datahub) enable real-time energy management and open new avenues for flexibility trading (Rahman et al., 2025). The rapid uptake of electric vehicles further amplifies flexibility potential, as these assets can function as mobile storage units, charging when renewables are abundant and discharging during periods of high grid demand (Bohnsack et al., 2014). Meanwhile, grassroots initiatives like citizen-led energy communities demonstrate how flexibility is not just a technological solution but a social and institutional transformation (Ruostetsaari, 2020). As these developments converge, energy flexibility in the Finnish electricity market offers a fertile setting to explore how innovation, regulation, and changing consumer roles interact in reshaping energy systems. Nevertheless, how these elements collectively drive deeper transformation in electricity market structures remains underexplored. That is a question addressed in the following section.

1.4 Understanding market transformation: key perspectives

Consistent with the view that markets are malleable and evolving systems, market transformation is understood as a multifaceted and ongoing process rather than a singular event (Mele et al., 2015). Westman et al. (2023) highlight that market transformation affects all transactions within a market by reshaping the production, consumption, and structural foundations of goods and services. While transformation can indeed be spurred by major disruptions, it often unfolds as a layered process shaped by incremental change (Nijhof et al., 2022). Sarasvathy & Dew (2005) explain that an interplay of technological, political, and regulatory forces typically drives such evolution. These external factors interact with internal market dynamics as actors actively reconfigure market structures (Flaig & Ottosson, 2022).

In the context of electricity systems, particularly energy flexibility, the focus lies in transforming existing market structures rather than creating entirely new markets or initiating radical sustainability transitions. Table 1 outlines key research streams related to market change—market creation, market emergence, sustainable market

transition, and market innovation—and positions them in relation to energy flexibility.

Table 1. Key research streams related to market change

Research stream	Definition	Relevance to energy flexibility-driven market transformation
Market creation	Involves building entirely new markets through innovation and stakeholder engagement under conditions of uncertainty (Sarasvathy & Dew, 2005).	Energy flexibility does not signify the birth of a new market but a transformation of the present electricity sector.
Market emergence	Often driven by entrepreneurial efforts to leverage cultural or niche dynamics, leading to new market segments (Biraghi et al., 2018).	Energy flexibility reflects more of a top-down transformation driven by technology, regulation, and consumer behaviour shifts, rather than organic niche-driven emergence.
Sustainable market transition	Involves a radical, non-linear shift towards sustainability, progressing through phases such as inception, synergy, and institutionalization (Nijhof et al., 2022).	While sustainability goals influence energy flexibility, this study focuses on adapting current market structures rather than a radical overhaul into a purely sustainable system.
Market innovation	Refers to institutionalized solutions that emerge from intentional efforts by focal actors to carry out and transform markets (Vargo et al., 2015).	While focal actors may play a prominent role in facilitating energy flexibility in the market, achieving comprehensive transformation necessitates collaboration among a broader array of actors.

Given that energy flexibility involves the adaptation and reconfiguration of established systems, this study draws on the notion of market transformation to capture the empirical scope of change. While not a distinct theoretical construct in the marketing literature, market transformation serves the current research as a descriptive anchor that foregrounds gradual, systemic, and actor-driven change. To develop a more analytically rigorous understanding of these dynamics, this study turns to two established perspectives within marketing research: market driving and market shaping (Pels et al., 2023).

Market driving refers to firms proactively reshaping market structures and behaviours through innovation to secure new competitive advantages (Jaworski et al., 2000). In this view, firms act as dominant agents, altering consumer expectations, industry norms, and even regulatory frameworks to suit their strategic interests (Narver et al., 2004). However, this perspective assumes a relatively linear and firm-centric view of change. As Pels et al. (2023) argue, such a perspective is increasingly proving inadequate in today's interconnected and adaptive market environments.

In contrast, market shaping conceptualizes transformation as an emergent and distributed process. Here, markets are seen as evolving ecosystems shaped by the ongoing interaction of diverse actors (Baker & Nenonen, 2020). Firms involved in shaping do not simply impose change; they engage in the collaborative reconfiguration of market structures in alignment with broader visions of value and coordination. This view also emphasizes the enabling role of external forces, such as regulation, digital infrastructures, and changing consumer values, in structuring opportunities for transformation (Harrison & Kjellberg, 2016).

Therefore, this study adopts the market shaping perspective to investigate energy flexibility as a driver of market transformation. The approach provides a theoretically robust lens with which to analyse how heterogeneous actors interact, coordinate, and align their efforts within complex institutional contexts, while also accounting for the technological and policy environments that condition market evolution. The following section elaborates on this perspective and outlines its conceptual relevance to understanding electricity market transformation.

1.5 Market shaping as a conceptual lens

Market shaping has emerged as a central concept in marketing scholarship over the past two decades, offering a powerful lens for understanding the formation, transformation, and evolution of markets (Nenonen & Storbacka, 2021; Pontikes & Rindova, 2020). It moves beyond passive participation, emphasizing strategic efforts

to reconfigure market systems by reshaping the roles, behaviours, and expectations of the various actors embedded within them (Hawa et al., 2020).

The theoretical foundations of market shaping are deeply interdisciplinary, drawing from economics, sociology, and management (Mele et al., 2015). Several overlapping perspectives, such as institutional theory, the resource-based view, practice theory, social movement theory, innovation research, entrepreneurship, and service-dominant logic (SDL), contribute to this body of work (Nenonen and Storbacka, 2021). Each offers distinct insights into how actors shape markets. For instance, institutional theory explains how stakeholders participate in institutional work to preserve, disrupt, or create new operating principals (Kaartemo et al., 2020), while SDL focuses on resource alignment and value co-creation across networks (Arnould, 2008). Other strands emphasize the dynamic capabilities of firms, including their ability to sense, seize, and transform in response to changing environments (Flaig et al., 2021).

Crucially, market shaping is typically understood as an ecosystem-level phenomenon. It unfolds in settings where a plurality of actors engage to co-create value, leading to the emergence of new markets or the transformation of existing ones (Adner, 2017; Nenonen et al., 2019). In this study, the ecosystem perspective is applied descriptively to the Finnish electricity sector, highlighting interactions that extend beyond producer-consumer exchanges to involve coordination across institutional, technological, and symbolic domains (Pels et al., 2023). When ecosystem participants are aligned, market-shaping efforts are reinforced and enable firms to create favourable conditions for collective transformation (Storbacka et al., 2022). Furthermore, periods of crises and disruption, such as turbulence from globalization, climate change, or pandemics, often act as catalysts for market shaping (Nenonen & Storbacka, 2021; Pedersen & Ritter, 2022). These shifts allow actors to reorganize their roles and activities to achieve specific objectives (Storbacka et al., 2022). Innovations during these periods are often adaptive responses rather than radical disruptions, as actors integrate existing technologies and practices to create value in creative ways (Kaartemo & Nyström, 2021; Nenonen et al., 2019). Intentionality plays a key part in this process, as visionary ideas about future market configurations shape actors' mental models, business practices, and organizational behaviour (Baker & Nenonen, 2020; Flaig et al., 2021). This process is known as market scripting and involves reconfiguring the foundational structures and practices of a market (Storbacka & Nenonen, 2011).

The electricity market provides a particularly compelling context for studying market shaping due to its ongoing transformation. As Syväri et al. (2025) note, market shaping in this sector goes far beyond regulatory compliance or externality

mitigation to encompass reimagining the fundamental logics of exchange, ownership, and value. For example, the liberalization of electricity markets in the 1990s required profound institutional restructuring to break up monopolies and embed competition (Glachant & Finon, 2003). Similarly, recent EU-level institutional reforms, such as REPowerEU, reflect ongoing efforts to reshape the energy markets (European Commission, 2022). These reforms_emphasize accelerating renewable deployment and energy efficiency while also reinforcing consumer engagement, including participation in flexibility markets. Concurrently, actor roles are also undergoing a significant shift. Utilities and grid operators now operate alongside prosumers, energy communities, and digital service providers, each contributing to a distributed and collaborative shaping process (Schaumann & Tarnovskaya, 2023). Such actor diversification exemplifies how market shaping is not limited to dominant incumbents but involves alignment and negotiation across a broader ecosystem. Moreover, market shaping in electricity systems entails the dual nature of market-shaping strategies, with offensive strategies (e.g. introducing ensuring grid stability given variable renewables) both coexisting in the market (Di Foggia et al., 2022; Syväri et al., 2025).

Finally, the electricity sector resonates with SDL's systemic view of markets as configurations of resource integrating actors (Vargo & Lusch, 2016). Markets here are shaped through dynamic integration of generation, consumption, and storage resources across multiple levels (Rahman et al., 2025). This integration illustrates how shaping efforts transcend individual firm boundaries and unfold at the level of entire market systems. Against this backdrop, the following section outlines the purpose of this study and presents the research questions it seeks to address.

1.6 Purpose of the study, research questions, and intended contributions

Despite increasing scholarly attention on the evolution of markets, limited understanding persists regarding the mechanisms through which markets are shaped, whether by individual actors exercising strategic agency or through collective, ecosystem-wide interactions. This dissertation addresses that gap by examining how market shaping unfolds across different levels of agency and coordination, driven by technological advances, regulatory shifts, and sustainability imperatives. Specifically, it responds to calls in the literature for exploratory research illuminating the mechanisms, actions, and interactions through which market-shaping processes emerge and evolve (e.g., Nenonen & Storbacka, 2021).

The study's empirical basis is the Finnish electricity ecosystem, and it investigates three interconnected dynamics: how focal actors strategically reconfigure markets through business model innovation (BMI); how platforms and their governance mechanisms enable coordination among distributed actors; and how value co-creation fosters institutional transformation through collaborative resource integration. While these frameworks have been widely studied in isolation, their interdependencies and combined market-shaping potential remain underexplored, particularly in infrastructure-intensive, regulated sectors. This study brings these lenses into dialogue, linking microfoundations of strategy and dynamic capabilities with ecosystem-wide coordination and collaborative institutional change (Eisenhardt & Martin, 2000; Vargo et al., 2015). Synthesizing these perspectives enables a comprehensive investigation of market shaping as a layered, actor-driven process.

Accordingly, this thesis is guided by the following research question:

How do actors' actions and interactions contribute to market shaping over time?

This overarching question is addressed through three interlinked sub-questions:

RQ1: How do focal actors strategically contribute to market shaping in response to external pressures?

This question investigates how focal actors, such as electricity retailers, strategically mobilize organizational capabilities to shape emerging market structures in the Finnish electricity ecosystem. The empirical focus lies in understanding how these actors leverage BMI to respond to regulatory shifts, technological disruption, and sustainability imperatives. The key parties apply BMI to reconfigure their value creation and capture logics, contributing to broader market transformation.

The study draws on the microfoundations perspective of BMI, which emphasizes mechanisms such as sensing, seizing, and transforming capabilities (Eisenhardt & Martin, 2000; Teece, 2007). These dynamic capabilities, embedded in decision-making routines and managerial practices, constitute the building blocks of strategic agency. While BMI has been widely examined as a tool for firm adaptation, its role in intentional market shaping remains underexplored (Hawa et al., 2020; Nenonen & Storbacka, 2021; Storbacka, 2019). By investigating how electricity retailers strategically deploy these microfoundation elements, the study deepens the understanding of focal actors' agency in market transformation and extends the application of BMI theory. It offers practical insights for energy companies seeking to redesign their business models to align with market conditions and institutional change.

RQ2: In what ways do coordination mechanisms enable collaboration across an evolving market ecosystem?

This question examines how platforms function as coordination mechanisms that facilitate collective market shaping by aligning and orchestrating diverse ecosystem actors. In particular, it investigates how governance structures, such as access rules, control rights, and incentive mechanisms, shape participation, interaction, and value exchange across the market. Drawing on platform governance theory, the study conceptualizes platforms not merely as digital infrastructures but as institutional arrangements that define roles, responsibilities, and collaborative pathways in emerging market configurations (Rahman et al., 2021).

The empirical focus of the study is on digital platform development in the Finnish electricity sector, explored through use cases such as managing energy flexibility, aggregating demand-side resources, and facilitating decentralized transactions. These platforms provide coordination architectures that enable participation by both incumbent and emerging actors and nurture interoperability, transparency, and distributed innovation. In doing so, this research contributes to the literature on platform-mediated market dynamics and offers practical insights into how governance design can support flexible, responsive, and collaborative energy ecosystems (Amit & Zott, 2001; De Oliveira & Cortimiglia, 2017; Kavadias et al., 2016).

RQ3: How do actors align and integrate resources to co-create value, leading to market shaping?

The research question is rooted in SDL and investigates how actors within the Finnish electricity ecosystem mobilize resources to co-create value and, in the process, shape emerging market structures. The empirical focus lies in examining prosumer-enabled energy flexibility initiatives, where actors such as consumers, utilities, and technology providers align their resources and capabilities to enable more responsive and distributed energy systems. These efforts provide a lens on how ecosystem-level collaboration drives institutional and structural change.

Service-dominant logic conceptualizes markets as evolving systems of resource-integrating actors where value is created through interaction rather than isolated exchange (Nenonen & Storbacka, 2010; S. L. Vargo & Lusch, 2004). Within this framework, institutional arrangements both shape and are shaped by collaborative activity (Kaartemo et al., 2020). This study investigates such dynamics in practice by analysing how energy market actors engage in resource alignment that transforms the institutional fabric of the market. Consequently, it contributes to emerging midrange theorization of market shaping by empirically grounding SDL in a sectoral application (Kaartemo & Nyström, 2021; S. L. Vargo & Lusch, 2017). It offers

practitioners insights into how cross sectoral collaboration enables more responsive and participatory energy systems through value co-creation.

1.7 Positioning of the study

The conceptual ambiguity around what constitutes a market continues to spur calls for research grounded in real-world practices and actor dynamics (Mele et al., 2015; Möller et al., 2020). This dissertation answers that call by positioning itself within the market shaping literature, which views markets as evolving ecosystems shaped by the purposeful actions and interactions of multiple actors (Pels et al., 2022). This perspective is particularly valuable for analysing the electricity sector, where longstanding structures are being reconfigured in response to external pressures such as digitalization, regulatory change, and new consumption practices. Within this setting, energy flexibility provides a focal point for examining how market transformation unfolds in practice, capturing both adaptive responses and deliberate efforts to steer systemic change (Ruostetsaari, 2020).

The study integrates three theoretical pillars to help illustrate this process: BMI, platform governance, and value co-creation. Illustrated in Figure 1, these concepts operate at different but interconnected levels of analysis:

- BMI captures how focal actors (e.g., electricity retailers) strategically innovate and reconfigure their business models in response to changes in the external environment.
- Platform governance represents the coordination mechanisms that align and organize interactions among multiple ecosystem actors through shared rules, standards, and infrastructures.
- Value co-creation focuses on collaborative resource integration across actor groups, emphasizing how value is co-created through interaction and how markets are shaped through distributed participation.

The combination of these perspectives provides a multilevel framework for analysing how market shaping unfolds in a complex socio-technical system. This dissertation contributes to midrange theorizing by empirically operationalizing the concept of market shaping in a sectoral context, using energy flexibility as a lens.

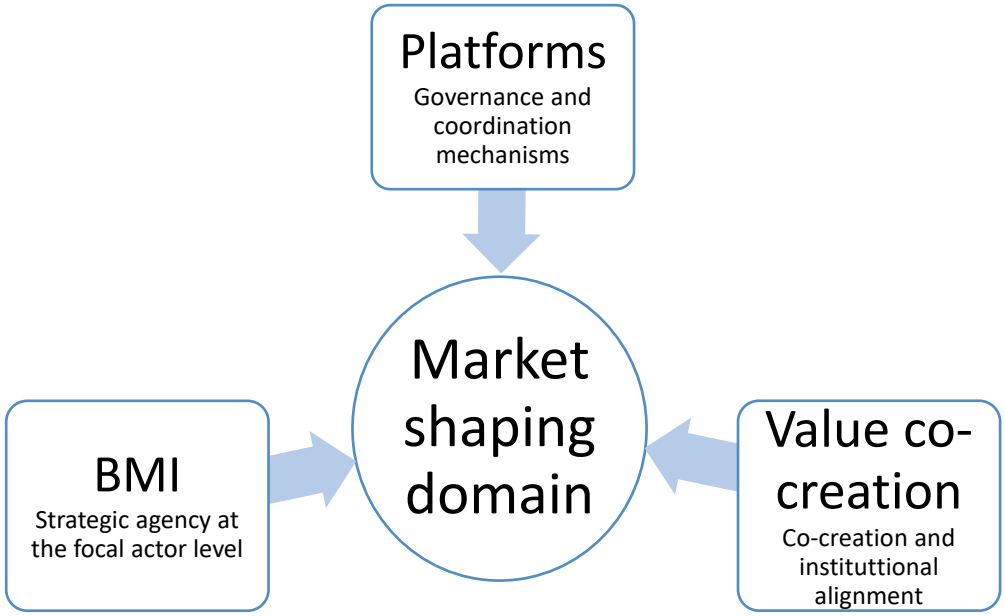

Figure 1. Conceptual framework of market shaping in this dissertation.

1.8 Structure of the study

This dissertation follows a two-part structure. The first part—the introductory chapter or *kappa*—presents the overarching synthesis of the research project. It outlines the research objectives, reviews the relevant literature, discusses the philosophical and methodological choices, summarizes the individual articles, and synthesizes the main findings and contributions. The second part consists of the three individual articles that form the empirical basis of the study.

Within the first part, The *Introduction* section presents the research problem, theoretical framing, and research questions. The *Literature Review* section discusses the key bodies of literature and connects them to the concept of market shaping. The *Methodology* section discusses the ontological, epistemological, and axiological underpinnings of the study and outlines the methodological choices, including data collection, analysis, and reporting strategies. The fourth section summarizes the three research articles and highlights their main contributions. An overview of these articles is also provided in Table 2. Next, the *Discussion* section synthesizes the principal findings of the dissertation, discusses their theoretical relevance and presents a revised framework integrating the empirical insights. The *Conclusion* section closes the first part of the dissertation by outlining the key theoretical and practical implications of the study. It also reflects on the study's main limitations and proposes directions for future research.

Table 2. Overview of the dissertation articles

	Article I	Article II	Article III
Title	Microfoundations for business model innovation: Exploring the interplay between individuals, practices, and organizational design	Ushering in a new dawn: Demand-side local flexibility platform governance and design in the Finnish energy markets	Prosumer flexibility as an enabler for ecosystem value co-creation: A resource integration approach from the Finnish electricity markets
Research questions addressed	RQ1: How do focal actors strategically contribute to market shaping in response to external pressures?	RQ2: In what ways do coordination mechanisms enable collaboration across an evolving market ecosystem?	RQ3: How do actors align and integrate resources to co-create value, leading to market shaping?
Themes	Microfoundations, BMI, strategic adaption, and focal actors	Platform design and governance, collective action, and flexibility markets	Resource integration, value co-creation, prosumer engagement, and ecosystem-wide transformation
Type of research	Empirical study focusing on the microfoundation aspects of BMI in electricity retailers	Empirical study on platform governance and design in energy flexibility markets	Empirical study using resource integration theory to explore actor roles in co-creation
Gaps addressed	Provides insights into how electricity retailers strategically adapt their business models, highlighting microfoundations that drive market shaping	Shows how platform governance structures facilitate collective action among diverse market actors	Demonstrates actor roles in value co-creation and how resource integration supports ecosystem-wide market shaping in the energy sector

2 LITERATURE REVIEW

This section examines the theoretical foundations of the dissertation. It first maps the key literature streams on market shaping and highlights critical gaps. It then provides an overview of BMI, platforms, and value co-creation literature, and situates each within the broader market-shaping framework.

2.1 State of research on market shaping

This section reviews the state of research on market shaping by outlining key literature streams that have structured the field, followed by a discussion of critical gaps.

2.1.1 Key literature streams in market shaping

As noted in the introductory sections, market shaping builds on interdisciplinary foundations. Building on this base, research has expanded and branched out into key streams such as processes, activities, roles, capabilities, and strategies (Nenonen & Storbacka, 2021; Sandvik et al., 2024), as summarized in Table 3. Scholars have explored how firms intentionally disrupt or maintain market conditions (their *strategies*), how they engage in collaborative value creation and resource alignment (their *activities*), the dynamic capabilities that enable effective shaping (their *capabilities*), the sequential and symbolic processes involved (the *processes*), and the resulting impacts on market configuration (the *outcomes*) (Azimont & Araujo, 2007; Flaig et al., 2021; Nenonen et al., 2019; Sandvik et al., 2024).

Table 3. Conceptual map of market shaping literature

Key literature streams	Detailed description	Central concepts	Representative articles
Market shaping strategy	Refers to the intentional activities firms perform to shape market dynamics in their favour. These strategies can be offensive or defensive, depending on the firm's objectives and its reading of the market stability. Strategic actions include efforts to shape market demand, influence competitive dynamics, or alter institutional	Market disruption, market maintenance, and market widening	Flaig et al., (2021); Nenonen et al., (2024); Flaig et al., (2021b)

Key literature streams	Detailed description	Central concepts	Representative articles
	frameworks, which together contribute to the long-term reconfiguration of market systems.		
Market shaping activities	Encompasses the specific external actions that actors take to influence market dynamics. These activities involve direct interactions with market participants and structures, such as value co-creation, resource alignment, and technological innovation. Firms engage in these activities to reclassify products, reposition brands, or shape customer expectations.	Value co-creation, collaboration, resource alignment, technological innovation, and market reclassification	Kindström et al., (2018); Flaig and Ottosson (2022); Baker et al., (2018) Baker & Nenonen (2020); Azimont and Araujo (2007)
Market shaping capabilities	Focuses on the internal dynamic capabilities firms must develop and leverage to effectively shape markets. These include the capacity to sense market shifts, seize opportunities, and transform resources and activities in response to market conditions.	Sensing, seizing, transforming, dynamic capabilities, triggering capabilities, and facilitating capabilities	Nenonen et al., (2019); Windahl et al., (2020)
Market shaping processes	Refers to both the underlying mechanisms and the phases through which firms engage in market shaping. Those processes involve phases such as market exploration, preparation, and experimentation, as well as the symbolic and ideological work needed to reconfigure market narratives and influence market actors.	Market exploration, market preparation, market experimentation Regulation and policy, innovation and technology, narrative and symbolism, and ideology shaping	Sandvik et al. (2024); Flaig et al. (2021a) Kindström et al., (2023); Storbacka & Nenonen (2011) Baker et al., (2018); Azimont and Araujo (2007)

Key literature streams	Detailed description	Central concepts	Representative articles
Market shaping outcomes	Discusses the final results or impacts of market shaping efforts. Market outcomes can range from the creation of entirely new markets to the transformation or stabilization of existing ones. These outcomes are influenced by the effectiveness of market-shaping activities, strategies, and capabilities.	Market creation, market transformation, market stabilization, value creation, and resource linkages	Flaig et al., (2021); Nenonen et al., (2024); Nenonen et al., (2019)

2.1.2 Critical gaps in market shaping research

As articulated previously, market shaping provides a compelling lens illuminating how actors actively influence market configurations, norms, and structures (Storbacka & Nenonen, 2011). This perspective highlights the intentional efforts of firms, policymakers, and other stakeholders to alter market conditions, industry standards, and resource flows. To analyse these efforts, market shaping is often disaggregated into three core components: actors ('who'), objects ('what'), and processes ('how') (Flaig et al., 2021; Nenonen et al., 2019).

Markets evolve within ecosystems where interdependent actors collaborate and compete to shape industry trajectories (Adner, 2017; Pels et al., 2023). These ecosystems operate across multiple levels—micro, meso, and macro—forming dynamic structures that facilitate or constrain innovation and value creation (Nenonen & Storbacka, 2021). While previous research has explored how ecosystems develop through new business models and value co-creation, there is limited understanding of how emerging markets stabilize, particularly in early-stage settings where governance structures and actor relationships are still forming (Purchase et al., 2024).

A key research gap concerns the role of platforms as orchestrators of market shaping. Platforms facilitate multi-actor coordination, align incentives, and enable technological convergence through governance mechanisms (Kaartemo & Nyström, 2021). While their influence in mature ecosystems is well established, less attention has been paid to how platforms function in nascent market environments, where regulatory uncertainty, fragmented actor networks, and undefined market norms present added challenges (Purchase et al., 2024). Similarly, the inclusion of peripheral stakeholders remains under-theorized, despite their growing role in

shaping decentralized and user-driven markets (Schaumann & Tarnovskaya, 2023). Understanding how firms can engage these actors more effectively presents an important research avenue.

Another unresolved question concerns resource integration and sensemaking. The ability to align perspectives, create shared meaning, and coordinate resource flows is fundamental to market shaping, yet the mechanisms through which this occurs remain somewhat opaque (Kleinaltenkamp et al., 2021). Firms that successfully foster a shared understanding among stakeholders can accelerate institutional alignment and ecosystem co-evolution; however research has yet to capture the temporal and translational dynamics underlying these processes (Lawrence & Suddaby, 2006; Mattsson & Junker, 2023). Additionally, the interplay between offensive and defensive market-shaping strategies warrant further investigation. While some firms pursue aggressive innovation strategies disrupting existing norms (offensive shaping), others focus on preserving stability and maintaining regulatory alignment (defensive shaping) (Flaig et al., 2021). How firms hybridize these approaches to balance disruption and stability is especially relevant in regulated industries such as energy, where market transitions require long-term coordination involving multiple stakeholders.

Finally, future-oriented visions play a crucial role in market shaping by effecting governance structures and institutional norms. However, research has yet to fully examine how long-term visions guide regulatory frameworks and ecosystem coordination, particularly in fuzzy front-end markets, where structures are still emerging (Purchase et al., 2024). Understanding how firms and policymakers embed future visions into market-shaping efforts could offer new insights into long-term industry transformation.

The following sections expand on these themes by exploring three critical mechanisms that drive market shaping: BMI, platforms, and value co-creation through resource integration. Business model innovation empowers firms to reconfigure market structures, challenge dominant logics, and introduce new value propositions that drive systemic change. Platforms facilitate multi-actor coordination, governance structuring, and technological alignment, making them essential in shaping emerging and established markets alike. Finally, value co-creation and resource integration highlight the collaborative processes through which actors integrate resources, establish institutional norms, and embed shared meanings into market structures. Together, these perspectives provide a comprehensive framework to unveil how markets are shaped and transformed over time.

2.2 An overview of business models, business model innovation, and microfoundations

Business models serve as fundamental frameworks through which firms structure value creation, delivery, and capture (Coombes & Nicholson, 2013). These models not only provide organizations with mechanisms to sustain competitive advantage but also enable them to navigate complex and evolving market landscapes (Foss & Saebi, 2018; Teece, 2010). As adaptable systems, business models enable firms to align their internal processes with external changes, particularly in volatile environments (Palmié et al., 2021). Beyond operational structuring, business models contribute to systemic market evolution, acting as vehicles for competitive strategy and market transformation (Budde Christensen et al., 2012).

The increasing dynamism of markets, particularly in sectors undergoing disruptive transitions, underscores the need for firms to continuously adapt their business models (Hall & Roelich, 2016; Karami & Madlener, 2021). Teece (2010) highlights that business models must evolve to accommodate external pressures, including emerging technologies, regulatory realignments, and shifting consumer expectations. Nevertheless, reconfiguring such models in response to dynamic environments is rarely straightforward. When legacy models constrain a firm's ability to innovate, BMI becomes a crucial mechanism for transformation, allowing the organization to fundamentally reconfigure value structures and market interactions (Foss & Saebi, 2017). Business model innovation involves strategically modifying constituent components, including value propositions, revenue models, and delivery mechanisms, to generate new opportunities and address emerging challenges (Kavadias et al., 2016). The successful integration of technological advancements into effective business models is a key driver of industry transformation, emphasizing the importance of aligning innovation with market needs (Kavadias et al., 2016). However, BMI is not a linear process; it involves iterative experimentation, learning, and adaptation. Firms engage in trial-and-error cycles to refine their strategies, ensuring that new models align with changing market conditions (Sosna et al., 2010).

Despite its potential, BMI can be hampered by cognitive and structural barriers. Cognitive biases, often shaped by dominant industry logics, can limit managerial decision-making and prevent firms from recognizing transformative opportunities (Chesbrough & Rosenbloom, 2002). Structural barriers, such as deeply entrenched value chains and regulatory complexities, further restrict firms' ability to implement novel business models, particularly in highly regulated sectors (Gavetti et al., 2017; Richter, 2013). Overcoming these challenges necessitates a focus on the microfoundations of BMI, which are the individual and organizational-level mechanisms that drive the process (Felin & Foss, 2005).

The microfoundation perspective on BMI offers a lens for examining the underlying decision-making heuristics, resource reconfigurations, and learning processes that enable firms to shape markets (Eisenhardt & Martin, 2000; Teece, 2007). Managers play a pivotal role in interpreting market signals and translating them into actionable business model adjustments, often requiring cognitive shifts to overcome organizational inertia (Chesbrough & Rosenbloom, 2002). Furthermore, the ability to reconfigure technological, human and financial resources determines the effectiveness of BMI in aligning firms with broader ecosystem shifts (Gummesson & Mele, 2010). Learning and adaptation are integral to this process, as firms must continuously refine their business logic to sustain competitive advantage in uncertain environments (Palmié et al., 2021; Rabetino et al., 2025). To support such processes, organizations must balance innovation and operational continuity —what O'Reilly and Tushman (2013) describe as ambidexterity.

In markets such as energy, where technological disruptions and regulatory changes demand continuous evolution, BMI microfoundations are particularly critical. This perspective is particularly relevant when examining the role of focal actors in market shaping, which is explored in the next section.

2.2.1 Business model innovation as a focal actor perspective in market shaping

Business model innovation emerges as a pivotal mechanism in market shaping, as it enables focal actors not only to adapt to market conditions but to actively shape them (Flaig & Ottosson, 2022). Traditionally, researchers have presented BMI as a firm-centric process, but its impact extends beyond the firm. Recent scholarship underscores its influence on the broader ecosystem and establishes that it can be a tool for redefining market structures, influencing industry norms, and catalysing systemic change (Kindström et al., 2023).

Focal actors, namely firms with significant influence, play a central role in reconfiguring market dynamics through BMI. They introduce new value propositions, alter resource flows, and embed new market logics into the broader ecosystem (Gitelman & Kozhevnikov, 2023). For instance, in energy markets, firms leveraging BMI to introduce demand-response mechanisms do not merely compete within existing structures but actively reshape how value is created, exchanged, and regulated (Kaartemo & Nyström, 2021).

A crucial aspect of BMI in terms of market shaping is its ability to challenge and reframe institutionalized mental models; the dominant assumptions that govern industry practices (Kindström et al., 2023). Market shaping requires firms to

influence how other actors perceive and engage with markets, creating new behavioural expectations and industry standards (Pedersen & Ritter, 2022). Often termed market scripting, this process involves embedding novel business logics into regulatory frameworks, consumer behaviour, and competitor strategies (Baker & Nenonen, 2020). For example, in sustainable energy markets, firms pioneering peer-to-peer energy trading use BMI not only to design viable business models but also to legitimize fresh ways of structuring energy transactions.

Market-shaping strategies driven by BMI can be categorized as either offensive or defensive; however, recent studies suggest that firms are increasingly applying hybrid approaches to balance short-term stability with long-term transformation (Syväri et al., 2025). Offensive shaping involves introducing radically new business models, pricing mechanisms, or enhanced consumer engagement aimed at redefining market boundaries. Defensive shaping emphasizes regulatory alignment, stakeholder reassurance, and safeguarding system stability (Flaig et al., 2021). This dual approach is particularly salient in energy markets, where innovation must be pursued within tightly regulated and reliability-focused infrastructures (Parag & Sovacool, 2016).

Finally, the microfoundation underpinnings of BMI in market shaping remain largely underexplored. Existing research has examined BMI as a firm-level adaptation tool, often overlooking the individual and organizational capabilities that drive market-shaping efforts (Kumar & Srivastava, 2020). However, studies increasingly highlight the cognitive, relational, and structural microfoundations that enable BMI-driven market transformation (Felin & Foss, 2005; Nenonen & Storbacka, 2021). Managerial cognition plays a crucial role, as decision-makers must interpret emerging trends, construct new value narratives, and align stakeholders on shared visions (Chesbrough & Rosenbloom, 2002). At the same time, the ability to strategically reconfigure resources and develop dynamic capabilities is essential for firms to facilitate new market interactions and realign their institutional frameworks (Teece, 2007). This requires firms to experiment iteratively, engaging in trial-and-error processes to test, refine, and scale new market structures (Sosna et al., 2010). Firms that can integrate these microfoundations can apply innovative business models to move beyond reactive market adaptation toward proactive market shaping.

2.3 Overview of platforms and their role in ecosystems

Platforms have emerged as fundamental enablers of contemporary business ecosystems, facilitating interaction, value creation, and innovation among a diverse range of actors. While the platform concept is not novel (Kim, 2018), platforms' role has expanded with technological advancements and the digital economy (Schneider,

2018). Platforms function as multi-sided markets that mediate interactions between producers, consumers, and third-party contributors (Eisenmann et al., 2006), shaping industries through their ability to connect and coordinate stakeholders (Gawer & Cusumano, 2014).

At their core, platforms provide the infrastructure for collaboration and value exchange, enabling ecosystem participants to co-develop *complementary products, technologies, and service*s (Gawer, 2009). That characteristic makes platforms pivotal to reshaping industries by enabling resource exchange, standardization, and multi-actor coordination (Fenwick et al., 2019). Whether centralized (controlled by a dominant firm) or decentralized ecosystems (such as blockchain-driven networks), platforms mediate competitive dynamics and strategic interactions within market environments (Fenwick et al., 2019).

Platforms also represent a distinct business model that is different from linear value chains. Unlike conventional firms that operate within predefined industry boundaries, platforms leverage network effects, where increased participation expands the total value available to all participants (Katona et al., 2011). These ecosystems thrive on interdependencies, meaning that platform participants do not merely consume value but actively co-create it (Gawer & Henderson, 2007). This structural flexibility enhances adaptability, allowing platforms to integrate evolving technological, regulatory, and market requirements (Eloranta & Turunen, 2016).

Governance is a key determinant of platform success, ensuring transparency, trust, and alignment among participants. Governance mechanisms define decision rights, participation rules, pricing models, and accountability structures, thereby shaping how actors engage within platform ecosystems (Tiwana et al., 2010). The effectiveness of platform governance depends on balancing control and openness—restricting access where necessary while enabling enough elasticity for innovation (Parker & Van Alstyne, 2018). In dynamic sectors like energy flexibility markets, governance frameworks must accommodate emerging players while maintaining system stability (Rahman et al., 2021). Table 4 summarizes the key platform governance and design decisions that an ecosystem managers must consider to ensure platform effectiveness and sustainability.

Table 4. Key platform governance decisions

Platform Governance Decisions	Description	Sources
Ownership and Leadership Structures	Defines who controls the platform (e.g., platform owner, third party) and determines market access, nurturing competition, or maintaining incumbents' dominance.	Tiwana et al. (2010); Fenwick et al. (2019)
Operational Rules and Processes	Establishes how actors interact within the ecosystem, including participation guidelines, transaction rules, and integration of new services or technologies.	Gawer, 2021; Tiwana et al. (2010); Tura et al. (2018)
Data Security and Privacy Protocols	Maintains trust through secure data exchange and privacy protections, enabling efficient operations and stakeholder confidence.	Fenwick et al. (2019); Tiwana et al. (2010)
Pricing and Revenue Models	Determines how the platform generates and distributes revenue to sustain operations while encouraging participation and innovation.	Furstenau et al. (2019); Tura et al. (2018)
Stakeholder Collaboration	Facilitates interactions and alignment among diverse participants to promote value co-creation and innovation.	Gawer & Cusumano (2014); Brusoni & Prencipe (2009)
Balance Between Autonomy and Control	Strikes a balance between providing participants with enough freedom to innovate and retaining necessary control to safeguard platform integrity.	Tiwana et al. (2010); Fenwick et al. (2019); Parker & Van Alstyne, 2018

2.3.1 Platforms as catalysts for collective market shaping

Platforms have long been studied as technological and economic facilitators, but their role in market shaping has only recently been recognized (e.g., Kaartemo & Nyström, 2021). Platforms do not just mediate transactions; they actively reshape market structures, define competitive dynamics, and influence regulatory frameworks (Gawer & Cusumano, 2014). Moreover, platforms' governance structures support multi-actor alignment, collective action, and ecosystem-wide coordination (Fehrer et al., 2018).

Recent research highlights that platforms act as orchestrators of systemic change, moving beyond traditional firm-centric models of market shaping (Nenonen et al., 2019). Instead of individual firms driving market evolution, platforms aggregate and synchronize the efforts of various ecosystem actors, including regulators, startups, incumbents, and consumers (Baker & Nenonen, 2020). This shift from a dominant-actor-driven to a collectively orchestrated market-shaping indicates a fundamental change in how industries evolve (Storbacka & Nenonen, 2011).

A central mechanism through which platforms shape markets is governance-driven market orchestration. Effective governance ensures that platforms establish shared norms (Kindström et al., 2023), incorporating new rules and industry standards into market ecosystems. It further enables technological convergence by defining interoperability requirements and resource exchange frameworks (Kaartemo & Nyström, 2021). Governance orchestration also mediates power dynamics by balancing inclusivity (welcoming new entrants) with control mechanisms that prevent monopolistic behaviours (Tiwana et al., 2010).

Moreover, platforms function as regulatory intermediaries, bridging the gap between fragmented regulatory environments and market actors (Pedersen & Ritter, 2022). Platforms serving energy markets facilitate compliance with policies and regulations while allowing for decentralized innovation, such as peer-to-peer energy trading (Gitelman & Kozhevnikov, 2023). By integrating policy mechanisms into governance structures, platforms effectively co-shape regulatory landscapes alongside firms and policymakers. The dual role of platforms as market orchestrators and regulatory intermediaries highlights their ability to facilitate both incremental adaptations and systemic transformations (Fehrer et al., 2018). Furthermore, unlike linear firm-driven innovations, platform-based market shaping relies on distributed agency, where multiple actors contribute to shaping market outcomes over time (Flaig & Ottosson, 2022).

Despite the transformative potential of platforms, several gaps remain in understanding their role as catalysts for collective market shaping. For instance,

platforms are particularly influential in nascent ecosystems, where norms and relationships are still forming. However, research remains limited on how platforms synchronize emerging actors and align incentives during the early stages of market development (Purchase et al., 2024). Additionally, while recent studies emphasize their role in shaping mental models and market narratives, the mechanisms through which platforms script new market logics and influence institutional change require further exploration (Kindström et al., 2023).

2.4 Overview of value co-creation and resource integration

Value co-creation has become a foundational concept in understanding collaborative market dynamics, particularly within the SDL framework (Vargo & Lusch, 2004, 2008). Service-dominant logic reconceptualizes markets as interconnected ecosystems where value emerges through resource integration and reciprocal interactions rather than through traditional linear exchanges (Akaka & Vargo, 2014). This perspective expands value co-creation beyond firm-customer interactions to include multi-actor collaborations, incorporating firms, consumers, regulators, and technology providers into shared value-creation processes (Hein et al., 2019; Williams & Aitken, 2011).

The theoretical foundations of value co-creation have been examined through various lenses. Saha et al. (2022) identify four dominant perspectives—*SDL, practice theory, social exchange theory, and stakeholder theory*—each offering distinct insights into how actors interact and integrate resources in market environments. Similarly, Alves et al. (2016) categorize co-creation research into six streams, emphasizing aspects such as service science, postmodern marketing, and consumer culture theory. Among these, SDL is particularly relevant for market shaping, as it underscores the role of resource integration in reconfiguring market structures and driving systemic transformation (Saha et al., 2022).

Importantly, resource integration plays an essential role in both value co-creation and market shaping by facilitating the alignment and recombination of various resources, enabling markets to evolve dynamically (Vargo & Lusch, 2006). It involves the structured and collaborative deployment of technological, financial, and relational resources to generate new value propositions (Frow et al., 2016). Three key dimensions of resource integration relevant to market shaping are complementarity, redundancy, and asymmetry. Complementary refers to the integration of synergistic resources, such as combining technological capabilities with market knowledge, to nurture innovation (Gummesson & Mele, 2010).

Redundancy, involving the sharing of resources among actors, facilitates the transfer of tacit knowledge and collective learning but requires careful management to avoid inefficiencies (Pikkarainen et al., 2022). Asymmetry, characterized by unequal access to critical resources such as capital or networks, necessitates deliberate efforts to promote inclusivity and equitable participation (Dehling et al., 2022; Prahalad & Ramaswamy, 2004). Resource integration drives market shaping by enabling actors to align their capabilities and address shared challenges. For instance, in the energy market, it facilitates the integration of green energy technologies with existing infrastructure to create flexible energy systems (Shakeel et al., 2023).

From a process perspective, value co-creation unfolds through three interconnected stages: antecedents, activities, and outcomes (De Oliveira & Cortimiglia, 2017). Antecedents establish the conditions conducive to collaboration, such as trust, shared objectives, and governance frameworks. Activities involve active resource integration and joint problem-solving among ecosystem actors to generate market value. The outcomes of these interactions include economic value, institutional stability, knowledge diffusion, and innovation spill overs.

Value co-creation is particularly relevant in markets undergoing technological and regulatory transformation, as collective efforts not only lower transaction costs and enhance system adaptability but also drive new market configurations (Mele et al., 2010; Nenonen & Storbacka, 2010). For instance, in energy markets, prosumers actively shape market structures by contributing surplus energy to decentralized networks, thereby influencing grid stability and reshaping traditional distribution models (Shakeel et al., 2023).

2.4.1 Value co-creation as a mechanism for market shaping

Unlike firm-centric market strategies, value co-creation is rooted in collective action, positioning markets as adaptive ecosystems where interactions among diverse stakeholders continuously reshape structures and create new value networks (Nenonen et al., 2019; Vargo & Lusch, 2004). Value co-creation-based market shaping operates through three interrelated mechanisms. First, institutional work and market reconfiguration emerge as actors engage in repeated interactions, co-developing shared understanding, behavioural expectations, and governance structures that define emerging landscapes (Kindström et al., 2018). These interactions contribute to institutional evolution, where business models, industry standards, and stakeholder relationships are continuously refined, enabling markets to adapt to environmental shifts (Sandvik et al., 2024). Second, networked resource integration further reinforces market shaping as firms, policymakers, and consumers strategically align their resources toward shared objectives (Vargo & Lusch, 2016).

This process involves coordinated investments, the development of interoperability standards, and the structuring of market infrastructures to support long-term ecosystem stability (Baker et al., 2019). Third, innovation spill overs and market expansion enhance the market's adaptive capacity by integrating underutilized resources and attracting new participants into value networks (Tantalo & Priem, 2016). As more actors engage in co-creation, they reinforce positive feedback loops that accelerate market transformation, increasing the system's overall capacity for value creation and exchange (Flaig et al., 2021).

In the energy sector, value co-creation mechanisms enable collective energy flexibility, where households, businesses, and utilities dynamically co-integrate resources to balance supply and demand in real time (Di Foggia et al., 2022). This transformation is further reinforced by regulatory shifts that incentivize market participation from prosumers, aggregators, or third-party operators ensuring that policy objectives align with market dynamics (Dodd & Nelson, 2019). Such systemic shifts resonate with socio-technical transition theory, which emphasizes how new technologies, user practices, and institutional structures co-evolve during periods of market transformation (Geels, 2004). By embedding value co-creation principles into energy markets, these mechanisms facilitate both incremental market adjustments and deep systemic transitions toward more sustainable and decentralized energy systems.

However, the understanding of how value co-creation measures shape markets remains incomplete. Inclusivity in co-creation is underexplored, particularly with regard to peripheral actors such as community groups and local innovators (Schaumann & Tarnovskaya, 2023). Technology is a critical enabler of co-creation, facilitating real-time coordination, data sharing, and decentralized participation (Amit & Han, 2017). Nevertheless, research on these enablers remains fragmented, particularly in understanding how digitalization enhances co-creation dynamics and scales market transformation (Leone et al., 2021). Additionally, cross-sectoral insights are limited, with most value co-creation studies focusing on high customer involvement sectors, such as consumer technology and product innovation; non-traditional markets, like electricity, remain underrepresented (Alves et al., 2016).

2.5 Integrating theoretical perspectives

Taken together, the perspectives of BMI, platforms, and value co-creation offer complementary mechanisms that interconnect dynamically in market shaping. BMI explains how focal firms reconfigure value propositions, challenge dominant logics, and embed new practices that can cascade across the wider market. Platforms extend

this agency by creating governance structures and coordination mechanisms that aggregate efforts, synchronize actors, and mediate regulatory or technological conditions. In turn, value co-creation highlights how distributed participation and resource integration consolidate these changes into emergent, adaptive ecosystems.

Importantly, these mechanisms are recursive and mutually reinforcing. Firm-level BMI often requires platforms to scale and stabilize new practices; platforms, in turn, depend on value co-creation to generate legitimacy and engagement; and co-creation processes are frequently catalyzed by innovative business models or platform-mediated governance. Thus, market shaping unfolds not through isolated mechanisms but through a dynamic interplay across firm-centric innovation, platform orchestration, and collective co-creation. This synthesis provides the conceptual basis for examining how these dynamics manifest in practice in the following empirical chapters.

3 METHODOLOGY

This section outlines and justifies the methodological and philosophical foundations of the dissertation. It begins by discussing the study's research philosophy, including its ontological, epistemological, and axiological assumptions, followed by an explanation of the chosen research design and the methodological approach. The next part elaborates on the data collection and analysis methods used across the three case studies. The section concludes with a critical evaluation of the research quality, addressing trustworthiness and rigour.

3.1 Research philosophy

A research philosophy reflects assumptions about reality (ontology), knowledge (epistemology), and values (axiology). These foundational perspectives shape how the research is designed, how data is collected, and how the findings are interpreted. As this study explores the transformation of the Finnish electricity ecosystem through the lens of market shaping, it necessitates a philosophical stance that can account for both the complexity of socio-technical systems and the agency of actors operating within them.

Ontology reflects on the nature of reality and what we consider to exist in the world (Burrell & Morgan, 1979). The ontological position of this study is anchored in critical realism, a stance that asserts reality exists independently of human perceptions and is only partially accessible through observation and interpretation (Bhaskar, 1975; Sayer, 2000). Critical realism posits a stratified view of reality, composed of (i) the real—underlying structures and generative mechanisms; (ii) the actual—events that occur regardless of whether they are observed, and (iii) the empirical—events and experiences as they are perceived and interpreted by human actors.

The empirical context of this study, namely the transformation of the Finnish electricity market exemplifies the need for such a layered ontological perspective. Changes such as the rise of prosumers, digital platforms, and novel regulatory mandates are evident; nevertheless, they are underpinned by deeper institutional structures, socio-technical regimes, and historical dependencies that shape and constrain actor behaviour. A critical realist ontology enables the interrogation of these hidden mechanisms, providing a deeper understanding of how and why certain patterns of market change emerge. Moreover, the focus of this dissertation on market shaping demands an ontological lens that appreciates both the constructed nature of markets and their embeddedness in material and institutional structures. Markets are not merely abstract or conceptual spaces but socio-material systems that evolve through a combination of mutual constitution of technologies, infrastructures, and

social practices (Kjellberg & Helgesson, 2006). As such, the ontological commitment in this study avoids the binary between objectivism and subjectivism. Instead, it embraces a stratified and emergent view of reality grounded in the critical realist tradition, which acknowledges that while reality exists independently, our knowledge of it is always mediated through social interpretation (Bhaskar, 1998; Sayer, 2000).

Epistemology deals with how knowledge is generated, evaluated, and justified. From a critical realist perspective, knowledge is considered fallible, theory-laden, and socially mediated, yet capable of uncovering real mechanisms through interpretive engagement and empirical investigation (Bhaskar, 1975; Sayer, 2000). Accordingly, this dissertation adopts the epistemological stance that meaningful explanations require attention to both actors' sense-making and the broader structural conditions that enable or constrain action. This aligns with the critical realist view that understanding the social world necessitates bridging the interpretive accounts of actors with the causal analysis of the structures that shape their behaviour (Easton, 2010). The approach views subjective meanings and objective mechanisms as independent rather than contradictory; actors' interpretations are seen as both shaped by and shaping the institutional, material, and technological structures in which they are embedded (Archer, 1995; Sayer, 2000). Hence, interpretive insights contribute to identifying causal tendencies, while causal analysis helps explain the conditions under which certain interpretations emerge and become consequential (Wynn & Williams, 2012). Such epistemology is particularly suited to the study's focus on how actors, including electricity retailers, prosumers, and regulators, make sense of and act upon emergent opportunities in energy flexibility. At the same time, it acknowledges the existence of broader regulatory, infrastructural, and technological systems that influence these sense-making processes

The research draws on semi-structured interviews, industry documents, and contextual materials to explore how actors make sense of and respond to emerging developments. However, these accounts are not taken as direct reflections of an objective reality. Instead, they are treated as windows on how different actors engage with, and are shaped by, underlying structural forces and institutional arrangements. The goal is not to generate generalizable laws but to develop context-sensitive explanations that illuminate patterns of agency, coordination, and systemic change. This aligns with critical realism's post-positivist orientation, which prioritizes explanatory depth over the mere identification of surface-level regularities (Easton, 2010).

Axiology refers to the role of values that underpin the research process (Saunders et al., 2012). This dissertation adopts a value-aware stance, recognizing that the topic of

energy flexibility is deeply entwined with normative concerns such as sustainability, resilience, and the democratization of energy systems. Rather than striving for detached neutrality, the research acknowledges the transformative aspirations of many actors involved in shaping the future of energy systems in Finland. This orientation also reflects the researcher's own position as an engaged scholar. While striving for analytical rigour and empirical grounding, the researcher recognizes that all knowledge is produced from a particular vantage point (Alvesson & Sköldberg, 2018; Finlay, 2002). Reflexivity was employed throughout the research process, especially during interviews and analysis, to remain cognisant of personal biases, theoretical predispositions, and contextual influences. That approach included active reflection during interviews, critical engagement with emerging themes during analysis, and iterative sense-making with co-authors and informants (e.g., Tracy, 2010).

Moreover, ethical considerations, namely informed consent, confidentiality, and respect for participant perspectives, were integral to the study design and implementation. Participants were treated as co-constructors of knowledge, and their perspectives were respected not only as data points but as valuable insights into the complexities of market shaping (Guillemin & Gillam, 2004; Tracy, 2010). This aligns with the epistemological commitment to understanding markets from the inside out by considering the experiences and interpretations of those who enact them. Such an approach is grounded in interpretivist enquiry, which values thick description and insider perspectives to reveal how actors make sense of and engage with socio-material systems (Flyvbjerg, 2001).

While Section 3.2 explains the research design choices, it is also important to consider the methodological implications of the philosophical positions outlined above. Given the study's critical realist ontology and epistemology, an abductive research logic was adopted. Abduction is well suited to research that moves iteratively between theory and empirical data, allowing the researcher to refine conceptual understandings in light of real-world complexity (Timmermans & Tavory, 2012). Such orientation supports the dissertation's aim to develop an explanatory, midrange theory by linking observed practices and actor perspectives to deeper market-shaping dynamics. It is also consistent with the study's qualitative case study design, which emphasizes contextually embedded knowledge and interpretive depth. The specific methods of data collection, case selection, and analytical techniques are explicated in the following sections. The research philosophy and the methodological choices of the dissertation are summarized in Table 5.

Table 5. Research philosophy

Dimension	Position adopted	Relevance to study
Philosophical paradigm	Critical realism	Enables the investigation of both observable phenomena and the deeper, institutional, and socio-technical mechanisms that shape them; both are necessary for the study of market transformation.
Ontology (Assumption about the nature of reality)	Stratified Reality (Real / Actual / Empirical)	Acknowledges that observable changes in the electricity market are underpinned by hidden structures and historical dependencies. Avoids simplistic objectivist/subjectivist dichotomy.
Epistemology (Assumption about the optimal ways to enquire into the nature of the world)	Situated Explanation (Critical Realist Epistemology)	Combines depth-seeking explanations with sensitivity to actors' sense-making in context. Recognizes knowledge as fallible, socially situated, and theory-laden.
Axiology (Assumptions about the role of values in research)	Value-aware and Reflexive	Recognizes the normative dimensions of sustainability and energy democratization. Reflects the researcher's engaged but critically reflexive stance.

3.2 Research design and chosen methods

The research design of this dissertation is rooted in a qualitative tradition with its emphasis on uncovering how diverse actors collectively shape the market through BMI, platform governance, and value co-creation. Qualitative research is particularly fitting when the goal is to examine social processes, actor perspectives, and institutional change within real-world contexts (Fisher, 2007). Rather than testing

predefined hypotheses or pursuing statistical generalization, such methods enable researchers to engage with empirical realities in a flexible and interpretive manner, thereby emphasizing meaning-making, negotiation, and situated action (Denzin & Lincoln, 2011; Miles et al., 2014). In this dissertation, the research questions are processual and exploratory in nature, as they not only ask what is changing in the electricity market but also how and why actors contribute to market shaping under evolving technological, regulatory, and societal conditions. Such questions demand a design capable of attending to both actor-level sense-making and broader structural influences, precisely where qualitative inquiry excels. Moreover, because energy flexibility remains a relatively novel and developing concept within the electricity market, the phenomenon requires methodological openness and contextual sensitivity, qualities best served by adopting qualitative approaches rather than rigid, variable-driven quantitative designs.

A case study strategy was adopted to explore these market-shaping dynamics in depth. A case study design enables an in-depth investigation of contemporary phenomena in their real-life contexts, particularly when the boundaries between the phenomenon and its context are blurred (Yin, 2015). This is especially relevant in infrastructure-heavy, highly institutionalized settings such as electricity markets. The case study approach supports the dissertation's aim to produce context-sensitive, empirically grounded insights into the dynamics of market transformation. Given the heterogeneous nature of the research questions, the study employs both multiple and single-case study designs across its three constituent articles.

Article I applies a multiple-case-study approach, drawing on three focal cases of electricity retailers in the Finnish market. This design enables comparison across different organizational dynamics and strategic responses to illuminate the microfoundation aspects of BMI in the energy sector. The multiple-case approach helps identify patterns in how retailers adapt their business models in light of regulatory, technological, and consumer changes.

Articles II and III employ single-case study designs to investigate specific empirical contexts in greater depth. Article II focuses on the design and governance of a local flexibility market in Finland. The case was selected for its revelatory value and represents the first commercial attempt in Finland to establish a demand-side flexibility platform with collaborative actor involvement. The single-case design permits a detailed examination of the platform's architecture, governance choices, and stakeholder coordination mechanisms, as well as their implications for the broader evolution of the electricity market. The article thus contributes to the theoretical debate on platform-mediated market shaping.

Article III investigates prosumer flexibility and ecosystem-level value co-creation. The study focuses on the Finnish electricity ecosystem as a whole but concentrates on specific actor constellations (e.g., emerging versus incumbent actors) and their resource integration practices. The case illustrates how prosumer engagement with flexibility initiatives contributes to a reconfiguration of market structures and actor roles. A single-case design is appropriate here because it enables an in-depth, process-oriented analysis of complex co-creation dynamics and their institutional embeddedness.

The methodological logic that guides the dissertation as a whole is abductive. Abduction refers to a research process that moves iteratively between theory and empirical data, allowing conceptual frameworks to evolve as new insights emerge (Dubois & Gadde, 2002; Timmermans & Tavory, 2012). Rather than beginning with a fixed theoretical model or purely inductive reasoning, this dissertation uses sensitizing concepts (i.e., BMI, platform governance, and value co-creation) from the broader market shaping literature as starting points for its empirical enquiry. These concepts are then refined, challenged, or extended in light of field data. Importantly, although only Article I expressly labels its approach as abductive, all three articles were developed using similar logic. This is evident in their iterative engagement with theory and data, flexible data collection procedures, and focus on explanatory insight over purely descriptive or inductive inference (e.g., Dubois & Gadde, 2002).

This abductive orientation is particularly suited to the research aims of this dissertation, which seeks to contribute to theory development rather than theory testing. For example, early data from platform developers and regulators revealed tensions regarding the participation threshold, which led to a deeper engagement with platform governance literature. Similarly, observations on localized prosumer activity led to a stronger emphasis on value co-creation and institutional embeddedness, particularly with respect to local and national energy regulations, market design rules, and cultural attitudes toward collective energy action. Abduction thus supports the construction of midrange theory grounded in empirical observations that is also informed by broader conceptual frameworks (Ketokivi & Choi, 2014). This logic is further reflected in the comparative, ecosystem-level design of the dissertation. While each article addresses a specific research question and empirical setting, all are embedded within the broader context of the Finnish electricity market. The comparative structure supports both within- and cross-case insights, helping to uncover demi-regularities—recurring patterns suggesting the operation of underlying causal mechanisms (Wynn & Williams, 2012). The empirical data collection and analysis processes were designed to reflect this contextual and iterative logic and are detailed in the following section.

3.3 Data collection and analysis

Building on the abductive, interpretivist approach outlined above, the data collection strategy was designed to trace how actors interpret and respond to emerging opportunities in energy flexibility. To support this aim, the studies employed theoretical sampling (Eisenhardt, 1989; Patton, 2015), prioritizing cases and participants that offered information-rich perspectives on BMI, platform governance, and value co-creation. Semi-structured interviews served as the primary method of data collection, complemented by document analysis and participation in collaborative research settings. Table 6 provides an overview of the interview material across the three articles, while Table 8 summarizes the use of archival and secondary sources.

Table 6. Summary of the interviews

Article	Data Collection Period	Interviews (n) & Actor Types
Article I – Business Model Innovation	2020–2023	25 interviews with retailers, business developers, regulators, and experts
Article II – Platform Governance	2020–2022	14 interviews with system operators, platform developers, public authorities, and EU benchmarking cases
Article III – Value Co-creation	2019–2024	18 interviews with system operators, retailers, aggregators, prosumers, communities, platform developers, and policymakers
Total	2019–2024	**57 semi-structured interviews** across diverse actor categories

Article I employs a multiple-case study design to examine the microfoundations of BMI across three medium-sized Finnish electricity retailers. Case selection criteria included geographic diversity, independence from multinational ownership, and active BMI. Sixteen semi-structured interviews were conducted with 12 business development professionals in two phases (Aug–Dec 2021 and Feb–Oct 2023), supplemented by live case insights with one of the retailers participating in a master's-level business development course. Interviews were conducted via Zoom, recorded, and transcribed verbatim. Snowball sampling ensured access to relevant organizational personnel (Patton, 2015). In addition, a broader sectoral analysis was conducted between August 2020 and July 2021 to contextualize firm-level insights and inform the case selection process. This effort included nine semi-structured interviews with market experts, regulators, and industry observers to capture

evolving trends, challenges, and opportunities related to BMI in the Finnish electricity sector. Data analysis followed an abductive approach, combining theory-led sensitization and inductive theme development. Coding in NVivo 14 was initially guided by the literature on microfoundations and refined iteratively through team discussions. The thematic analysis drew on Braun & Clarke's (2006) framework, with the data structured according to the Gioia methodology (Gioia et al., 2013) into first-order concepts, second-order themes, and aggregate dimensions. The study's critical realist and interpretivist foundation supported a focus on explanatory depth and contextual embeddedness.

Article II applies an exploratory single-case study design to investigate the governance and institutional dynamics of local flexibility markets (LFMs). Due to the emerging and context-specific nature of LFM development in Finland, this design enabled an extensive analysis of actor relationships, policy contexts, and technological systems. Data collection occurred in two stages: first, ten semi-structured interviews were conducted with Finnish stakeholders, including system operators, platform developers, and public authorities. The interview guide was structured into three parts: sector context, stakeholder-specific themes, and open-ended reflection. The second stage involved four benchmarking interviews were with representatives of European LFM projects operating in similar regulatory and technological environments. These interviews focused on platform business models, governance practices, and policy alignment. Purposeful sampling targeted participants with strategic visibility into platform design and implementation (Yin, 2009). Analysis proceeded via content coding and abductive iteration between emerging patterns and theoretical constructs (Patton, 1990). Insights were organized into structured case records and visualized through thematic mapping following the Gioia methodology. The final case narrative highlights the key governance mechanisms and institutional enablers shaping LFM development.

Article III employs a single-case study design to investigate the integration of prosumer flexibility and value co-creation in Finland's electricity sector. Finland was selected due to its advanced digital infrastructure, regulatory experimentation, and growing prosumer activity. Eighteen semi-structured interviews were conducted between September 2019 and May 2022, with a follow-up in June 2024 to capture the post-energy-crisis dynamic. Participants included system operators, retailers, aggregators, energy communities, platform developers, and policymakers. The interviews followed a flexible guide structured into three parts: sector context and flexibility needs, organizational perspectives, and emergent views on value co-creation and resource integration. The study employed ecosystem architecture development (Ma et al., 2021) as a conceptual tool, combining business ecosystem thinking with system engineering and energy transition literature. Sampling was

purposeful, emphasizing information richness over statistical generalization (Yin, 2009). The timeline of interviews allowed the incorporation of developments such as the COVID-19 pandemic, the war in Ukraine, and major national energy policy shifts. The data analysis followed a three-stage pattern-based content analysis approach: descriptive summarization, cross-actor pattern recognition, and abstraction into second-order insights. This process was supported by a Gioia-inspired methodology. Coding was primarily conducted by the lead author to ensure the consistency of criteria, while the co-authors validated the process throughout. Insights from a national flexibility project involving three co-authors informed the analysis (e.g., Fielding & Schreier, 2001). Data saturation was deemed to have been achieved when no new substantive insights emerged in the final round (Fusch & Ness, 2015; Guest et al., 2006). Additional benchmarking interviews (2020–2024) with six European prosumer flexibility platforms provided comparative validation and broadened the study's relevance beyond the Finnish context. Table 7 summarizes the design and methodological choices of the three articles.

Table 7. Methodological choices in the dissertation papers

Dimension	Article I	Article II	Article III
Study Focus	Microfoundations of BMI	Governance and institutional dynamics of LFMs	Integration of prosumer flexibility and value co-creation
Methodological Logic	Abductive	Abductive	Abductive
Case Study Design	Multiple-case study	Exploratory single-case study	Exploratory single-case study
Empirical Context	Three Finnish electricity retailers	Finnish LFM governance ecosystem, with European platform benchmarks	Finnish electricity ecosystem, with benchmarking of six European prosumer flexibility platforms
Sampling Strategy	Theoretical and snowball sampling	Purposeful sampling	Purposeful sampling
Interview-guide Structure	Focused on: business development, microfoundations	Three-part guide: context, actor-specific insights, and open reflections	Three-part guide: sector context, organizational themes, and co-creation dynamics

Dimension	Article I	Article II	Article III
Analysis Method	NVivo 14; thematic analysis, Gioia methodology	Content coding, case records, Gioia methodology	Content coding, Gioia methodology
Analytical Logic	Abductive reasoning	Abductive reasoning	Abductive reasoning
Saturation Approach	Iterative coding and validation with the team	Saturation based on repetition and conceptual closure	Saturation confirmed through follow-up interviews

In addition to the interviews, archival and secondary sources were also systematically integrated into the analysis (e.g., Bowen, 2009; Ventresca & Mohr, 2002). These included company reports, policy documents, press releases, industry reports, benchmarking exercises, and project notes from workshops and seminars. Archival sources served three complementary roles: (i) providing contextual knowledge that informed interview guides and case selection, (ii) offering independent accounts that enabled triangulation of interview insights, and (iii) supporting validation of emergent findings by situating them within broader sectoral developments.

Table 8. Role of archival data across the three articles

Article	Archival Sources	Role in Analysis
I	Company reports, press releases, media articles, public presentations; notes from "live case" teaching interactions	Informed case selection and interview design; provided independent context on firm activities; validated themes emerging from interviews.
II	Project materials (e.g., workshop notes, internal memos), industry and policy reports	Complemented stakeholder interviews by clarifying governance arrangements and policy frameworks; supported triangulation of platform practices across contexts.
III	Benchmarking of European prosumer platforms; company reports, industry documents; project workshop notes	Offered broader sectoral context; triangulated interview insights with ongoing regulatory/technological developments; benchmarking documents provided comparative validation.

3.4 Trustworthiness and rigor of the study

The methodological rigour of this dissertation is rooted in principles of transparency, contextual sensitivity, and interpretive depth. In line with its critical realist and interpretivist positioning, the research aims for robust, theory-informed explanations of how diverse actors shape the Finnish electricity sector. To evaluate the trustworthiness of the methodological choices across the three empirical studies, this section draws on established qualitative research quality criteria: credibility, dependability, transferability, and confirmability (Lincoln & Guba, 1985).

Credibility relates to the plausibility and coherence of research interpretations in light of empirical data. Semi-structured interviews with purposefully selected participants served as the primary data source for all three articles. The participants were chosen based on their expertise and embeddedness in the focal phenomena and ranged from electricity retailers, DSOs, and platform developers to regulators, community energy organizations, and prosumers. That purposive sampling enhanced the depth and relevance of the insights obtained, particularly in a rapidly evolving and highly institutionalized sector. The research employed multiple credibility-enhancing techniques. Triangulation was achieved by systematically combining interview data with archival and secondary sources, such as company reports, policy documents, media releases, and workshop notes (Lincoln & Guba, 1985). In Article I, the integration of a live case study into a master's-level teaching course provided an additional layer of observational evidence. In Article II, comparative benchmarking interviews with European LFM initiatives helped validate and contrast emerging insights. Article III leveraged the authors' involvement in a national flexibility research project, which facilitated access to project memos and additional expert interactions. Furthermore, coding and analysis procedures were transparently documented. The data informing Article I were managed in NVivo to maintain traceability and support code reuse across iterations. In Articles II and III, manual coding was chosen for its flexibility in handling longitudinal, cross-actor narratives. Lastly, the coding for all articles was guided by abductive reasoning, which involved iteratively moving between emerging empirical themes and sensitizing theoretical constructs (Dubois & Gadde, 2002).

Dependability refers to the logical consistency and replicability of the research process (Lincoln & Guba, 1985). Interview protocols were tailored to each study's research questions as well as theoretical framing and were refined through pilot testing and author reflection (Saunders et al., 2012). The fieldwork was conducted over several years (2019–2024), allowing prolonged engagement and iterative refinement of the data collection strategy. To ensure interpretive consistency, team-based coding and validation were applied to each article. One author led the initial

coding, while others reviewed and discussed emerging categories and patterns. These peer discussions not only improved intersubjective agreement but also reduced individual researcher bias. In all cases, memoranda were used for reflection, and audit trails were maintained, providing a transparent account of analytical decisions and changes over time. The Gioia methodology (Gioia et al., 2013) was applied across all three papers, offering a rigorous structure for theme development. First-order codes captured participant-centric terminology and meanings, while second-order themes abstracted these into broader theoretical constructs.

Transferability refers to the extent to which a study's findings can be applied to other contexts, settings, or actor groups (Lincoln & Guba, 1985). While statistical generalizability is not the aim of qualitative case research, this dissertation contributes to analytical generalization by offering context-rich insights that may resonate with similar settings (Yin, 2009). The Finnish electricity sector is characterized by its digital infrastructure, regulatory openness, and prosumer engagement which makes it a productive empirical location for examining market shaping whose findings may be applicable in other sustainability-oriented, infrastructure-intensive industries. Theoretical sampling across all three studies ensured diversity in terms of organizational form, actor role, and geographical location. For example, in Article I, case companies from the western, central, and eastern regions of Finland were selected based on their innovation track record and independence from international ownership. Article II incorporated both national stakeholders and European benchmarks to capture a broader governance landscape. In Article III, cross-sectoral perspectives, including those of platform developers, policymakers, and consumers, provided a holistic view of prosumer flexibility. Thick descriptions of cases, actor roles, and institutional dynamics were included in all articles to enable readers to assess the applicability of findings to other contexts.

Confirmability refers to the degree to which findings are shaped by the data rather than the researcher's personal motivations or assumptions (Lincoln & Guba, 1985). Reflexivity was maintained throughout the research process. The researcher's background knowledge of the energy industry and sustainability issues was an asset in understanding domain-specific practices and building trust with informants, but it also necessitated ongoing critical self-reflection. To mitigate potential bias, the data analysis process began with inductive coding, allowing empirical themes to emerge before engaging in theoretical mapping and abductive refinement. Research memoranda and peer debriefings were used to check assumptions. Co-authorship of the articles provided further opportunities for external feedback and theoretical triangulation, especially during theme refinement and interpretation. Participant validation was employed in Article I through follow-up discussions with case company managers. In Article III, the final round of interviews in 2024 served as both

a temporal update and a credibility check, reaffirming insights discovered earlier and identifying no major contradictions.

4 SUMMARY OF THE ARTICLES

This section presents the three research articles that form the empirical foundation of this dissertation. It summarizes the key results and contributions of each article individually. The aim is not to restate the theoretical or methodological background discussed in earlier sections. Similarly, implications and synthesis of findings are addressed in the Discussion section. The full texts of the articles are included in Part II of the dissertation (Articles I, II, and III). Author contributions are detailed in the appendices.

Article I, *"Microfoundations for Business Model Innovation: Exploring the Interplay Between Individuals, Practices, and Organizational Design",* is a co-authored empirical study. The first author is Professor Rodrigo Rabetino (School of Management, University of Vaasa). The article was published in the *Journal of Product Innovation Management*, a peer-reviewed journal ranked at 4* by the CABS (AJG 2024) and at Level 3 by the Finnish Publication Forum.

Article II, *"Ushering in a New Dawn: Demand-Side Local Flexibility Platform Governance and Design in the Finnish Energy Markets"*, is a co-authored empirical study. The first author is Nayeem Rahman. The article was published in *Energies*, a peer-reviewed journal ranked at Level 1 by the Finnish Publication Forum.

Article III*, "Prosumer Flexibility as an Enabler for Ecosystem Value Co-Creation: A Resource Integration Approach from the Finnish Electricity Markets"*, is a co-authored empirical study. The first author is Nayeem Rahman. The article was published in *Applied Energy*, a peer-reviewed journal ranked at Level 3 by the Finnish Publication Forum.

4.1 Article I: Microfoundations for business model innovation: Exploring the interplay between individuals, practices, and organizational design

The first article examines how BMI is facilitated through microfoundation mechanisms operating at three interrelated levels: individual, processual, and interactional, as well as structural and design. The study examines how incumbent firms navigate BMI as they adapt to an evolving ecosystem within the Finnish electricity sector, a context marked by technological disruption, regulatory pressure, and heightened customer agency.

While prior research on BMI primarily addresses firm-level strategies and outcomes, this study aims to uncover the underlying elements that enable such innovation in

practice. It asks: *how do key microfoundation elements, notably individual behaviours and organizational processes and design, interact to drive business model innovation?* To answer this question, a multiple-case study involving three mid-sized electricity retailers was conducted.

At the individual level, the study finds that managerial cognitive capabilities are pivotal in enabling business model transformation. Specifically, strategic foresight, opportunity recognition, and the willingness to challenge organizational inertia appear to be key enablers. Managers who possess these capabilities act as internal change agents, navigating ambiguity, aligning stakeholders, and pushing for renewal within rigid organizational contexts. In the face of institutional norms and legacy systems, such individual agency becomes a critical spark for innovation.

At the processual and interactional level, BMI is shown to unfold not as a linear strategic initiative, but through ongoing practices and interactions across different units and stakeholders. The study identifies three processual stages of BMI—opportunity identification, model development, and implementation—each shaped by embedded routines and the flow of communication across teams. Success in these stages depends heavily on internal coordination and the ability to bridge different knowledge domains within the firm. However, inertia also arises from entrenched processes, risk aversion, and the complexities of knowledge translation across silos.

At the structural and design level, organizational configuration significantly affects a firm's capacity to progress BMI. Firms with flatter hierarchies, cross-functional teams, and greater decision-making autonomy at operational levels were better positioned to experiment with and implement new business models. In contrast, hierarchical rigidity, fragmented responsibilities, and path-dependent structures were found to obstruct innovation efforts, particularly during the implementation and scaling phases. Importantly, the study also shows that internal innovation must be complemented by ecosystem engagement. Collaboration with external actors such as technology providers, regulatory bodies, or end users is essential for prototyping, validating, and legitimizing new business models. This reinforces the notion that BMI in energy markets is both an intra- and inter-organizational process.

In summary, this article advances the literature on the microfoundations of dynamic capabilities by providing a multilevel framework that links individual cognition, organizational practice, and structural design to the enactment of BMI. It demonstrates that successful BMI is a cumulative and emergent process shaped by actors and mechanisms operating at different organizational levels. The article provides empirical insights into how incumbent firms in a highly regulated and technically complex sector can navigate transformation. It also suggests how energy

firms might cultivate the cognitive, processual, and structural conditions necessary for adaptive BMI in the face of systemic change.

4.2 Article II: Ushering in a new dawn: Demand-side local flexibility platform governance and design in the Finnish energy markets

The second article in this dissertation investigates the governance and design of digital platforms for local flexibility markets (LFMs) in the Finnish electricity sector. As electricity systems become more decentralized and reliant on distributed energy resources, LFMs are becoming as critical mechanisms for balancing grid needs through demand-side flexibility. Despite the technological maturity of flexibility platforms, the governance and institutional design required to support them remain underdeveloped, particularly in highly regulated, low-liquidity electricity markets. This study addresses the question: *how do market conditions and stakeholders shape emerging local flexibility platform governance choices?*

The article draws on a single exploratory case study set in Finland. It integrates insights from ten semi-structured interviews with key ecosystem actors, as well as comparative analysis from four European LFM projects. The findings reveal a complex interplay involving infrastructural readiness, regulatory constraints, and institutional incentives that shape the evolution of platform governance models. A central contribution of the study is the development of a multidimensional framework for LFM platform governance, comprising four key focus areas: ecosystem readiness, value-creation logic, platform architecture and governance, and platform competitiveness.

Ecosystem readiness emerged as a foundational dimension that is often overlooked. The study identifies infrastructural limitations that create critical bottlenecks; examples include inadequate smart meter capability and the high costs of installing flexibility-enabling devices. Regulatory and cost-related barriers, such as treating flexibility services as operating expenses rather than capital expenditures, further constrain the commercial viability of LFM platforms. The findings suggest that stakeholder willingness, technological and market standards, and smart meter penetration must align before LFMs can function as inclusive and sustainable platforms.

Platform architecture and governance are also central to LFM development. Due to EU regulations, neither transmission system operators (TSOs) nor distribution system operators (DSOs) can own or operate such platforms directly; thus, responsibility is shifted to third parties. This raises questions around ownership,

control, and neutrality. This raises questions around ownership, control, and neutrality. The study finds that platform design must accommodate complex market dynamics, which ensures transparency, equitable penalties for non-compliance, and standardized rules for aggregators and other intermediaries. Governance frameworks must also navigate sensitive power asymmetries between emerging players (e.g., aggregators) and established actors (e.g., electricity retailers), ensuring balanced participation and minimizing institutional resistance.

Value creation logic in LFMs is contingent upon designing credible and appealing propositions for both institutional actors and end consumers. The research highlights that both industrial and residential participants demand tangible economic benefits, seamless system integration, and low participation barriers. Aggregators play a crucial role in mobilizing small-scale flexibility, but their integration must be carefully managed to avoid conflict with incumbent retailers. Communication emerges as a critical factor in building trust and platform legitimacy, particularly in bridging the gap between B2B-centric infrastructures and B2C user engagement strategies.

Notably, platform competitiveness is shaped by the traditional chicken-and-egg dynamic familiar in multi-sided platforms. Stakeholder coordination, early liquidity generation, and regulatory sandboxing are identified as vital enablers for platform emergence. In the Finnish case, institutional actors such as the TSO is willing to act as "market makers" during early-stage development, but long-term viability depends on establishing robust supply-side participation through incentivizing residential engagement.

A key theoretical contribution of this paper is the cross-fertilization of platform and flexibility markets literature. It contributes to the non-technical stream of LFM research, demonstrating that infrastructural, regulatory, and institutional readiness are preconditions for platform success, particularly in infrastructure-intensive sectors such as energy.

The study presents an empirically grounded perspective on how LFMs are envisioned, debated, and designed within Finland. It also provides a roadmap for regulators, technology developers, and energy firms seeking to navigate the layered complexities of platform development in the energy markets.

4.3 Article III: Prosumer flexibility as an enabler for ecosystem value co-creation: A resource integration approach from the Finnish electricity markets

The third article investigates how prosumer flexibility facilitates value co-creation in the Finnish electricity ecosystem. As demand-side flexibility becomes increasingly important for balancing intermittent renewable energy sources, understanding the mechanisms through which prosumers contribute to ecosystem-wide value becomes critical. Despite growing academic and policy interest in prosumption, the literature has largely overlooked how prosumer flexibility contributes to broader systemic settings, especially in terms of resource integration and actor interdependencies.

This study adopts the SDL framework to conceptualize prosumer flexibility as a collaborative value co-creation process rather than a unidirectional energy service. Utilizing a single-case study of the Finnish electricity market, the research draws on 24 interviews with stakeholders representing utilities, regulators, aggregators, community energy groups, and flexibility service providers from around Europe. The study poses the question: *how does prosumer flexibility facilitate value co-creation in the Finnish electricity ecosystem, and what resources are needed by ecosystem actors to enable this integration?*

A core finding is that delivering value co-creation via prosumer flexibility requires harmonizing diverse resources from emerging and incumbent actors. The paper's findings are presented in relation to three key dimensions of resource integration: resource complementarity, redundancy, and asymmetry.

Resource complementarity emerged as vital for the adoption of prosumer flexibility. Integrating assets such as smart meters, electric vehicles, home energy management systems, and local battery storage enables actors to match capabilities and align around common objectives. For instance, retailers and aggregators can pool existing digital and billing infrastructures to streamline household participation in flexibility markets. Instances of resource redundancy reveal system inefficiency. Examples include duplicated infrastructure investments by multiple DSOs in urban zones or overdeveloped billing systems across established players that could be shared with emerging actors instead. These inefficiencies hinder the ecosystem's ability to effectively absorb and scale prosumer flexibility solutions. Finally, resource asymmetry refers to capability gaps, particularly between incumbents and emerging players. DSOs often lack information and communication technology (ICT) competencies and customer-centric design mindsets, while new actors struggle with financing, regulatory expertise, and network reach. This asymmetry hinders

flexibility scaling; however, it also opens up a space for collaboration. A recurring theme in this regard is the prevalence of "engineer mindset" in incumbent organizations that prioritizes infrastructure over service design, indicating a cultural mismatch that slows innovation.

The study also finds that digitalization, market design, and the evolution of actor roles are essential enablers of prosumer flexibility. While Finland's smart grid and the Datahub[1] initiative support real-time monitoring and prosumer integration, regulatory and infrastructural constraints—especially in rural areas—continue to hamper the adoption of prosumer flexibility. From the perspective of market dynamics, the research identifies the importance of actor interdependencies and collaborative governance. Prosumers, aggregators, retailers, and DSOs are all embedded in a tightly interconnected value chain. Without mutual coordination, innovation risks triggering stakeholder resistance. The study proposes that business models balancing innovation with incumbent welfare are essential to avoid system-wide friction.

Theoretically, this article is among the first to integrate SDL into the prosumer flexibility literature, linking value co-creation to resource alignment in early-stage ecosystem transition. It extends SDL by introducing resource harmonization as a meso-level mechanism that enables alignment between actors with heterogeneous capabilities and incentives. It also introduces the concept of resource harmonization to describe the coordinated orchestration of complementarities across actors. Practically, the study offers insights into how prosumer flexibility adoption can be accelerated through retailer-led energy literacy programmes, improved DSO service competencies, and policies that support grid upgrades and prosumer incentives.

[1] A centralized data exchange for the electricity retail market.

5 DISCUSSIONS

This section addresses the main research question of the dissertation: *how do actors' actions and interactions contribute to market shaping over time?* Drawing on the findings from the three empirical articles, the discussion examines how market shaping unfolds across different layers of agency and coordination, spanning individual firm-level strategies, ecosystem governance, and collaborative resource integration. Each of the following sections corresponds to a sub-question and theoretical lens, analysing how BMI, platform governance, and value co-creation each reveal distinct mechanisms through which actors shape markets. The chapter concludes by synthesizing the cross-article insights into a multidimensional framework.

5.1 The influence of business model innovation on focal actor market shaping

This section addresses the sub-question: *how do focal actors strategically contribute to market shaping in response to external pressures?* Drawing on findings from Article I, this section demonstrates how BMI functions as a dynamic and iterative mechanism through which firms enact market shaping in the Finnish electricity sector. In doing so, it responds to recent calls to explore the microfoundations of market shaping (Storbacka & Nenonen, 2021), emphasizing how individual and organizational actions, situated within a context of regulatory inertia and technological uncertainty, shape evolving market configurations.

The findings support and extend prior conceptualizations of BMI as a strategic mechanism advancing firm adaptation (Teece, 2010; Foss & Saebi, 2017) but also suggest a more proactive and system-shaping role. Electricity retailers in Finland do not merely react to external disruptions but redefine industry structures through experimentation, lobbying, and customer re-engagement. This aligns with the recursive view of markets as performed (Storbacka & Nenonen, 2011), which perceives firms as both responding to and reshaping the institutional conditions they operate under.

A central insight is that technological uncertainty significantly shapes the way BMI unfolds. Firms operate under shifting conditions, where the dominant technological configurations, particularly those concerning the integration of renewables, digital platforms, and smart grid architecture, are not yet stable. That environment forces actors to anticipate multiple possible futures, leading to a proliferation of experimental strategies. The finding confirms earlier work suggesting that early-stage markets are characterized by multiple competing market images and

technological framings (Kindström et al., 2023). It extends the domain by showing how firms attempt to hedge their innovation bets while simultaneously working to shape dominant narratives. Strategic experimentation becomes not only a way of responding to uncertainty but a mechanism through which firms attempt to influence which market pathways become institutionalized.

Regulatory ambiguity compounds this challenge. Firms often anticipate upcoming reforms or act on partial guidance from public authorities. While policy direction regarding flexibility, digital metering, or data exchange is broadly supportive of innovation, its implementation remains vague, delayed, or inconsistently applied. This ambiguity creates friction in the execution of BMI. However, the findings also reveal that firms do not passively wait for regulatory clarity but actively engage in shaping the regulatory discourse. They attempt to influence policy design through lobbying, public consultations, and pilot projects aligned with the frameworks they anticipate. This behaviour mirrors the pattern of institutional entrepreneurship, where actors seek to mobilize resources and legitimacy to alter existing institutional arrangements in their favour (Lawrence & Suddaby, 2006). Accordingly, BMI is revealed to be both a strategic and a political process that is entangled with regulatory negotiation and influence.

Competitive dynamics in the electricity retail sector reinforce the urgency of innovation. Traditional utilities no longer compete solely with their peers but increasingly face disruption from digital-native firms, platform operators, and technology providers. In response, firms adopt BMI as a way to reconfigure their value propositions, emphasizing customer-centricity or digital engagement. However, the findings reveal a persistent tendency toward isomorphism, where firms gravitate toward similar business models (e.g., time-of-use tariffs and home energy management systems), driven by risk aversion and benchmarking. This situation confirms the argument made by Flaig et al. (2021) that market shaping features both proactive and defensive moves. While some actors attempt to push the boundaries of the market, others reinforce existing norms, limiting the scope of systemic transformation.

The relationship between strategy and BMI within organizations is revealed to be a complex one. While strategic clarity and long-term vision are necessary to support shaping efforts, overly rigid frameworks can become obstacles. Firms often evaluate new ideas through filters grounded in existing business logics, which biases decision-making toward incrementalism. This aligns with Chesbrough and Rosenbloom's (2002) observation that dominant cognitive frames within organizations can inhibit the recognition of radically new value logics. The findings demonstrate that firms continuously revise their strategic priorities to reflect evolving conditions, but these

shifts are not merely reactive; instead, they function as intentional market-shaping moves. Firms attempt to shape customer expectations, regulator attention, and partner alignment by signalling their preferred future orientation (e.g., digital-first strategies or energy-as-a-service models).

Organizational structure plays a dual role in shaping BMI outcomes. Flexible structures characterized by flatter hierarchies, cross-functional teams, and knowledge-sharing cultures enable firms to experiment with new offerings and governance models. These findings support the argument of Gavetti et al. (2017) that such conditions promote resource recombination and exploratory learning. However, legacy systems, bureaucratic inertia, and siloed units often restrict the institutionalization of BMI. Firms commonly attempt to navigate these tensions by establishing innovation units or pilot teams. Nevertheless, as O'Reilly & Tushman (2013) posited, those units often struggle with organizational ambidexterity. While they provide protected space for exploration, they risk becoming disconnected from core operations, undermining scalability. The scenario echoes the fragmented and provisional governance seen in early-stage shaping (Kindström et al., 2023), where innovation is decoupled from formal strategy and lacks organizational integration.

The findings of the current research indicate that entrepreneurs, managers, and employees can act as institutional entrepreneurs, identifying opportunities and challenging dominant logics, and also mobilizing support for change (Lawrence & Suddaby, 2006). This micro-level agency is particularly salient during the formative phases of BMI. In the absence of clear top-down mandates, mid-level actors and cross-functional teams might initiate change through informal coalitions, exploratory workshops, or external engagement. Our findings further indicate that middle managers are especially important: situated between strategic leadership and operational units, they translate broad innovation goals into feasible projects, connect internal actors with external stakeholders, and champion cross-silo coordination (Kindström et al., 2023). They also help nurture psychological safety, encourage experimentation, and enable cultures where failure is tolerated and learning institutionalized (O'Reilly & Tushman, 2013).

A key insight from the findings is that firms developing BMI strategies frequently leverage knowledge from adjacent industries, such as the telecommunications and digital platforms sectors. This reinforces the view of BMI as a trans-sectoral process involving the import, adaptation, and recombination of practices from other domains (e.g., Kavadias et al., 2016). Firms look outward for inspiration and legitimacy, borrowing pricing models, service architectures, or customer interfaces from those sectors they perceive to be more advanced in digitalization. However, our findings indicate that these adaptations often falter at the scaling stage, especially when

organizational routines or market logics are incompatible. The lack of structured learning processes (e.g., formal feedback loops or post-pilot evaluations) further undermines the ability to convert experimentation into systemic change.

The contextual specifics of the Finnish electricity market are essential for understanding these patterns. Finland combines high levels of digital infrastructure with a socially embedded energy regime. Public ownership remains strong, and regulatory bodies tend to favour stability and incrementalism. While these features support certain forms of experimentation (e.g., pilots enabled by smart metering infrastructure), the associated conservative procurement processes, political caution, and high consumer trust in legacy providers ultimately constrain radical innovation. This duality of being innovation-friendly yet structurally conservative means that firms operate in a space of bounded strategic flexibility. Accordingly, a key finding is that market shaping through BMI is possible but contingent upon navigating institutional lock-ins and aligning with public-interest logics.

The findings from Article I contribute to the literature by demonstrating that BMI acts not only as an internal firm-level innovation process but also as a strategic mechanism through which actors attempt to shape market configurations. It links individual agency (through institutional entrepreneurs) with organizational-level enablers, such as strategic alignment and governance structures, and points towards emerging connections with institutional influence through regulatory engagement and agenda-setting. Nevertheless, individual agency alone is insufficient for sustained transformation. Firms must establish supportive structures, incentives, and learning mechanisms to translate entrepreneurial efforts into broader market reconfigurations. These dynamics are explored further in the following sections, which examine how platform governance (Article II) and value co-creation (Article III) contribute to the institutionalization of market shaping at the ecosystem level.

5.2 Collective market shaping through local energy flexibility platforms

This section addresses the second sub-question: *in what ways do coordination mechanisms enable collaboration across an evolving market ecosystem?* Drawing on findings from Article II, this section examines how LFMs function not merely as intermediaries in executing transactions but as market shaping agents. Unlike those focal actors who pursue market shaping through internal strategic action, platforms shape markets through the design and governance of participation structures, pricing mechanisms, access rules, and institutional coordination (De Oliveira & Cortimiglia, 2017). By doing so, they instantiate a distinct form of collective market shaping

grounded in the distributed agency of ecosystem participants and the architectural logic of platform governance.

The findings indicate that fragmented intraday electricity markets risk becoming low-liquidity islands, undermining the viability of energy flexibility platforms. This points to a fundamental challenge in early-stage market shaping, that is, ensuring supply and demand are sufficiently balanced to permit stable transactions (e.g., Katona et al., 2011). Unlike traditional markets that evolve organically, platforms must be intentionally designed to structure liquidity through participation rules, entry incentives, and transaction mechanisms (Tura et al., 2018). One key enabler of liquidity is reducing entry barriers, allowing prosumers and small-scale flexibility providers to participate. However, the findings suggest that household-level participation remains inefficient due to high onboarding costs, necessitating the development of aggregation mechanisms to integrate smaller consumers into the market. This observation is consistent with the work of Rahman et al. (2021), which highlights that while LFMs aim to enable decentralized participation, the transaction costs, technical requirements, and behavioural barriers common in individual households often necessitate a role for aggregators. In this sense, aggregation emerges not merely as a logistical workaround but as a strategic governance decision that mediates access, reduces coordination complexity, and ultimately shapes who can participate in the market.

The study highlights a critical facet of platform design: the need to reconcile infrastructural and operational asymmetries across system levels. The findings show that LFMs must balance the flexibility needs of TSOs, which transport high-voltage electricity, and the DSOs, which manage power distribution at the local level. Since TSOs require centralized flexibility and DSOs operate at a regional level, energy flexibility platforms must mediate access to shared resources to prevent conflicts and inefficiencies. The findings suggest that market-based flexibility procurement by DSOs, particularly in rural areas, could significantly reduce grid investment costs, especially where high electricity transportation costs drive up prices. This supports Fehrer et al.'s (2018) view of platforms as actors reconfiguring resource flows and reshaping market structures. Moreover, the role of platforms in organizing actor participation and redefining coordination practices resonates with Mele et al. (2015), who emphasize the performative capacity of market arrangements to reconfigure industry logics through architectural design.

International benchmarking further illustrates how platform-driven market transformation can be implemented. The Dutch electricity sector serves as a relevant reference for Finland as it is a frontrunner in smart grids, renewable energy integration, and consumer-centric energy technologies. The Netherlands employs a

platform approach to facilitate TSO-DSO cooperation, ensuring efficient flexibility trading and market scalability. Given Finland's energy flexibility ambitions, adopting similar governance mechanisms could streamline system operator coordination, enhance grid efficiency, and establish a scalable flexibility platform.

Crucially, energy flexibility platforms offer a structural shift, transforming flexibility from an embedded grid function into a tradeable market asset. Traditionally, flexibility was an integrated feature of grid stability; however, platform-based mechanisms commodify it, enabling a competitive marketplace where flexibility resources are actively bought and sold. By externalizing previously internalized grid functions, platforms introduce economic incentives that redefine market participation. This transformation is particularly evident in localized energy trading, where platforms facilitate peer-to-peer transactions between distributed energy resources, such as solar panels, electric vehicles, and battery storage. This development aligns with actor-driven market shaping, as it involves reconfiguring value networks by shifting transactional boundaries (Nenonen et al., 2019). Additionally, through dynamic pricing models and engagement frameworks, these platforms aim to reshape energy consumption behaviours by shifting consumers from passive users to active market participants. However, as Smallbone (2004) argues, such transformations depend not only on monetary incentives and information dissemination but also on how embedded consumer practices, preferences, and infrastructures are reconfigured, indicating that consumer-driven change is often more aspirational than guaranteed.

Moreover, just as consumer-led transformation remains difficult to realize, incumbent actors also exhibit deep-rooted structural resistance to change. Despite platforms being designed to engage both supply- and demand-side participants, adoption is slowed by cognitive and institutional inertia within legacy organizations. Many firms, particularly large industrial players, remain accustomed to traditional electricity markets where flexibility is embedded in long-term grid planning rather than actively traded. Such entrenched mental models hinder platform adoption by narrowing actors' interpretations of flexibility as a market asset. That assertation aligns with Storbacka & Nenonen (2011), who argue that market shaping requires not only new offerings or practices but a reconfiguration of mental models since these models define what market configurations are feasible or even considered legitimate.

Regulatory measures exert a dual influence on market shaping, as they both enable constrain. Current regulatory frameworks favour centralized grid investments over market-based solutions, reinforcing structural biases that limit the development of decentralized energy markets. A principal example is the categorization of flexibility procurement as an operational expense rather than a capital investment, which

historically made it less attractive financially than traditional infrastructure upgrades. Such constraints discourage firms from investing in new models, illustrating how institutional arrangements shape the feasibility of new business models. These effects align with theories emphasizing regulatory change as a market-shaping mechanism, where institutional work actively reconfigures market structures to enable new value creation (Baker et al., 2019; Nenonen & Storbacka, 2021). However, regulatory instruments can also actively facilitate market innovation. The EU's Clean Energy Package, for instance, strengthened the institutional legitimacy of flexibility markets by mandating demand-side integration into grid operations.

The study highlights that governance plays a decisive role in operationalizing energy flexibility platforms as market-shaping instruments. How platforms are governed determines whether they facilitate an inclusive and competitive market environment or entrench existing power structures. Governance decisions determine platform boundaries, participation structures, and market accessibility, strengthening the view that platforms emerge through active configuration through governance decisions (e.g**.,** Gawer, 2021**).** A crucial aspect of this process is ownership and leadership structure, which are fundamental to determining market access and competition (Tura et al., 2018). The governing body of the platform can influence the extent to which flexibility markets promote inclusivity or reinforce the dominance of incumbents. If governance mechanisms prioritize open access, market shaping encourages competition; if incumbent-led governance prevails, existing power structures may persist (Kaartemo & Nyström, 2021). Operational rules and participation processes also play an important role in market evolution and transactional efficiency. It particularly determines participation criteria, compliance mechanisms, and transaction rules balancing reliability with innovation. For instance, penalties for non-delivery maintain operational discipline, while automated bidding increases prosumer participation. By designing decentralized yet structured participation frameworks, platform governance facilitates ecosystem-wide actor engagement with regulatory stability, which has been shown to accelerate market transformation (Baker & Nenonen, 2020).

Effective coalition-building and institutional alignment are critical to the scalability and interoperability of flexibility markets, as these depend on integrating heterogeneous actors and systems through relational and constitutive ties (Brusoni & Prencipe, 2009). Platform administrators must coordinate with stakeholders such as TSOs, DSOs, aggregators, and retailers to ensure that the market functions as a cohesive system rather than as a series of fragmented, isolated initiatives. While models for inter-DSO collaboration exist (e.g., the Dutch model), Finland's highly fragmented energy market, comprising over 70 DSOs, presents a governance

challenge for standardization. Aligning such a diverse set of institutional actors within a coherent platform governance structure is an essential market-shaping task (Nenonen & Storbacka, 2021).

Another key governance aspect shaping the market is data security and privacy protocols, which are crucial for maintaining transparency and fostering participant trust (e.g., Fürstenau et al., 2019). Our findings indicate that the Finnish Datahub is pivotal in supporting flexibility platforms by providing real-time access to consumption and production data. This infrastructure enables automated transactions, improves forecasting accuracy, and lowers transaction costs. By reducing information asymmetries, the Datahub strengthens the legitimacy of market-based flexibility procurement and reinforces the role of platforms in structuring a transparent, data-driven electricity market (Fenwick et al., 2019). However, as Parker & Van Alstyne (2018) warned that excessive transparency without appropriate privacy safeguards can erode trust, discourage participation, and compromise the institutional credibility of the platform itself. This risk that data governance decisions undermine platform legitimacy has not been sufficiently addressed in energy platform literature, where transparency is often treated as inherently beneficial. Our findings suggest that trust-building is not merely a technical issue but a strategic concern that directly influences market configuration.

Pricing models and revenue-sharing arrangements are critical determinants of platform sustainability. A market-based pricing structure, as observed in the Finnish energy sector, reinforces the notion that flexibility should be treated as a tradeable commodity rather than a regulated service. However, governance decisions must also address conflicts over revenue distribution—particularly between retailers and aggregators over unconsumed energy profits. To ensure long-term viability, platforms need transparent financial models that provide equitable returns for all participants. That should include mechanisms to support smaller flexibility providers and prevent monopolistic behaviour from dominant actors, a risk well-documented in the platform literature (e.g., Tiwana et al., 2010).

Ultimately, a critical governance challenge lies in striking a balance between autonomy and control, ensuring that platforms provide sufficient freedom for participants to innovate while maintaining oversight to safeguard stability and compliance. The findings suggest that highly centralized governance structures may inhibit market development, while overly decentralized models risk operational inefficiencies and regulatory misalignment. Although striking this balance is complex, evidence from successful platforms in other sectors shows that it can be achieved (Parker & Van Alstyne, 2018).

In summary, platform governance is not merely a set of administrative functions but a strategic market-shaping tool that determines who participates, how transactions occur, and how industry-wide regulatory and economic frameworks evolve. Viewed as a whole, governance decisions dictate whether energy flexibility platforms become inclusive and competitive markets or remain constrained by existing power asymmetries. While platforms structure participation through top-down governance, the next section explores how prosumer-enabled energy flexibility redefines value creation through bottom-up engagement.

5.3 Value co-creation and resource integration in market shaping: the role of prosumers and digital infrastructures

This section addresses the third sub-question of the dissertation: *how do actors align and integrate resources to co-create value leading to market shaping?* Drawing on findings from Article III, it shifts the focus from the strategic and structural dimensions of firm- and platform-led shaping towards the more distributed, emergent, and interactional processes through which markets are shaped in practice. The analysis centres on how resource integration and value co-creation—particularly among prosumers, utilities, aggregators, and digital service providers—enable new forms of participation, reconfigure actor roles, and contribute to the transformation of institutional and infrastructural arrangements within the electricity ecosystem.

The findings indicate that Finland's increasing reliance on renewable and nuclear energy amplifies the strategic importance of prosumer technology, such as heat pumps, electric vehicles, and smart meters that facilitate demand-side modulation. In SDL terms, these technologies extend the operant resources of prosumers, enabling them to participate in system balancing, a function traditionally monopolized by industrial actors (Vargo & Lusch, 2016). In line with Prahalad and Ramaswamy's (2004) DART model, such technologies facilitate dialogue, access, risk assessment, and transparency, thereby positioning consumers as active co-creators of market value. These developments are consistent with existing research findings that value co-creation increasingly transcends firm–consumer dyads, emerging as a distributed and systemic process embedded within the broader energy ecosystem (Kaartemo & Nyström, 2021; Baker et al., 2019).

The findings indicate that the digitalization of the electricity grid is a critical enabler of market transformation, providing the necessary infrastructure for the real-time exchange of energy data. It allows prosumers to monitor, manage, and optimize their energy consumption and production in accordance with system-level requirements.

Moreover, the central electricity market information exchange, Datahub, is pivotal in institutionalizing value co-creation practices. As a service platform, it facilitates the integration of real-time resources and supports coordinated engagement between ecosystem actors. At the user interface level, smart meters and automated systems (e.g., home energy management systems) function as interaction points for resource integration. They enable synchronization between prosumer flexibility and grid-level demands, transforming passive consumption tools into active, distributed grid resources. In doing so, these technologies serve as the connective tissue for emergent resource constellations created through continuous processes of sensemaking and sensegiving (e.g., Kleinaltenkamp et al., 2022).

While traditional market-shaping literature often focuses on firms and regulators as central shapers (Nenonen & Storbacka, 2021), the findings from Article III suggest that prosumers, particularly those engaged through community frameworks or intermediaries are becoming grassroots contributors to market transformation. Their growing role in managing peak demand and providing localized flexibility expands market boundaries, a defining feature of market-shaping strategies (Flaig et al., 2021). However, such participation is contingent on clear, tangible incentives, especially monetary ones. This pragmatism challenges the normative framing of sustainability as the primary driver of transformation. Syyväri et al. (2025) observed a similar dynamic and argued that even actors with strong environmental commitments must access stakeholder-specific, often non-environmental, incentives to gain market traction. These patterns suggest that prosumers are not merely responding to preconfigured market designs but are actively shaping them as co-designers of evolving market configurations in line with the SDL view of distributed value creation (Vargo & Lusch, 2016).

It is important to note that market shaping is not always deliberate; it can also emerge unintentionally through the activation of loosely engaged actors who begin to perceive new benefit structures are relevant (e.g., Purchase et al., 2023). This dynamic is particularly evident among prosumers and community energy initiatives, whose participation in flexibility schemes might influence market configurations despite the absence of strategic intent. Our findings show that these emergent interactions are contributing to a structural shift in the electricity ecosystem towards a more open, service-oriented configuration in which DSOs, retailers, and third-party intermediaries renegotiate their roles. That shift resonates with Storbacka and Nenonen's (2011) observation that market shaping involves both the restructuring of value networks and the reconfiguration of actor roles through resource integration.

The findings also reinforce the inherently contested nature of market shaping. Incumbent actors may resist change when value chain disruptions threaten profitability. The notion aligns with the work of Baker et al. (2018), who emphasize that collaboration and resistance coexist in shaping markets. Prosumer flexibility challenges established structures but also creates incentives for cooperative transformation, especially when the value pie is expanded through resource integration across stakeholders. It is important to acknowledge that evolution in the Finnish electricity market is not solely driven by linear policy design but also by a combination of top-down initiatives and negotiated, emergent processes. The TSO emerged as an initial market maker, echoing market-shaping literature that emphasizes the role of initiatory actors in reconfiguring institutional arrangements (Baker et al., 2019). Nevertheless, as the process unfolds, role redefinition, such as DSOs transitioning into flexibility facilitators or aggregators scaling prosumer participation, remains contested and partial. The situation reflects how broader transformation unfolds through iterative alignment, resistance, and pragmatic adjustments across the ecosystem.

At the same time, structural barriers persist. Legacy regulations, particularly the reliance on capital expenditures for profitability, create institutional friction that hampers DSOs' transition into flexibility facilitators. Similarly, the rise of independent aggregators presents electricity retailers with both challenges and opportunities. While aggregators are central to managing household-level flexibility, their limited capacity to act as balance-responsible parties due to financial and operational burdens reveals a coordination problem. Furthermore, the sector's fragmentation complicates alignment and delays the stabilization of resource linkages. That situation echoes Kleinaltenkamp et al.'s (2022) concern with the propagation of meaning-laden linkages in fragmented markets. It also underscores the need for shared governance frameworks to align the disparate visions of various actors, as highlighted by Purchase et al. (2024).

Beyond structural and technical coordination, the institutionalization of prosumer flexibility also depends on social enablers such as energy literacy and public trust. While Kleinaltenkamp et al. (2022) emphasize the importance of deliberate sensemaking strategies to stabilize emerging market linkages, our findings show that low public understanding and lingering mistrust of utilities providers inhibit meaningful engagement with flexibility services. The current research aligns with that of Purchase et al. (2024), who observed that the adoption of emerging market practices depends on targeted social investments to raise awareness, as well as to promote legitimacy and perceived relevance, particularly among loosely connected or peripheral actors.

The findings also emphasize that flexibility adoption depends not on isolated technologies but on complementary resource configurations. Battery storage, particularly behind-the-meter systems and electric vehicles, was highlighted as a resource nexus linking households with grid-wide flexibility needs. While these resources were already valuable in local energy contexts, their integration into the broader grid redefines their function and meaning at the system level. The realization supports Nenonen et al.'s (2019) assertion that resources derive strategic value through contextual reconfiguration within evolving market structures rather than that value being an inherent quality.

However, widespread engagement is still constrained by infrastructure gaps, notably the delayed deployment of next-generation smart meters. Here, we observe the temporal misalignment between complementary resources (e.g., platforms and metering systems) becoming a drag on co-creation potential. This challenge aligns with Kindström et al.'s (2023) account of loosely coupled, uncoordinated resources at the fuzzy front end of market shaping, where misaligned actor timelines can hinder the articulation of a shared market image. The findings also highlight structural and cultural resource asymmetries. Compared to TSOs, DSOs lack the market access and digital infrastructure to engage meaningfully in prosumer flexibility. At the same time, an entrenched engineering culture inhibits service-oriented innovation. As prosumers and end users gain prominence as co-creators, market actors must move from machine-centric to service-centric logics, reflecting the operant resource orientation of SDL (Vargo & Lusch, 2004). However, in the absence of institutional champions or representative mechanisms, the engagement of prosumers remains limited, leading to underutilized tangible and intangible resources. This mirrors Flaig and Ottosson's (2022) insights on the need for actor alignment and role support to enable market-shaping participation across a heterogeneous ecosystem.

In summary, while the technical and regulatory foundations for prosumer flexibility are advancing, its system-wide adoption and institutionalization remain constrained by asymmetries in resource access, underdeveloped complementarities, and overlooked coordination opportunities. As the market matures, addressing these barriers will require deliberate resource orchestration, not just among dominant players but also across peripheral actors who hold the key to unlocking demand-side flexibility at scale. Ultimately, the future of energy flexibility depends not only on the diffusion of technology but on the institutional embedding of new resource logics, collaborative norms, and service-oriented identities across the ecosystem.

5.4 Toward a systemic understanding of market shaping: a multi-actor, multi-level, and multi-temporal synthesis

This section synthesizes the empirical insights from Articles I–III to develop a richer, multidimensional understanding of market shaping. Moreover, echoing the theoretical synthesis, we treat BMI, platform governance, and value co-creation as interlinked mechanisms of market shaping. Figure 2 below updates the conceptual framework introduced in Section 1, integrating actor roles, institutional levels, temporal orientations, and intentionality to highlight the complexity and recursive nature of shaping processes in real-world electricity markets.

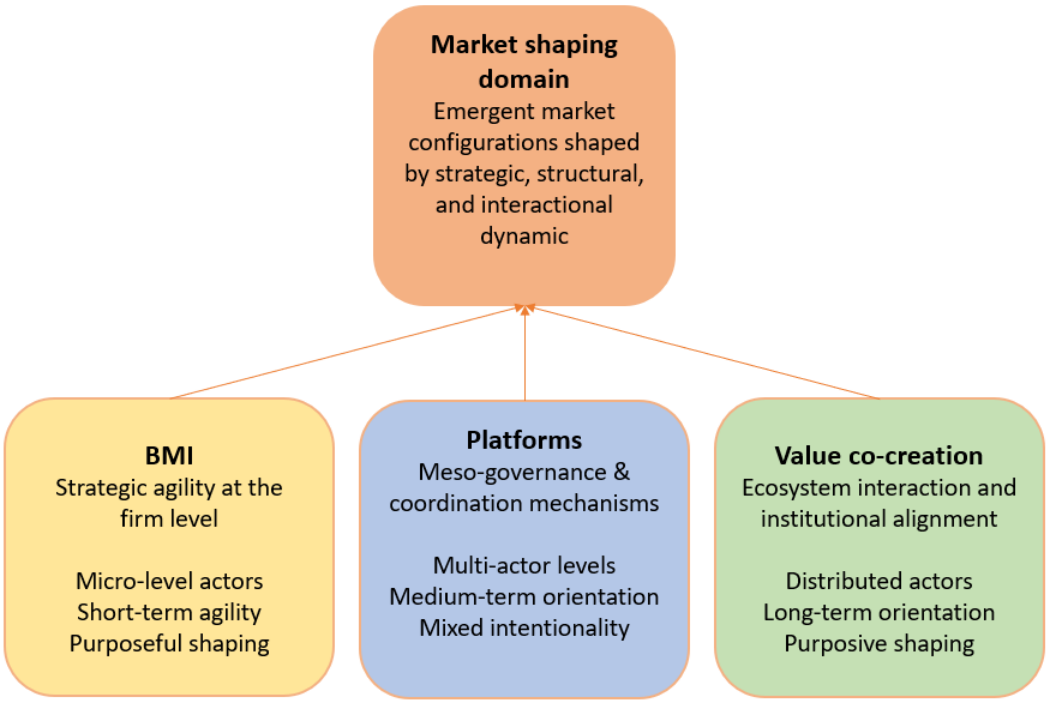

Figure 2. Empirically enriched framework of market shaping

First, the multi-actor nature of market shaping is evident through the diverse configurations of agency across the three studies. Article I illustrates how focal firms (e.g., electricity retailers) strategically employ BMI to reconfigure market dynamics—shaping not only the commodification of electricity but also regulatory logic and consumer expectations along the way (Teece, 2010; Flaig et al., 2021). Article II demonstrates how platform governance mediates collective market shaping by redrawing transactional boundaries, participation structures, and actor hierarchies, and in doing so, acts as a regulatory and economic intermediary within the ecosystem

(Gawer & Cusumano, 2014; Rahman et al., 2021). Article III extends the scope further by showing how peripheral actors, particularly prosumers and citizen energy communities, contribute to market transformation through resource integration and participatory value co-creation (Rahman et al, 2025; Prahalad & Ramaswamy, 2004; Kleinaltenkamp et al., 2022). Together, these findings highlight a distributed and polycentric mode of agency that challenges firm-centric models of market formation and aligns with ecosystem perspectives, viewing markets as emergent, collectively shaped systems (Mele et al., 2015; Storbacka & Nenonen, 2011; Vargo & Lusch, 2016).

Second, market shaping unfolds across micro (firm), meso (platform and regulatory), and macro (policy and socio-technical) levels. The articles collectively illustrate how these levels interact recursively: firm-level BMI is influenced by regulatory lock-ins (Article I), platform governance is shaped by national data infrastructures and EU directives (Article II), and prosumer mobilization is constrained or enabled by infrastructural and legal conditions (Article III). Kindström et al. (2023) observe that early-stage market shaping often features misaligned or loosely coupled resource configurations across these levels, underpinning the challenge of achieving institutional alignment. Addressing that issue requires treating markets as nested and recursively constituted, where micro, meso, and macro dynamics are not only positioned in relation to each other but actively co-evolve through interlinked practices and translation processes (Kjellberg & Helgesson, 2006; Mattsson & Junker, 2023).

Third, time plays a vital role in shaping outcomes. Article I highlighted the short-term strategic agility required to navigate technological and regulatory uncertainty (Teece, 2007). Article II explored medium-term infrastructure structuring, platform scalability, and policy experimentation. Article III emphasized longer-term institutionalization processes, including delayed smart meter rollouts and the slow diffusion of prosumer flexibility. These findings point to market shaping as a multi-temporal process involving sequences of experimentation, negotiation, and stabilization (Sosna et al., 2010; Nenonen et al., 2019). At first glance, this suggests a linear progression from agility to structuration to institutionalization. However, as Kjellberg and Helgesson (2006) and Kindström et al. (2023) emphasize, market shaping unfolds through recursive, overlapping processes rather than fixed stages. For example, strategic pivots may recur even during later stages; platforms often evolve in parallel with policy adaptation rather than following it; and institutional arrangements remain open to reinterpretation and contestation, rather than becoming fixed endpoints. Ultimately, this calls for a dynamic understanding of market shaping as a co-evolutionary process, where short-, medium-, and long-term dynamics do not follow a linear path but actively shape and define one another.

Fourth, market shaping is not solely the result of deliberate strategies. All the articles revealed emergent dynamics, from spontaneous prosumer communities to unintended regulatory barriers, significantly influenced shaping trajectories. Article II, for example, highlighted how governance structures unintentionally exclude new entrants from flexibility platforms, while Article III revealed how consumers respond to monetary incentives despite sustainability framings (Syyväri et al., 2025). These findings reinforce Baker and Nenonen's (2020) argument that markets are co-produced by strategic intent and emergent system responses. Conceptually, this aligns with Hawa et al.'s (2020) framework of market-shaping intentionality, which moves beyond binary distinctions between purpose and emergence. That framework illustrates how shaping efforts may involve a dynamic interplay between purposeful coordination ("conducting" and "choiring") and adaptive, situational responses ("practising" and "jamming"). Accordingly, market shaping is best understood as an evolving configuration of intentionality rather than a fixed continuum.

Finally, while Figure 2 provides an overarching visual synthesis, Table 9 below offers a comparative breakdown of the market-shaping mechanisms across the four discussed analytical dimensions.

Table 9. Comparison of market shaping mechanisms across analytical dimensions

Dimension	BMI	Platforms	Value co-creation
Actor configurations	Focal actors initiate strategic market shaping via innovation (e.g., product-service reconfigurations, flexible pricing models, or prosumer-targeted offerings)	Multi-actor coordination via centralized rule setting and intermediation	Peripheral and emergent actors (e.g., prosumers, aggregators) engage through participatory market shaping; incumbents also contribute by enabling resource integration and service exchange
Institutional level	Micro-level firm strategy is influenced by meso and macro constraints; individuals as microfoundations drive this through cognition, routines, and design	Meso-governance mediating between firm logics and policy layers	Interaction occurs at all levels; enables bottom-up participation and bridges micro-meso resource alignment

Dimension	BMI	Platforms	Value co-creation
Temporal orientation	Primarily short-term: strategic agility and rapid pivots to seize openings, though may contribute to longer-term transformation when aligned with institutional change	Medium-term: structuring scalable infrastructures and participation mechanisms	Long-term: building trust, alignment, and institutional embedding of resource linkages and practices
Intentionality	Purposeful: goal-oriented reconfiguration of offerings and roles	Mixed: partially deliberate but shaped by emergent constraints and system-level feedback	Often purposive: present-oriented responses to context, but capable of becoming strategic over time through institutionalization

6 CONCLUSION

This section brings the first part of the dissertation to a close by summarizing the key implications of the study. It details the theoretical contributions, highlights the managerial and policy relevance, and considers the study's limitations alongside proposing avenues for future research.

6.1 Theoretical contributions

This section advances the theoretical understanding of market shaping by articulating seven interrelated contributions, as outlined below.

6.1.1 Operationalizing market shaping across the actor, institutional, and temporal dimensions

This study proposes a multidimensional framework for market shaping that integrates four key dimensions: actor configuration, institutional level, temporal orientation, and intentionality (see Table 7). First, it traces how shaping shifts from focal firms (e.g., electricity retailers) to broader, ecosystem-wide configurations, including intermediaries, platform operators, and grassroots actors. Second, it delineates institutional levels, from micro-level BMI to meso-level platform governance, while recognizing the influence of macro-level policy and regulatory structures on shaping trajectories. Third, it captures the temporal layering of shaping, moving from short-term strategic agility to medium-term governance structuring and long-term institutionalization. Finally, it incorporates intentionality as a dimension by acknowledging that shaping is both strategically driven and emergent, an issue highlighted further in the next section.

This framing answer calls for multilevel approaches that account for institutional complexity and temporal layering (Mattsson & Junker, 2023) and responds to critiques of overly linear or firm-centric models (Nenonen & Storbacka, 2021). Drawing on performativity and translation approaches to market studies (Kjellberg & Helgesson, 2006), the framework conceptualizes shaping as a multi-practice phenomenon that unfolds across analytically distinct but interrelated dimensions.

6.1.2 Advancing understanding of intentionality in market shaping

Another key theoretical advance concerns the treatment of intentionality in market shaping. While early studies in the field emphasized deliberate, goal-driven strategic action, such as market visioning, institutional entrepreneurship, or nonmarket

lobbying, recent work stresses the importance of emergent, situated, and unintentional forms of agency (Baker & Nenonen, 2020). Building on the framework developed by Hawa et al. (2020), this dissertation conceptualizes intentionality not as a binary (purposeful vs. unintentional) but as a continuum between purposeful and purposive action. Purposeful action refers to future-oriented, strategically coordinated shaping, while purposive action reflects situated, context-driven behaviour, which is often experimental, responsive, and embedded in everyday practices.

The empirical chapters illustrate how actors move along that continuum depending on role, temporal context, and institutional embeddedness. For instance, prosumers may unintentionally shape markets through their everyday decisions on energy, while regulatory sandbox designs may generate unforeseen ambiguity rather than enablement. Furthermore, the dissertation integrates a microfoundation perspective to demonstrate that purposeful shaping is not merely a matter of intent but also depends on individual-level capabilities, such as social skills, foresight, and the ability to challenge institutional inertia. These actor-level traits, as highlighted by Hawa et al. (2020) and Emirbayer and Mische (1998), help explain how focal actors initiate shaping under conditions of constraint. This extension connects intentionality with agency, reinforcing that strategic shaping is grounded in situated human capabilities, not merely organizational strategy (e.g., Emirbayer and Mische, 1998). Moreover, these insights complement current debates on distributed agency and emergent shaping (e.g., Flaig & Ottosson, 2022; Harrison & Kjellberg, 2010) and invite further research on how intentionality interacts, collides, or aligns over time.

6.1.3 Bridging micro-level agency and system-level change

While the previous sections offered a structural framework for analysing market shaping, this section adopts a processual perspective. It focuses on how micro-level agency and situated practices contribute to system-level transformation, a critical gap identified in recent market shaping literature (Nenonen & Storbacka, 2021; Hawa et al., 2020). By tracing the translation of actions from local experimentation to institutional embedding, this study emphasizes market shaping as an iterative institutional process.

This view is derived from institutional work literature (Lawrence & Suddaby, 2006) and practice-based perspectives on market formation (Azimont & Araujo, 2007; Kjellberg & Helgesson, 2006). Those emphasize that markets are not static structures but continually enacted through the interplay of material, discursive, and organizational practices. The empirical trajectory across the three articles illustrates how early-stage BMI efforts, including informal experimentation, internal innovation

labs, and exploratory pilots, create new value propositions that challenge existing market logics. These micro-level actions often prompt meso-level governance responses, such as platform structuring, actor enrolment, and standard-setting. Over time, these practices can become institutionalized at the macro level through formal regulation, funding mechanisms, and changes in policy discourse. However, that process is not linear. As demonstrated in the examples of regulatory sandboxes and delayed smart meter rollouts, feedback loops and temporal misalignments can disrupt or redirect the shaping process.

This mechanism-based account reveals how shaping unfolds through sequential layering: business model innovation initiates change at the firm level, platforms structure and scale participation at the ecosystem level, and value co-creation contributes to institutional stabilization. The current research thus addresses gaps in how actor-driven experimentation connects with system-level consequences (e.g., Nenonen & Storbacka, 2021; Kleinaltenkamp et al., 2021). This recursive layering also resonates with Kjellberg and Helgesson's (2006) notion of translation chains, wherein exchange, representational, and normalizing practices co-produce market configurations.

Finally, the analysis underscores the importance of distributed agency. Middle managers, entrepreneurial employees, and prosumers operate within institutional constraints yet exercise discretion in interpreting, negotiating, and experimenting with shaping practices. Their actions can amplify, stabilize, or unsettle emerging trajectories, which highlights that market shaping is not orchestrated by single actors but emerges from situated, embedded efforts across the ecosystem (Storbacka et al., 2022; Mattsson & Junker, 2023).

6.1.4 Linking focal and collective market shaping

Market shaping research has traditionally positioned focal firms as the primary agents of transformation by focusing on actors capable of reconfiguring market institutions, coordinating resource linkages, and enacting strategic visions (Storbacka & Nenonen, 2011; Flaig et al., 2021). More recent work, however, has expanded this view by highlighting collective market shaping, where change is co-constructed through the dynamic involvement of various actors (Baker & Nenonen, 2020; Flaig & Ottosson, 2022). This dissertation contributes to this trajectory by demonstrating how shaping roles evolve over time and across levels—beginning with focal experimentation (via BMI), scaling through governance structures (platforms), and stabilizing through participatory practices (value co-creation). These findings support the view that shaping roles are not fixed but develop through interaction,

institutional feedback, and evolving system conditions, in alignment with the role dynamism identified by Flaig and Ottosson (2022).

Furthermore, this research highlights how both dominant and peripheral actors—such as DSOs, prosumers, regulators, and community intermediaries—contribute to shaping outcomes through processes of mutual adjustment, co-development, and resource coordination. This pluralistic actor configuration challenges firm-centric assumptions in market shaping research and aligns with recent calls to account for distributed shaping dynamics within institutional and infrastructural contexts (Purchase et al., 2024; Kaartemo & Nyström, 2021; Nenonen & Storbacka, 2021).

6.1.5 Extending market shaping to regulated, infrastructure-dependent markets

Whereas much of the market shaping literature has emerged from consumer sectors (e.g., wine bottle closures; Baker and Nenonen, 2020) and service ecosystems (e.g., cultural experiences; Baker et al., 2019), the current research applies that lens to the electricity flexibility ecosystem, a field characterized by infrastructural rigidity, regulatory complexity, and institutional layering. Consequently, this study examines the shaping dynamics under institutional constraints and infrastructure path dependency, thereby extending the theory to settings where market creation is structurally inhibited.

The findings reveal how actors embedded in electricity markets must navigate multi-level governance systems with conflicting institutional logics, investment classification asymmetries, and a lack of systemic coordination to scale decentralized participation. These dynamics illustrate that market shaping in infrastructure-intensive sectors involves both shaping and being shaped by regulatory institutions, advancing the understanding of how structural frictions mediate market formation (e.g., Richter, 2013; Ruostetsaari, 2020).

A further key contribution is to highlight the role of technology in mediating resource integration and shaping potential in such constrained environments. While market shaping is often theorized through institutional or strategic lenses, actors in the energy ecosystem rely heavily on enabling technologies, such as digital platforms, ICT infrastructures, and DSM systems to align resources, bridge participation gaps, and co-create new market configurations (Hall & Roelich, 2016; Kaartemo & Nyström, 2021). These technologies do not merely support transactions; they structure the very conditions under which shaping practices unfold. Platforms, in particular, function as both technological and institutional enablers, governing access, mediating resource flows, and standardizing interaction protocols. This insight resonates with

SDL (Vargo & Lusch, 2016) and socio-technical transition theories (Geels, 2004), both of which position technology as a constitutive force in market evolution.

6.1.6 Navigating strategic tensions in market shaping

This dissertation contributes to market shaping theory by showing that shaping strategies not only vary across actors but may also coexist (sometimes in tension) within the same organization. Flaig et al. (2021) observed that actors often pursue conflicting strategies: some aim to widen or disrupt markets and are thus offensive, while others seek to preserve institutional stability and are therefore defensive. Building on this insight, the findings from the energy flexibility domain reveal a more nuanced picture. For example, DSOs and retailers simultaneously experiment with innovative models while protecting grid stability and maintaining regulatory compliance. This internal dissonance reflects a form of negotiated hybridity, where organizations manage both transformation and continuity within their own strategic repertoires.

Rather than treating that hybridity as a conceptual paradox, this dissertation demonstrates how it is enacted in practice, such as enabling prosumer participation while restricting access through system rules or piloting new market mechanisms under the constraints of legacy infrastructures. At the same time, actors interpret and respond to market transitions at different speeds and with differing levels of urgency. While retailers and some DSOs view prosumer integration as inevitable, others delay engagement due to infrastructure inertia or risk aversion. These misalignments underscore the importance of strategic interpretation and sensemaking, particularly in interdependent ecosystems where no single actor controls the pace or outcome of transformation (Kaartemo & Nyström, 2021; Pikkarainen et al., 2022).

This research complements recent conceptualizations of shaping as a contested, emergent, and adaptive process (e.g., Kjellberg & Helgesson, 2006; Baker & Nenonen, 2020; Flaig & Ottosson, 2022). It does so by framing market shaping as an ecosystem-wide balancing act among partially aligned, interdependent strategies and orientations. It highlights the embedded negotiations, temporal misalignments, and political dynamics that emerge when multiple actors with differing resources, institutional roles, and strategic horizons simultaneously influence market evolution. This perspective answers recent calls to explore the interplay of shaping strategies across actors and time (Flaig et al., 2021).

6.1.7 Ontological contribution: markets as performed, emergent fields

This dissertation contributes ontologically by reinforcing the view of markets as performed, emergent, and institutionally entangled fields rather than pre-existing arenas of exchange. Grounded in performative market studies (Kjellberg & Helgesson, 2006) and extended through recent shaping perspectives (Storbacka & Nenonen, 2015), the findings demonstrate how markets emerge through the situated coordination of meanings, materialities, and institutional practices. This outcome resonates with broader ontological shifts in marketing research, which reject reductionist, linear, and actor-centric models in favour of distributed agency, co-evolution, and non-linear emergence (Sprong et al., 2021; Mele et al., 2015). The empirical case of energy flexibility underscores the perspective by showing that market shaping is not the execution of a fixed blueprint but a situated, adaptive response to structural tensions and emergent opportunities. Consequently, the study advances a market-as-becoming ontology through the interlocking of BMI, platforms, and value co-creation. Moreover, by synthesizing SDL (Vargo & Lusch, 2004), institutional theory (Mattsson & Junker, 2023), and socio-technical systems thinking (Adner, 2017), the study contributes to a more holistic conceptualization of markets as nested and evolving ecosystems.

6.1.8 Methodological contributions: a heuristic for empirical inquiry

This dissertation also contributes methodologically by offering a structured basis for aligning research designs with the dynamics of market shaping. In particular, the framework in Table 9 links conceptual distinctions to potential units of analysis, research designs, and analytical strategies. For example, the differentiation of actor configurations invites multi-actor designs that capture both focal and peripheral roles, from firm-level microfoundations to ecosystem-wide participation. Similarly, the specification of institutional levels highlights the value of multi-level approaches that trace how governance, rules, and routines interact across firm, meso, and system layers. The articulation of temporal orientations emphasizes the importance of longitudinal and processual methods suited for short-term pivots, medium-term structuring, and long-term institutional embedding. Finally, the dimension of intentionality underscores the need for methodologies that can accommodate both deliberate and emergent forms of shaping, from retrospective process tracing to ethnographic observation of unfolding practices. In sum, the framework opens a portfolio of strategies—comparative case studies, longitudinal process tracing, ethnography, and network analysis—that can be combined or adapted depending on the empirical focus.

6.2 Managerial and policy implications

This dissertation offers several practical implications for managers and policymakers shaping the energy market. The implications are best understood not as discrete recommendations but as insights into how market shaping dynamics can be strategically supported or unintentionally stalled by decisions on organizational design, governance infrastructure, capability-building, and regulatory intervention.

6.2.1 Managerial implications

One of the most immediate practical insights concerns the strategic role that BMI plays in initiating and directing market shaping. As shown in Article I, BMI is not merely an internal redesign activity but a vehicle through which firms articulate and test new value propositions, challenge prevailing logics, and redefine the boundaries of participation in a market. Managers seeking to influence the evolution of the market should therefore recognize that BMI is a key lever of focal shaping, providing the ability to imagine and enact alternative futures and to align internal capabilities with emergent institutional demands.

If it is to effectively influence market formation, BMI must be approached not as a one-off project but as an iterative and exploratory process. This requires organizational structures that support cross-functional collaboration, reduce internal resistance to experimentation, and enable the translation of frontline innovation into strategic direction. Senior leaders, in particular, must create organizational spaces for experimentation and dynamic sensemaking and also recognize that market shaping unfolds in phases, from ideation and piloting to the eventual institutional embedding. This also calls for mechanisms that align human resources practices, incentive structures, and resource allocation with longer-term shaping goals rather than short-term financial metrics. Such practices enable firms not only to innovate internally but also to project new possible market configurations, potentially influencing norms, expectations, and investment logics beyond firm boundaries. Essentially, firms that internalize market shaping not as an external environment to adapt to but as a domain they actively co-produce will be better positioned to thrive in systems undergoing deep structural transition.

Managers should also recognize that market shaping often involves navigating tensions between offensive strategies pursuing transformation and defensive strategies aiming to preserve system stability. This requires firms to engage in strategic sensemaking, knowing when to lead change and when to adapt to existing institutional rhythms, technological trajectories, or regulatory conditions.

However, BMI alone does not constitute market shaping unless it is coupled with mechanisms for scaling and coordination. This directs attention to the centrality of platform governance as a meso-level enabler of collective shaping. Article II demonstrated that the development of LFMs rests not only on the technical viability of flexibility solutions but also on how participation is organized, which roles are incentivized, and how value is distributed across the ecosystem. For platform owners and orchestrators, this means designing not only interfaces but institutional arrangements comprising rules of engagement, decision rights, and value exchange mechanisms that align with the evolving ecosystem context. Market shaping here is achieved through the deliberate structuring of participation, enabling new actors to enter, reducing ambiguity around responsibilities, and creating conditions for mutual adjustment.

Nevertheless, shaping through platforms also requires sensitivity to emergent system responses. Rigid governance architectures or exclusionary design choices can entrench fragmentation rather than enabling convergence. Managers responsible for platform development should therefore adopt adaptive governance practices that balance openness and control, encourage modular experimentation, and build relational trust among actors with asymmetric capabilities. In this way, platform design can become a central mechanism shaping the contours of the market itself.

Beyond platforms and BMI, value co-creation plays a critical role in the distributed shaping of markets. Article III illustrates that co-creation concerns more than delivering value to end users and involves aligning heterogeneous resource bases and meanings across institutional divides. This is particularly evident in the context of energy flexibility, where actors, including households, aggregators, and DSOs, contribute different resources to the market and also different expectations, temporalities, and forms of legitimacy. Managers must recognize that value co-creation is both an operational and a meaning-making activity. Accordingly, engaging with end-users is not simply about increasing adoption but about embedding new value propositions, modifying usage practices, and translating technical potential into socially recognized contributions.

In contrast to more centrally coordinated strategies such as platform governance, or especially BMI, shaping markets through value co-creation requires managers to facilitate boundary-spanning interactions across organizational and consumer groups. That includes engaging in demand-side education, co-developing services with energy communities, and enabling hybrid organizations that operate across technical, financial, and civic domains. Importantly, value co-creation highlights that shaping is not only a top-down activity but also a bottom-up one. Actors at the margins, such as community energy groups, may not initiate shaping deliberately but

contribute materially and symbolically to market stabilization when their participation is enabled and legitimized.

Importantly, in many cases, the ability to co-create value is contingent upon technological mediation through digital platforms, ICT systems, and smart devices, which shape how actors interact, access information, and align resources. Firms must consider how these technologies structure coordination, scale interaction, and enable resource harmonization across organizational boundaries (Kaartemo & Nyström, 2021; Hall & Roelich, 2016).

The observations on resource harmonization in Article III reveal that shaping is often contingent on how well resource complementarities are recognized and activated by actors. Mismatches such as lacking invoicing capabilities in aggregators, underutilized digital infrastructure in incumbent retailers, or fragmented knowledge about flexibility in households often block otherwise viable shaping trajectories. Managers must therefore adopt a system-level view of resource deployment, moving beyond firm-centric optimization to strategic alignment of resource bases across the ecosystem. This entails identifying where resource asymmetries can be turned into complementarities, where redundant resources can be recombined in new configurations, and where bridging mechanisms can enable otherwise disconnected actors to collaborate. By actively managing resource harmonization, managers contribute to the structural reconfiguration of the market, which not only improves efficiency but also alters who can participate, on what terms, and to what end. In doing so, they help shape the market's field conditions.

Finally, managers must engage in continuous sensemaking, as shaping strategies depend on both interpretations and actions. In complex transitions, actors may share a general understanding that change is underway yet diverge in how they perceive its direction or timing. Strategic misalignment, such as between retailers advocating prosumer integration and DSOs questioning its feasibility, can stall shaping efforts unless addressed through open negotiation.

6.2.2 Policy implications

From a policy perspective, this dissertation reveals that regulatory structures and institutional arrangements are not passive backdrops but active contributors to market shaping. Policymakers thus play a crucial role not only in correcting market failures but also in structuring the field in which new markets emerge and stabilize.

One central implication concerns the misalignment of regulatory incentives, which reinforces systemic path dependencies. For instance, while DSOs are increasingly

expected to act as flexibility enablers, the regulatory regime rewarding capital expenditures reinforces path dependencies and delays market transformation. Policymakers must therefore devise regulatory models that break institutional path dependencies and legitimize market transformation toward flexibility-oriented configurations. In the context of flexibility markets, that represents a broader re-signalling of institutional legitimacy, encouraging investment, innovation, and experimentation among actors.

Second, policies must address the systemic capability gaps that block collective shaping. The empirical findings above illustrate how DSOs and other incumbents often lack ICT proficiency and service-oriented design capabilities that are essential for interacting with decentralized actors in complex ecosystems. Capacity-building programmes and policy-driven partnerships can help overcome this inertia. For example, embedding service innovation modules in DSO training programmes or providing targeted funding for platform governance experimentation can directly enhance shaping capacity within traditionally conservative organizations. Drawing on examples such as Germany's SINTEG initiative[2], regulatory frameworks should include reflexive governance mechanisms that involve and evolve with the ecosystem (BMWi, 2021).

Policymakers also grapple with managing coexisting shaping strategies. Incentivizing flexibility while ensuring grid reliability or supporting new entrants while protecting systemic equity requires a hybrid approach that integrates both transformative and stabilizing policy instruments. This balance is crucial in interdependent ecosystems where the actions of one actor can amplify or counteract those of another.

At the same time, consumers and emerging actors face capability barriers. Energy literacy, particularly regarding the role of flexibility in grid stability, remains low. Policies should support modular, community-driven energy literacy programmes that link flexibility to household-level concerns vis-à-vis electric vehicle charging optimization, solar self-consumption, or grid resilience in rural areas. These efforts are not only educational but constitutive of shaping: they enable new forms of market participation, shift consumer expectations, and help establish new shared meanings around energy.

Third, policymakers must proactively manage the design and evolution of platforms. Rather than treating LFMs as neutral infrastructures, regulators should recognize them as institutions in the making. This entails setting clear guidelines for platform governance, for instance, minimum transparency requirements, standard contracts,

[2] Smart Energy Showcases – Digital Agenda for the Energy Transition

and interoperability protocols, while also allowing for context-sensitive experimentation.

Moreover, policies must embrace a pluralistic view of shaping, recognizing that markets are shaped not only by firms and regulators but by a diverse set of actors, including consumers, communities, and intermediaries. Supporting structures that legitimize their participation (e.g., cooperative governance models, community-led pilots) is essential for inclusive and resilient market evolution.

Finally, the design of infrastructure must be seen as a policy priority. The extension of rural DSO investment deadlines in Finland risks entrenching regional inequalities in flexibility access. Without grid upgrades or digital infrastructure, rural consumers remain excluded from participation, inhibiting the emergence of a truly national flexibility scene. Infrastructure policy must therefore be forward-looking and embed flexibility requirements in network development plans and funding mechanisms. This fix goes beyond the technical aspect; it becomes a market-shaping intervention that determines which actors can enter, where value is created, and how widely benefits are distributed.

6.3 Limitations and further studies

This dissertation set out to explore how diverse actors collectively shape the Finnish electricity market through BMI, platform governance, and value co-creation. Integrating these three conceptual lenses enabled the study to contribute to forging a richer, more processual understanding of market shaping as a distributed and multi-level phenomenon. However, like any theory-developing research, it is not without limitations. Those limitations also suggest potentially productive directions for future research.

6.3.1 Conceptual boundaries and contributions

This dissertation presents a multidimensional view of market shaping through three empirically grounded cases. Each case focuses on a specific dimension: focal actor strategy (BMI), ecosystem coordination (platforms), and institutional integration (value co-creation). Together, they offer complementary insights, yet the synthesis does not fully resolve how these shaping mechanisms interact over time or across different phases of market evolution. For instance, the temporal and causal interplay between firm-led shaping (as seen in BMI) and emergent, collective reshaping (as enabled through value co-creation) warrants further exploration. Future studies

could investigate how early-stage focal shaping evolves into—or is disrupted by—bottom-up resistance, ecosystem feedback, or policy realignment.

Moreover, the conceptual architecture of market shaping used here is primarily grounded in the energy flexibility domain, which may inhibit transferability. For example, in sectors where market configurations are less tightly coupled to infrastructure, or where regulatory agencies play a lesser part, the roles of platforms or collective value creation may look fundamentally different. Comparative work across sectors, particularly those less embedded in formal institutions, could extend the relevance and granularity of the market shaping framework developed here.

6.3.2 Empirical context and actor representation

The Finnish electricity ecosystem offered a timely and information-rich setting for studying market shaping in motion. Its regulatory transparency, digital infrastructure, and policy momentum around energy flexibility made it an ideal empirical laboratory. At the same time, this specificity may limit the applicability of findings to markets with less liberalized market settings or those with less technologically mature infrastructures vis-à-vis energy markets. Although the aim of this dissertation was analytical generalization rather than statistical inference, future research should examine how shaping mechanisms travel across contexts, especially in the global south or highly centralized markets where institutional constraints differ significantly.

Additionally, while this study incorporated a diverse range of stakeholders, its primary voices were those of professional stakeholders. Especially in Article III, grassroots dynamics were viewed through the lens of community organizers rather than individual members. As such, the everyday experiences, motivation, and resistance of individual prosumers remain underexplored. Future research would benefit from incorporating ethnographic or participatory methods focusing on lived experience, for instance, among less digitally engaged, lower-income, or rural consumers whose shaping influence may be subtle but nonetheless meaningful.

Relatedly, the comparative case structure privileged actor diversity over temporal depth. The evolution of shaping practices remains an open empirical question. Research seeking to address it could investigate how BMI trajectories unfold across regulatory cycles or how governance tensions in platforms stabilize or fragment over time. Longitudinal research tracing actor pathways, shifting coalitions, and friction in governance would enrich the processual understanding of shaping as an emergent and historically contingent phenomenon.

6.3.3 Methodological trade-offs and theoretical development

This dissertation employed an abductive, theory-developing logic, using empirical cases to refine and extend sensitizing concepts. While this approach enabled conceptual innovation, it also involved methodological trade-offs. Abduction requires navigating tensions between empirical openness and theoretical framing and, in the process, invites a certain ambiguity. Specifically, interpreting data through overlapping lenses can blur causal attribution and obscure instances of discontinuity. Future research could clarify the boundaries and interdependencies between shaping mechanisms, perhaps through mixed-method approaches that incorporate process tracing, simulation, or network analysis.

Another limitation concerns the absence of real-world, fully operational local flexibility platforms in Finland. As a result, much of the analysis in Article II, in particular, relied on benchmarking or forward-looking insights from pilots or related EU initiatives. While these offered meaningful insights, they could not substitute for empirical engagement with functioning platforms in situ. As more platforms mature, there is an opportunity for researchers to engage in embedded or real-time studies of shaping-in-practice and observe how technical, commercial, and institutional components co-evolve.

Finally, the dissertation focuses primarily on shaping rather than reshaping or resisting. Nevertheless, in real-world markets, shaping efforts are often contested. Future research might extend the current framing by studying conflicting scripts, institutional pushback, or counter-shaping strategies, particularly as regulatory and societal expectations evolve.

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Appendix: Author contritutions to Articles I-III

Article 1

The first author Rodrigo Rabetino contributed to the conceptualization, methodology, investigation, formal analysis, and data curation of the paper. He was also responsible for writing the original draft and contributed to reviewing and editing the manuscript. Marko Kohtamäki participated in the conceptualization of the study and contributed to writing – review & editing. Nicolai J. Foss contributed to the conceptualization of the paper and participated in writing – review & editing. Nayeem Rahman contributed to the methodology, investigation, formal analysis, and data curation. He also participated in writing – review & editing. Tuomas Huikkola contributed to the investigation and formal analysis and participated in writing – review & editing.

Article 2

Nayeem Rahman is the first author of the paper. He was responsible for the conceptualization, methodology, investigation, formal analysis, and data curation. He also wrote the original draft and participated in writing – review & editing. Rodrigo Rabetino contributed to the conceptualization, methodology, and investigation. He also provided supervision and participated in writing – review & editing. Arto Rajala provided supervision and contributed to writing – review & editing. Jukka Partanen participated in writing – review & editing

Article 3

Nayeem Rahman is the first author of the paper. He was responsible for the conceptualization, methodology, investigation, formal analysis, and data curation. He also wrote the original draft and participated in writing – review & editing. Rodrigo Rabetino contributed to the methodology and investigation, provided supervision, and participated in writing – review & editing. Arto Rajala contributed to supervision, participated in the investigation, and was responsible for funding acquisition. Hannu Makkonen contributed to the conceptualization of the study and participated in writing – review & editing.

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Microfoundations for business model innovation: Exploring the interplay between individuals, practices, and organizational design

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Abstract

This article explores the microfoundational aspects of business model innovation (BMI) under conditions of rapid change caused by technological and regulatory disruptions. Based on empirical analysis of relevant industry incumbents, we address the following research question: *How do key microfoundational elements, notably individual behaviors and organizational processes and design, interact to drive business model innovation*? Despite its importance, little is known about this question. We explore the microfoundations of BMI via a multiple-case study method. We specifically investigate the interplay between microfoundational components at varying levels (individual, process, interaction, and organizational design) in three incumbent companies in Finland's power electricity sector. Theoretically, this article's contributions lie in examining the interaction mechanisms that drive the interplay between microfoundational elements at macro and micro levels during the different BMI stages. These mechanisms are critical for shaping interaction processes in BMI and supporting value creation and appropriation. For managers, our research provides a microfoundational framework for guiding BMI, including guidelines for critical tasks such as promoting a creative culture, enhancing cross-functional collaboration, balancing innovation with operational stability, aligning with industry trends, and preparing the organization for continuous innovation.

KEYWORDS

business model innovation, digital servitization, dynamic capabilities, microfoundations, strategic change

1 | INTRODUCTION

Companies must often reconsider their business models—the logic, architecture, and mechanisms for creating, delivering, and capturing value (Teece, 2010)—to address external disruptions and changing organizational contingencies (Geissdoerfer et al., 2022). Such a process often entails innovating the business model (Aspara et al., 2010). Business model innovation (BMI) implies changing the business model's essential elements (Foss & Saebi, 2018),

that is, value creation, delivery, and capture activities (Gassmann et al., 2020), and how these elements are linked. Extant research offers valuable insights into the overarching dynamics of BMI (Snihur & Markman, 2023). It provides an understanding of the driving forces of BMI across industries, the organizational responses to evolving environmental conditions, and their consequences for collective outcomes that impact companies' performance (Fjeldstad & Snow, 2018; Foss & Saebi, 2017; Latifi et al., 2021). Thus, the literature has addressed the core issues of BMI conceptualization, BMI as an organizational change process, BMI as an outcome, and the consequences of BMI (Foss & Saebi, 2017, 2018; Wirtz & Daiser, 2018).

However, while it is a prevalent form of innovation and constitutes a key area for future innovation management research, BMI is still understudied compared to product and process innovation (Spanjol et al., 2024; Spieth et al., 2025). Many matters remain underexplored and poorly understood or in search of cumulative theoretical foundations, clarifications, and operationalization (Foss & Saebi, 2018). Foss and Saebi et al. (2017) identified research gaps concerning external and internal antecedents; moderators at the macro, firm, and micro levels; outcomes; and boundary conditions (e.g., fields of application). Notably, BMI is a scholarly domain dominated by macrolevel explanations regarding success, performance, or competitive advantage and in search of microfoundational accounts (Mancuso et al., 2024; Palmié et al., 2023). An important gap remains in the exploration of the microfoundations of BMI, that is, the interplay between underlying organizational members' agency/behavior and interactions, organizational processes, and organizational designs (Foss & Saebi, 2017; Ringvold et al., 2023). Ultimately, BMI develops due to human agency, and choices concerning, for example, organizational design and processes are made to facilitate BMI ideation and implementation and generally support the new business model. BMI is both a firm- and a system-level activity (Zott & Amit, 2010) but is ultimately driven by human decisions, behaviors, and interactions (Andreini et al., 2022). From a microfoundational perspective, agency is attributed to individuals (Kurtmollaiev, 2020), and the micro level is primary (Contractor et al., 2019). Thus, research on the microfoundations of the BMI process must examine the firm's governance system and the attributes of employees, managers, and the top management team (TMT) (Spanjol et al., 2024).

Despite the relevance of adopting a microfoundational perspective on BMI, with few recent exceptions, the microfoundations and BMI research streams have few touchpoints (Palmié et al., 2023). Studies address microfoundations of related domains, such as value creation and capture mechanisms (Mancuso et al., 2024), HR practices (Loon et al., 2020), global strategies (Contractor et al., 2019), and dynamic capabilities (Randhawa et al., 2021; Sandberg & Hultberg, 2021; Santa-Maria et al., 2021; Teece, 2007). Nevertheless, only a few studies have consistently adopted the microfoundational perspective in a BMI setting (e.g., Ringvold et al., 2023). This is a significant problem, not only from a research perspective but also from a practical perspective, as the lack of attention to microfoundations means that key aspects of decision support for managers are missing. Such decision support is essential for companies, particularly those within disrupted traditional sectors dominated by deep-rooted and conservative practices (Malmi et al., 2023). Disruptive forces offer opportunities for BMI but require a business logic shift (Volberda et al., 2017). Understanding such a change in business logic requires addressing the interplay of individual agency, organizational processes, and design elements in BMI (Spanjol et al., 2024). A lack of understanding of the underlying microfoundations driving BMI prevents

Practitioner points

- Critical managerial tasks during business model innovation (BMI) include aligning strategy with industry trends, promoting an innovative culture, enhancing cross-functional collaboration, balancing innovation with operational stability, and preparing the organization for continuous innovation and adaptation.
- Senior leaders must clearly communicate the strategic vision for scoping BMI and balancing long-term goals with adaptability by promoting autonomy and agile methodologies to create flexible, silo-breaking organizational structures and ensure responsiveness to market opportunities while maintaining operational stability.
- To accelerate BMI, managers must promote an innovative culture by enhancing communication channels, promoting cross-functional project teams, setting incentives and rewards, and establishing internal innovation programs that include hiring innovation champions, training employees, and reinforcing behaviors that drive BMI.
- Engaging with external stakeholders, such as customers, regulators, and industry forums, provides joint innovation opportunities, fosters co-creation, and accelerates new business model recognition, development, and adoption.

transformative business logic change, potentially overlooking or misdirecting any attempts to foster BMI (Ringvold et al., 2023). Consequently, this article addresses the following research question: *How do key microfoundational elements, notably individual behaviors and organizational processes and design, interact to drive BMI*? Here, we take "microfoundations" to refer to both the actual phenomena and their theoretical representation.

Following the conceptual underpinnings of the microfoundation movement in strategy and organization theory (Felin et al., 2015), our research examines the microfoundations that drive BMI in the context of a multiple-case study aimed at investigating the factors that foster or hinder BMI within three incumbents in Finland's power electricity sector. This sector, once conservative and rooted in traditional practices, now faces disruptive challenges from digitalization, fluctuating energy prices and costs, regulatory changes, and emerging renewable technologies. Consequently, companies must discover new, often digital, business models.

The contributions of this article are twofold. First, we break new ground from a conceptual perspective by investigating the interplay between microfoundational components and outlining interaction mechanisms. Specifically, we develop a process framework that addresses BMI in three phases: opportunity identification, business model development, and integration and implementation. While this sequence is not new per se, the novelty of our contributions lies in examining the mechanisms that drive the interplay between microfoundational elements at different levels during the three stages. These mechanisms are critical for shaping interaction processes, such as sensemaking, strategizing, coordination and integration, information processing, learning, and knowledge sharing (Andreini et al., 2022; Felin et al., 2012), and supporting value creation and appropriation (Fjeldstad & Snow, 2018; Sjödin et al., 2020). Here, we underscore the crucial role of individuals in fostering BMI, mainly focusing on the importance of managerial agency (Helfat & Peteraf, 2015). In doing so, the research adds to the microfoundations of the dynamic capabilities research stream by connecting Teece's (2007) approach and the microfoundation movement (Felin et al., 2015), also shedding some light on the individual-level components (Helfat & Peteraf, 2015). Second, from a managerial viewpoint, our research may support and guide BMI efforts by offering relatively concrete suggestions for fostering an innovation culture, enhancing cross-functional collaboration, balancing innovation with operational stability, aligning with industry trends, and preparing organizations for continuous innovation.

The rest of the article is structured as follows. The next section presents the theoretical underpinnings for the research, characterizing BMI from a microfoundational perspective as an organizational change process that spans levels in the organization. Section 3 presents the article's multiple-case study methodology and design, describing the research strategy and context, case selection, the data sources and their collection, the data analysis approach, and the trustworthiness and rigor of the analysis and conclusions. Section 4 introduces the main findings, addressing macro- and microlevel relationships in BMI through the microfoundational lens. Section 5 discusses the big picture, highlighting the links between critical microfoundational elements at the micro and macro levels and the situational, action-creation, and transformational mechanisms driving their interplay. Section 6 presents the research's takeaways and implications, including conceptual and practical contributions. Finally, the last section presents the main limitations of this research and suggestions for future research.

2 | BMI AS A MULTILEVEL ORGANIZATIONAL CHANGE PROCESS

2.1 | Representing the BMI process: A microfoundational approach

BMI denotes a strategy-driven corporate change (Aspara et al., 2011; Leih et al., 2015) where strategy guides BMI and influences the resulting business models (Casadesus-Masanell & Ricart, 2010; Cortimiglia et al., 2016). BMI may be examined as both a process and a content phenomenon, but our primary interest is in the process of adapting the organization to changing organizational and environmental conditions (Saebi, 2015; Saebi et al., 2017; Zott & Amit, 2010). To gain insight into the BMI process as it plays out within companies, we begin by fitting the abstract process of BMI, as described in the extant literature, into a specific framework. This exercise aims not to derive particular predictions but to prepare the ground for our empirical examination of BMI later in this article, where we delve into the finer, still poorly understood mechanisms of BMI.

Conceptually, BMI can be represented as a linear multistage process, from discovery to ideation and implementation (Gassmann et al., 2020; Morris et al., 2005). In actuality, BMI deviates from linearity (Bucherer et al., 2012), as it involves (bidirectional) interactions between the various phases from discovery to implementation. Additionally, BMI is a highly complex process, not only because of its nonlinearity but also because it involves interactions between multiple organizational components placed at different

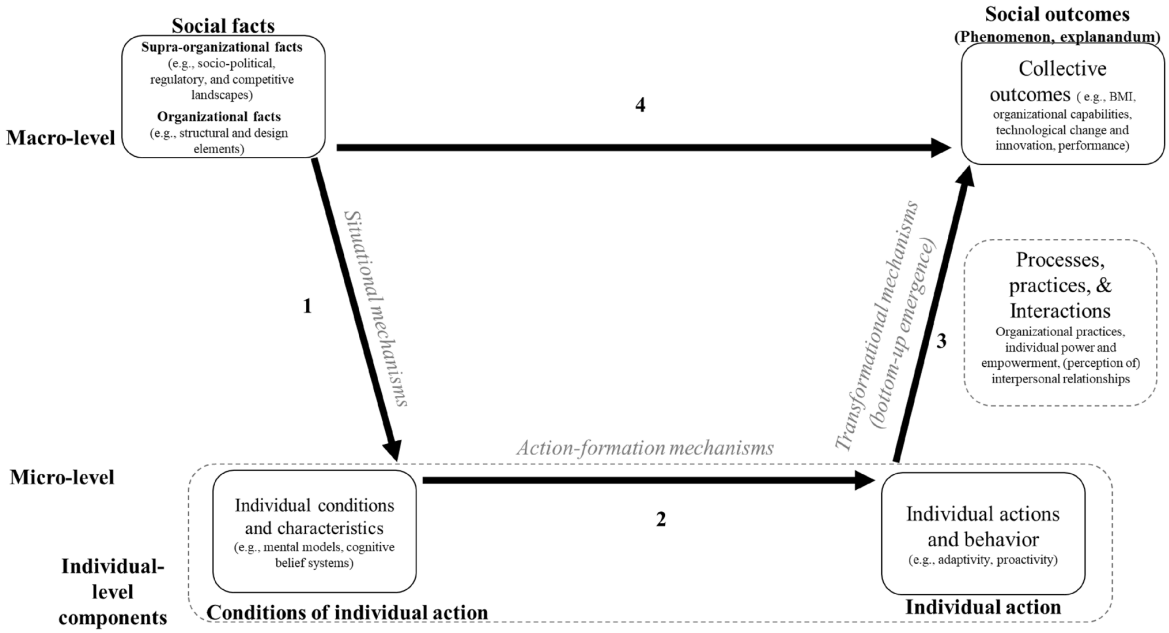

FIGURE 1 Microfoundations: Key components and linking mechanisms.

analytical levels (e.g., macro and micro) and organizational levels, such as organizational design, organizational routines, individual behaviors, and processes of interactions among individuals within the firm, as well as across the boundaries of the firm (Felin & Foss, 2012; Grigoriou & Rothaermel, 2014; Ringvold et al., 2023). From the microfoundational viewpoint, grasping the 'microfoundational challenge' of BMI implies understanding how managers and organizations do what they do (Ringvold et al., 2023). Based on the so-called "Coleman bathtub" (Coleman, 1990: Chpt. 1), three microfoundational components and how they are linked need to be considered (see Figure 1). Note that the bathtub figure may be thought of as a directed acyclic graph (DAG), that is, a graph whose nodes are directionally related without forming a closed loop. Because we are concerned with the BMI process, we think of the bathtub-DAG as time-dimensioned (i.e., the northwestern node may be thought of as the temporally first node).

The ultimate goal is to comprehend how microlevel actions and interactions mediate relationships between macrolevel variables. Thus, it is essential to understand both how supra-organizational (e.g., sociopolitical, regulatory, and competitive landscapes) and organizational attributes (e.g., structure and design) facilitate or impede individual and collective action and interaction and how the behavior and interactions of microlevel actors influence organizational processes and lead to emergent and collective outcomes and impact macrolevel entities (Palmié et al., 2023).

2.2 | Macrolevel supra-organizational and organizational components of BMI

At the macro level, social facts such as supra-organizational and organizational facts may be represented as antecedents of social outcomes such as BMI (Palmié et al., 2023; Ringvold et al., 2023), as shown by Arrow 4. However, a basic microfoundational claim is that Arrow 4 is merely "shorthand" (as there is no causality at the macrolevel only) for more complex microcausal mechanisms (i.e., arrows 1, 2, and 3). Thus, a complete explanation of BMI calls for addressing the underlying causal sequence of macro–micro or situational (Arrow 1), micro–micro or action-formation (Arrow 2), and micro–macro or transformational (Arrow 3) mechanisms (Felin et al., 2015).

2.3 | Microlevel components as conditions of individual behavior and interactions for BMI

At the micro level, individual-level components are affected by situational mechanisms (Arrow 1) and involve microfoundational conditions for individual agency and resulting actions and behavior through action-formation mechanisms (Palmié et al., 2023; Ringvold et al., 2023), as shown by Arrow 2. BMI requires exploration, experimentation, trial and error, and

learning (McGrath, 2010; Sosna et al., 2010) undertaken and shaped by employees and managers. Thus, the attitudes, motivations, abilities, emotions, and cognition of employees and managers are critical aspects of the BMI process (Aspara et al., 2011; Frankenberger & Sauer, 2019). Cognitive capabilities (Helfat & Peteraf, 2015) and processes are crucial for sensemaking, overcoming inertia, and coping with biases to address BMI. They drive decision-making, sensing, perception, attention, learning, problem-solving, and information processing (Martins et al., 2015; Roessler et al., 2019).

2.4 | Processual and interactional components of BMI: Routines, processes, and practices

BMI requires adjusting existing processes, routines, and practices, and reconfiguring resources and structures (Demil & Lecocq, 2010; Doz & Kosonen, 2010; Teece, 2010). Therefore, dynamic capabilities such as sensing and seizing opportunities and integrating and reconfiguring core competencies are essential for BMI (Leih et al., 2015; Teece, 2018). Individuals' behavior impacts organizational doings through transformational mechanisms (Arrow 3), which define how microlevel individual actions and interactions embedded in processes, activities, and practices define macrolevel outcomes, such as BMI (Palmié et al., 2023; Ringvold et al., 2023).

Individuals' behaviors and interactions underpin organizational routines, the cornerstone of capabilities, and, in turn, dynamic capabilities (Cautela et al., 2022; Eggers & Kaplan, 2013; Felin et al., 2012). Dynamic managerial capabilities (Helfat & Peteraf, 2015) support broader capabilities by influencing organizational routines (Wenzel et al., 2020) and empowering managerial vision and the ability to overcome path dependencies (Helfat et al., 2007; Teece et al., 2016). Moreover, transformational mechanisms may also have a crucial impact on transforming organizational culture, notably establishing a creative culture, which is essential during BMI (Bock et al., 2012).

Thus far, we have argued that on conceptual grounds, it is possible to represent the BMI process in terms of the Coleman bathtub. We have done so to represent fundamental mechanisms present in the BMI process in a highly general manner. Although the bathtub framework does involve causal claims (as captured by the arrows connecting the nodes), it is placed on such a high level of generality that it is hardly predictive. However, the framework neatly organizes much of the existing knowledge about BMI and helps us identify where we know the least about the BMI process. Thus, it prepares the groundwork for our empirical analysis in the following.

3 | RESEARCH METHODOLOGY

In the following sections, we undertake an exploratory multiple-case study to gain insight into how microfoundations, encompassing individual characteristics and behaviors, organizational processes and interactions, and structural design components, drive BMI. We aim to highlight different underexplored mechanisms linking microfoundational components at different analytical levels (Contractor et al., 2019; Palmié et al., 2023; Reynolds et al., 2025) to better understand how BMI unfolds.

3.1 | Research strategy and design

Following a qualitative research strategy, we conducted an exploratory multiple-case study within the Finnish power electricity sector, an industry known for its historical conservatism. This type of study allows the exploration and description of a relevant and complex phenomenon, such as BMI, and its driving forces and mechanisms under rare and difficult-to-replicate conditions within specific contexts (Yin, 1994). The method allows for comparative analysis and provides a deeper understanding of the dynamics across different companies (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). While this research focuses on BMI to understand its microfoundations, it also considers the context's role and the sector's inherent characteristics that can support or hinder BMI. During the implementation, this research followed abductive reasoning (Dubois & Gadde, 2002). Based on the underpinnings of the microfoundation movement, the conceptual framework, empirical fieldwork, and case analysis coevolved. Thus, we moved back and forth between the empirical and conceptual worlds (Dubois & Gadde, 2002) to derive and conceptualize our findings.

3.2 | Research context

Historically, the power electricity industry has been highly regulated, and its transformation has been driven by technological changes in electricity generation and transmission (Erlinghagen & Markard, 2012). After years of regulatory changes from the 1990s onward aimed at liberalizing, the progressive introduction of renewable generation technologies and digitization (e.g., self-

generation, electricity storage, micro, smart grids, smart meters, and zero-net-energy buildings) recently emerged as the leading disruptors. Connectivity-enabled smarter grids emerge from the digitization of electricity, integrating hardware, sensors, software, and communication/connectivity (Shomali & Pinkse, 2016). They involve distributed electricity resources and generation, demand aggregation and management, energy efficiency and storage, energy communities, microgrids, prosumers, smart metering, and consumption control (Erlinghagen & Markard, 2012; Rodríguez-Molina et al., 2014).

Regulatory changes challenge the traditional generation–transmission and distribution–retail model (Nillesen & Pollitt, 2016) of selling units of electricity through centralized generation and grids (Bryant et al., 2018). Electricity has become a commodity, and costs have increased, eroding utility company revenues (Richter, 2013). Conservative incumbents face a growing need to engage in BMI to sense and seize business opportunities (Palmié et al., 2021; Rochlin, 2016). In this context, the tremendous volume of information and data generated by recent technological advances based on the Internet of Things (IoT) has fueled BMI (Rahman et al., 2021). Thus, BMI involves complex offerings based on connectivity, sensors, and software-enabled advanced services (Hall & Roelich, 2016). The transition involves a new business logic based on offerings only partially developed upon the commoditized good (i.e., electricity), such as new digitally enabled product-service-software offerings and smart solutions (Kohtamäki et al., 2022) built on remote monitoring and sensors, control systems, and optimizing the operation of smart connected equipment. This technology was previously unknown to most industry stakeholders.

This is a formerly conservative industry with little exposure to change, which has undergone a triple transition from (1) fossil fuels to renewable energies, (2) centralized generation and transmission to a decentralized smart grid based on increasing digitization supported by connectivity (e.g., IoT devices and smart energy metering), and (3) electricity as a commodity to service-led business logic (Rabetino et al., 2017) that involves efficient energy generation and consumption. Consequently, new models have emerged that benefit from the ability to measure how consumers use products and support the transition toward more distributed electricity resources. The emerging options range from service-based solutions (e.g., standard power products and services) to other energy-related services (e.g., life-cycle EV batteries change out, home-related convenience services, or the management of net-metering driven grid sell-back). Depending on utilities' capabilities for information management, service opportunities involve demand and energy management offerings related to energy efficiency and savings. Prominent examples include prosumers, peer-to-peer energy trading, energy-as-a-service, prescription-based energy retailing, demand response programs, and virtual power plans/aggregators (Larrea Basterra & Bilbao Ozamiz, 2020).

3.3 | Data sources, data collection, and case selection

This research draws on multiple data sources, including semistructured interviews, document analysis, interaction with case companies' managers and other key stakeholders in a research project, and a few master's courses on business model development, where one company acts as a live case. However, semistructured interviews are the primary data source for this research because they balance guided questioning and the flexibility to follow unexpected exploration paths (Creswell & Poth, 2018), which allows for a deep understanding of different

TABLE 1 Interviews in the Finnish electricity ecosystem.

Interviewee code	Organization role	Job title	Duration (min)
E1	Energy services	Development Director	101
E2	Fingrid (TSO)	Corporate Advisor	67
E3	Fingrid (TSO)	Specialist	69
E4	Electricity retailer	Head of Unit, Risk Management	57
E5	Electricity retailer	Business Director	70 + 81
E6	Industrial actor (BRP)	VP, Energy Markets	58
E7	Energy regulator	Deputy Director-General	55
E8	Energy industry interest group	Expert	61
E9	Aggregator	Operations Manager	54

Abbreviations: BRP, balance-responsible party; TSO, transmission system operator.

TABLE 2 Interviews in case companies.

Case	Company type	Interviewee code	Job title	Duration (min)
C1	A medium-sized company that operates in the center of Finland	M1	Unit manager, Partnership, and innovations	55
		M2	Development Manager	57
		M3	Product development manager	58
		M4	Unit manager, Sales, and Energy Services	61
C2	A medium-sized company that operates in (rural) Eastern Finland	M5	Risk Manager	52
		M6	Business Director (×2)	126 + 54
		M7	Development Manager	84
		M8	Business Unit Director (×3)	84 + 60 + 59
C3	A medium-sized company that operates in Western Finland	M9	Managing Director	76
		M10	Development Director	66
		M11	Development Engineer	64
		M12	Development Manager (×2)	91 + 63

microfoundational elements that influence BMI. The semistructured interviews were organized in two phases, following Bolton and Hannon (2016).

First, we conducted nine semistructured interviews via Zoom (due to the pandemic) for a broader sectoral-level analysis between August 2020 and July 2021 (see Table 1).

These interviews mainly aimed to gather perspectives on industry megatrends and the related challenges and opportunities for BMI in Finland's electricity sector. We wanted to understand BMI not as an isolated process but as embedded in an ecosystem of diverse stakeholders that may influence BMI possibilities, including utilities and private companies with different industry roles, regulators, and other public or private organizations. We targeted persons with a strong understanding of the industry's megatrends and their implications for companies' operations based on our experience from an ongoing three-year research project concerning BMI in the sector and reviewing industry reports and other documents. Some interviewees were representatives of the organizations that participated in the above project, which included a series of face-to-face and online workshops (during the pandemic). A snowball sampling strategy was also used (Patton, 2015), in which interviewees provided the names of more interviewees who were invited for interviews.

The second phase of our research was conducted in two waves and consisted of a multiple case study involving 16 interviews with 12 key informants in business development roles from three Finnish electricity retailers, two of whom were part of the above project (see Table 2). Denoted as C1, C2, and C3, the case selection followed purposeful sampling (Patton, 2015) and was based on the following criteria that allowed for a comparative analysis to extract nuanced insights. First, we wanted to study incumbent companies with a scale that enables them to engage in BMI actively but not be dominated by international shareholders since it is such that they could import new business models from parent companies abroad. Thus, we concentrated on medium-sized companies with some market share, excluding small, local electricity retailers and large companies with enormous economic power and resources (even with participation in or from foreign markets). Second, we focused on companies committed to BMI and effectively offering innovative business models to the market, regardless of financial and commercial success. Finally, we also accounted for geographical differences, so we chose one case on the west coast, one in the country's center, and one in the east of Finland (thus reflecting the existence of managers and consumers whose preferences may be affected by local traditions and demographics).

We interviewed team leaders (e.g., Directors) and at least two more people (typically middle managers) related to BMI in each company. The semistructured interviews with key informants from the three case companies were conducted in two rounds between August and December 2021 and between February and October 2023. The interview protocols elicited insights into individual cognitive processes, organizational routines, and structural elements influencing BMI. In each case, at least two authors participated in the Zoom interviews, which were video and audio recorded and transcribed verbatim to ensure accuracy in the data analysis.

Other sources were also used to complement the interviews. First, we reviewed companies' annual reports and press releases for indications of new business models

TABLE 3 Data sources.

Data source	Type of data	Topics included in the data source	Use in the analysis
Interviews	*Case study*: 16 Semi-structured interviews with case companies' employees (middle managers and Directors) working directly on business development tasks (Table 2)	*First round* (2020–2021) Industry trends and disruptors and their impact on BMI (in each stage) Opportunity recognition (sources, triggers, actors, tensions and coping mechanisms, actions, processes, and practices) Business model identification and development (actors, tensions, coping mechanisms, actions, processes, routines, and practices) Business model implementation (tensions, coping mechanisms, capability gap, organizational alignment and changes, key learnings) *Second round* (2023) Organizational members' attitudes enable or harm innovation in each BMI stage Individual behaviors and (external/internal) required interactions in each BMI stage Routinization of formal and informal interactions in the organization in each BMI stage Integration of new routinized practices in the existing operations and the role of old structures and processes during the integration in each BMI stage The company's vision, mission, values, and the market's competitive dynamics, regulations, and technological change influence people's attitudes in each BMI stage	As the primary data source, the semi-structured interviews provide an opportunity to gather rich, in-depth information from crucial informants within each case, allowing you to explore individual perspectives, experiences, and insights related to BMI and its microfoundations
	Trends: 9 Semi-structured interviews with stakeholders from the Finnish power electricity ecosystem (Table 1), including policymakers and regulators	Discussions about industry trends (e.g., technological, regulatory, and demand-related) supporting or harming business model innovation in the Finnish power electricity sector. In particular, challenges and opportunities concerning digitalization and the transition toward renewable energy sources, including new business models emerging in the industry	Insights were vital in understanding industry megatrends and their impact on BMI in Finland's electricity sector. By gathering diverse stakeholder perspectives, we identified challenges and BMI opportunities, which inform companies' decision-making
Project workshops	Notes from four workshops involving project consortium members (two co-authors were part of the three-year project)		
Close interactions with C3 personnel	Video records and notes from two C3 managers' presentations and interactions (acting as 'live case') in three editions of a master's course on business model development coordinated by one co-author. The same co-author delivered a four-hour (video-recorded) workshop on business models in the electricity sector to the company's key personnel (15 people enrolled)	Market trends, company's interests concerning key areas for developing new business models, main barriers, and problems. Potential actions to overcome barriers and problems during the business model innovation process	Notes from interactions with managers during courses were used as a tool for triangulation and to support our interpretation of the interview material

(Continues)

TABLE 3 (Continued)

Data source	Type of data	Topics included in the data source	Use in the analysis
Archival data	Press releases, media articles, annual reports, other public documents, and companies' public presentations	Market trends, business development actions, and future areas for business model innovation	Documents were used in preparation for the interviews with each company, and the notes from these documents have also provided insightful information for triangulation and to support our interpretation of the interview material

and strategic choices and changes. In addition, from 2020 to 2022, C3 acted as a "live case" in three master's courses on business model development taught by one of the coauthors, where students analyzed the situation based on the company manager's presentation and developed innovation proposals for the company. The documents provided a historical context, offering a complete understanding of each case's evolving landscape of BMI. While company documents were used in preparation for the interviews, notes from these documents, workshops, and interactions with managers during courses were used as tools for triangulation and to support our interpretation of the interview material (see Table 3).

3.4 | Data analysis

Following iterative steps, the researchers analyzed the data via content and thematic pattern-matching methods (Yin, 1994) and thematic analysis, as Braun and Clarke (2006) described, to systematically identify the collected data's patterns, themes, and relationships. First, researchers carefully and repeatedly read the materials to familiarize themselves with them and highlight important aspects of BMI and the related microfoundations. Next, the researchers followed open coding to identify phrases and meaningful concepts via the data analysis software NVivo 14. Following Gibbs (2018), we started with a list of preset codes from earlier relevant studies concerning microfoundations (Chirumalla, 2021; Inigo et al., 2017; Khan et al., 2020; Mezger, 2014; Mousavi et al., 2019; Ringvold et al., 2023; Santa-Maria et al., 2021; Teece, 2007). Data from alternative sources (e.g., notes from workshops and course interactions with managers and companies' reports) were not coded. Nevertheless, information was added as notes in NVivo 14 to support our interpretation of the interview material.

Later, the initial codes collapsed as the data emerged and were refined in different iterations during the coding process. Codes were subsequently grouped into broader themes, highlighting commonalities and variations across cases. These themes were refined through ongoing discussions and iterative analysis. The primary author conducted the coding process individually to ensure the homogeneity of the criteria, and then another coauthor validated the coding. The whole team engaged in discussing any discrepancies. Comparative analysis was conducted to identify overarching patterns and differences among the cases, allowing a deeper exploration of the elements contributing to BMI. Following Gioia et al. (2013), we created the data structure, condensing the codes into first-order concepts that describe and preserve interviewees' NVivo quotes. The second-order themes appeared based on the authors' thematic analysis and were grouped to form the aggregate dimensions (see Figures A1–A3 in the Annex for further details).

3.5 | Trustworthiness and rigor

Several steps were taken to increase the rigor, trustworthiness, and robustness of our research and guarantee the validity and reliability of the findings (Yin, 1994). The following strategies were jointly implemented to strengthen the research quality and provide a solid foundation for the findings and conclusions. First, the research team ensured methodological transparency and traceability by meticulously recording research procedures (e.g., interview protocols, coding frameworks, and notes/memos), which provided an audit trail for the validation of findings. One coauthor coded all the material for consistency assurance, whereas a second coauthor validated the coding (discrepancies were discussed among team members). Second, four business development team members (including the head) were interviewed at each case company, which allowed for cross-checking of the responses.

Moreover, cross-verification of data from multiple sources through triangulation (Yin, 1994) was employed to increase reliability and mitigate the potential for

singular interpretations or bias. Third, following an iterative feedback process, prolonged engagement enables trustful relationships, facilitating access to sensitive information and allowing participant checking (Lincoln & Guba, 1985) to review and validate the accuracy of our interpretations and findings and ensure that interpretations align with the participants' perspectives. Misinterpretations and discrepancies were addressed and discussed within the team and with the interviewee. Fourth, peer debriefing sessions and peer review/external validation involving multidisciplinary discussions with researchers with business and technical backgrounds not directly engaged in this research (including two conference presentations) helped us assess the consistency of interpretations and insights.

4 | EXAMINING MACRO- AND MICROLEVEL RELATIONSHIPS IN BMI THROUGH THE MICROFOUNDATIONAL LENS

In our three cases, BMI follows a generic three-stage process involving (1) initiation and ideation, including opportunity screening and generation and preliminary ideas with some informal preassessment or prioritization (*Stage 1*); (2) integration and development, involving idea assessment and specification, design, and piloting (*Stage 2*); and (3) implementation and integration, including reconfiguration of organizational resources and optimization and alignment of assets (*Stage 3*). Next, we present the key findings regarding the microfoundations of BMI in each stage of the innovation process, acknowledging them based on different levels from macro to micro: (1) supra- or meta-organizational facts, (2) structural and design components (*Level 3*), (3) processual and interactional components (*Level 2*), and (4) individual-level components (*Level 1*). Following Pratt's suggestions (Pratt, 2008, 2009), we provide the power quotes in the text, whereas the proof quotes are supplementary materials available upon request.

4.1 | Supra-organizational conditions and BMI

Supra-organizational conditions, that is, those elements in the organization's institutional/competitive environment that influence individual and organizational behaviors, emerged in the data as vital for triggering and driving BMI. Notably, new disruptive technology (renewables and digitalization), regulation, and market dynamics have heavily changed the nature of competition, particularly in retail electricity. Thus, companies have moved from a stable environment that only called for fine-tuning business strategies and where digital technology aided efficiency and security to one in which interconnected and often contradictory elements now appear concerning companies' external triggers and challenges.

While the technology push (e.g., integration of renewables and digitalization) triggers the need to search for new opportunities in *Stage 1*, companies must simultaneously address the uncertainty regarding what technology will dominate and become the industry standard. Thus, technological uncertainty makes evaluating potential opportunities challenging in *Stage 1* and may delay the business model specification and design efforts in *Stage 2*. While an ambiguous emerging regulation linked to renewables drives *Stage 1*, regulation ambiguity/delay (or the lack of regulation) makes estimating potential profitability difficult and hinders the creation of new business models in *Stage 2*. Clarifying potential forthcoming changes in legislation and their impact on companies' operations is critical when moving toward *Stage 3* since it influences the market's operation.

> "... the next regulatory model will be implemented in 2024. So then, we aim at what we get to the regulatory model, the idea that this OPEX is also considered the same way as CAPEX today. So, companies can, for example, use flexibility or other services to have a choice, not only build more cables, which is the case today." (E3)

In addition, competitive pressures have increased from the industry's inside (competitors and customer empowerment) and outside (newcomers). These competitive pressures drive technology and BMI while facing moves from competitors and new entrants.

> "Competition could be anything; it does not need to be anything of what we just discussed because that is now, but yes, from now on, it could be Google. Then, the question is, do we compete with Google or find a spot where we cooperate with Google and complement Google in some way." (M12)

Competitive pressures have also shaped the industry's evolution, pushing companies to look for new opportunities in *Stage 1*, a trend reinforced by commoditization (where it is increasingly difficult to differentiate offerings). Thus, competitive pressure has pushed companies to design digitally enabled offerings comprising a range of new services.

> "... all consumption data from every single electricity meter and household will be transferred to a huge data hub, and then it should be open data. So, if you are Company 1 [*name removed*] and want to get some clients of Company 2 [*name removed*], you can take the data from the data hub with the customers' permission and look at their consumption profile. Okay, we can give them the best option. It is just the streamline and opens the market more, making competitive bids easier." (M10)

The process is often characterized by isomorphism, in which competitors tend to specify similar solutions in *Stage 2*.

> "...the development ideas and products we have can also be found among competition. Of course, we do our tweaks and optimization variants of them too, you know, maximize the benefits and so on or functionalities, but, so far, what has been handled by my team has mainly been new things for the company, but not necessarily new in the industry." (M12)

Finally, customer needs and interests act as another key BMI trigger. In a context described by increasing customer empowerment, there is an (a priori latent) demand-pull for new technology-enabled services requiring new business models. Thus, companies must explore and invest to avoid being left behind, acknowledging that technology will eventually become dominant due to the push of regulation. Hence, customer needs are a crucial driver, and when looking for opportunities in *Stage 1*, the attention of developers may be directed based on concrete customer demands. However, tensions may emerge in *Stage 2* since consumers may remain uninterested in many segments, notably households, due to insufficient incentives and motivation to buy those services since the benefits are unclear or the costs offset the perceived advantages.

> "So, raising the people's interest is the first problem; even if it is for free, it does not cost you anything to raise the people's interest and to make people understand what this is about and how important it is in the big picture. It is hard to get people to understand, let alone if they would have to pay 1,000 euros plus the monthly fee." (E5)

4.2 | Organizational influence on BMI: Structural and design components

Organizational structural and design components (notably strategy and structure) seem to act as both antecedents (enabling or disabling) and outcomes of BMI (when BMI is seen as an outcome, that is, a new BM configuration embedding design aspects). Our evidence reveals the influence in all three stages, although the power and scope of such influence vary in each case (see Table A1 in the Annex). The impact of organizational design's influence on idea unfolding and embodiment appears to be twofold in *Stage 1*. First, organizational strategy emerges as BMI's main internal driver following the trends in the sector (with customer demand being one strong situational mechanism, as discussed above).

> "These are strategic choices. We have digitization, security of supply, interest groups, intelligent network, and partner ecosystem. This is all part of the strategy work we did, and we do that almost every year nowadays. These main topics did not change and did not change this year, for example. However, with these subtopics, because the focus changed differently, for example, this new generation of smart meters and how to benefit from those was before just a rollout project. That was our focus." (M2)

In particular, strategy as a steering and scoping tool becomes a directive force, a powerful situational mechanism that spills its impact downward, affecting people's behaviors at *Level 1* and, in turn, organizational processes at *Level 2*. Thus, strategy drives attention and influences the search direction and scope.

> "... whenever we come up with a new idea, then we compare it to our strategy. What does our strategy say? Does it fit into the strategy? If yes, and if we should do it, and if it is crystal clear that this is good, then we start. If not, then we start with a feasibility study. What is the market? Does it make any sense?" (M10)

Second, organizational structure design follows company strategy and affects the degree of organizational flexibility/inertia, influencing BMI. Flatter structures and smaller teams increase flexibility by supporting lateral information flows and the combination of knowledge and innovation. However, the inherited corporate culture can create inertia if it prevents the change in traditional

structures initially designed for a once-conservative industry where BMI was historically uncommon. Inertia may particularly affect people who have been in the company (or the industry) for a long time.

> "... the biggest tensions came from the mother company. You know, a lot of our grand ideas were more or less shot down, you know, we had the balloon flying, and then bang was shut down from the head office. If I say that is cruel, yeah, but that is our culture." (M6)

Under these circumstances, the TMT, notably the CEO, must guide emerging BMI plans (if they can overcome inertia forces or if they were recruited from other industries). They are vital in promoting a collaborative atmosphere, encouraging and supporting employees' exploration and experiential learning, and providing opportunities to try ideas that a priori seem less promising or relevant (e.g., budgeting). Changing organizational structures may require new employees to fill previously non-existent roles. While the new organizational structures will influence the direction and scope of the search, new recruits may act as both an action formation mechanism and a transformational mechanism (at *Levels 1* and *2*), especially when new innovative people come into developmental roles with fresh ideas and practices.

The role of strategy as a guideline and situational mechanism remains relevant to fostering an innovation culture and achieving cultural readiness in *Stage 2*, whereas strategic alignment becomes critical and calls for three core actions. First, defining strategies and actions to fit industry trends is necessary, and a continuous strategy work process is needed. In the considered company cases, strategy results from a strategic process with increasingly shorter cycles and more periodical recaps than earlier and calls for a systemic approach (e.g., following roadmaps). As stated above, new business models develop from strategy choices, which must be re-evaluated periodically to ensure they fit trends and adopt corrective measures before they are too late. The case companies undertake routine strategic work every 2 or 3 years to establish thematic priorities.

> "...in our company, we renew our strategy in three-year cycles. We overlook the whole business and see them try to see the trends, possibilities, and threats, which we can now see as the basis of our strategy. We look at the whole business every three years, which is how it works." (M5)

However, the industry's dynamics require that key stakeholders hold several checkpoints and recap a year, which will shape processual and interactional components at *Level 2* since this task is typically accomplished through workshops or periodic meetings. These gatherings are commonly utilized for sensemaking, where ideas are selected and prioritized in *Stage 1* and then shaped and further developed in *Stage 2*.

Second, developing a joint commitment to a shared vision and agenda starts with strategic choices, which require clear and formal communication and participatory processes. Guiding artifacts, such as roadmaps, facilitate this process. Third, organizational culture is crucial in promoting an innovative mindset and enabling individuals to engage in trial-and-error and risk-taking. Indeed, evidence highlights the interaction between organizational culture and individual mindsets and points to culture as a mechanism for making a difference at Level 2.

> "... but this kind of innovation culture, if you wanted to have it the fullest, you have this fail fast, but fail forward-thinking, so maybe in a way, we could have like one or two things that are really outside the box and go and see what is there." (M1)

Thus, organizational culture and its changes emerge as other situational mechanisms influencing individual mindsets (at Level 1), which, in turn, in our case companies, typically act as action creation and transformational mechanisms leading to new practices that ultimately redefine organizational processes at Level 2. Accordingly, fostering an innovation mindset in these traditional companies working in a conservative industry is vital for seizing new business models. In this context, providing opportunities for experimentation is essential. The TMT, notably the CEO, serves as a mediator and arbiter for emerging conflicts regarding ideas for BMI, observing strategic alignment.

Finally, *Stage 3* pertains to the organizational redesign required to integrate the emerging business models and encompasses three key components. First, it involves restructuring the organization and interlinking its functions. Thus, action concerning ensuring the interaction among organizational functions through flexible linking structures and appointing responsible people for new functions and tasks (e.g., creating new structures and processes and establishing channels for cross-unit interactions) is needed. It may also involve restructuring and "separate vs. integrate" decisions to achieve cultural readiness.

> "Some IT companies I know have separated the new innovative businesses from the existing ones by doing it in a separate company. That is the one way to do it so you can have a different company culture. I also see a risk in acquiring a smaller company, a very innovative company, to a very conservative company like you, which will kill their innovation in weeks." (M9)

Second, reconfiguring and leveraging resources involves adapting or changing existing systems, adopting new technologies, and retraining personnel. Staff recruitment may constitute another mechanism (both situational and transformational) that contributes to changing people's mindsets at the individual level and achieving cultural readiness. Resource reconfiguration also means acquiring boundary-spanning resources through integrating complementary competencies and partnership management (e.g., establishing and managing alliances and partnerships).

> "We might need to purchase a new company with new resources, or some person must be retrained to cope with the reality." (M12)

> "They are all related so that you would need for the new business; you would need the resources for the personal resources and the money and everything." (M9)

Third, the transformation needs the TMT's commitment and leadership to achieve change by enacting the vision, setting priorities, and accepting contradictions. The TMT may also become a source of inertia if it has been in the industry for a long time. Indeed, our cases show that leadership implies evangelizing tactics to spread beliefs and convert nonbelievers, collaborating tactics, and even involving collegial authority to remove obstacles. Leaders, especially CEOs, are crucial as change evangelists since the literature has shown that strategy-making is emotional and that cognitively sophisticated solutions are essential to balance efficiency and flexibility in dynamic environments. This implies the management team's ability to make quick and brave choices, avoiding being caught up in politics.

> "...we must accept that this situation is changing, and then we as leaders and managers must take care that the energy of the people is looking forward to the next steps and how we can utilize this possibility. How can we avoid those threats or those negative issues? How can we use this possibility? How can we make some new revenue or something from this situation?" (M4)

4.3 | Processual and interactional components of BMI

Distinctive elements can be identified for each stage by examining BMI processes, routines, practices, and interactions. The interviews revealed that while the organizational strategy provides guidance, opportunity sensing and ideation initially involve different rehearsing ideation practices, many of which become transformational mechanisms. These practices are essential for opportunity screening, fostering interaction among corporate members, and initial attempts to aggregate and formalize praxis. First, concerning opportunity screening, ideation interactions and processes are informal at the beginning of *Stage 1*. However, as progress is made toward *Stage 2*, the level of formalization seems to increase. Key processes entail market intelligence-related organizational activities such as market monitoring and technology scanning, involving the interaction and follow-up of customer needs and benchmarking competitors and trends from the sector and adjacent industries.

> "We have looked into the different companies, competition, and even different business areas, and that is, of course, where the strategy is to provide services not just for energy, such as electricity or district heating, but also for some related services. Of course, that also comes from other industries." (M9)

Second, opportunity recognition and initial ideation may occur at all organizational levels. Thus, companies must implement idea-creation processes across the organization to foster open interactions, which must be concrete but remain informal and open and be supported with specific instruments (e.g., customer interaction, discussion forums, idea assessment, and tracking). Companies generally utilize various idea-gathering practices to interact with and discuss potentially innovative ideas, often through workshops or messenger apps (e.g., WhatsApp) and an intranet (e.g., Teams) to follow up and keep them alive. Third, actual work still occurs in projects that demand formal higher-level processes guiding the steady systematization of informal practices. In our cases, they take the form of a project management model (milestone gates, flowchart, or similar) in its initial stages for aggregation and praxis formalization, which serves as a basis for decision-making concerning idea

preassessment and prioritization (with critical decisions made at the end of each milestone evaluation).

> "So, there is a path to how the ideas are passed forward, but you know it is not a machine where you put one at one end, you put ideas in, and at the other, you get innovations. You know it is more, I would say, rather a hippie style." (M6)

> "... but systematic in the big picture might be missing like we do not have an annual structure to sit down with tools and think about what is happening in the world in different businesses." (M8)

Next, *Stage 2* systematizes the definition and business model development by routinizing value creation based on specific processes and interactions. First, the interviewees agreed on prioritizing ideas that must be treated as projects for detailed planning, considering the big picture, following clear implementation rules, and fully formalizing the earlier milestone gate model. This stage includes defining the value proposition for customers and the organization (involving multiple stakeholders) and setting the project scope. These tasks imply understanding developmental requirements, structuring decision-making, and defining further assessment rules and KPIs at the core of the BMI process.

> "...once we have found an idea which we want to develop and look at, we have a gate milestone model which we then use for the idea's management or portfolio project management. So obviously, Gates Zero concludes that whatever we want to develop cannot be handled as a task. It must follow the project gate model, and then we have, you know, G1, G2, G3, G4, and then the post-project evaluation gate. We follow these different steps and prepare project charter plan schedules. Make the proper gate decisions to go ahead with the next one. So, I would say that is the governing model; once we have identified an idea, we want to work with." (M12)

As innovation will not be free of organizational tensions in rapidly changing contexts, encouraging, engaging in, and managing conflict appear essential when finding innovative business models that fit the strategy. Indeed, allowing some degree of tension seems to be ideal for moving the process forward.

> "... it is a kind of cultural conflict – and you know sometimes it creates, it really does create frustration, but on the other hand,it also kind of strengthens it blues us together." (M6)

Our findings suggest that managers must enable a psychologically safe environment for mature and open discussions, team up with people with different degrees of risk aversion, and use alternative problem-solving techniques (e.g., learning cafes).

Second, the stage contains critical practices and interactions for structuring business model generation based on adopting a customer-centric approach. It also calls for cross-functional exchanges and interactions with external stakeholders (e.g., consultants and IT providers) and design thinking tools for collective sensemaking, brainstorming, and development (e.g., PowerPoint, Miro, or business model canvas).

> "Of course, we have used the business model canvas and had some consultants helping us. So yeah, I think it is about the organization's maturity, and when it increases, we can use most of those tools ourselves. There is no need for another outside consultant." (M4)

Third, activities and interactions for learning and scaling opportunities by prototyping and piloting are keys.

> "First, we make prototypes and look for what works. Based on that, we create MVP for our service. So, it is about collecting user information, structuring it, making a prototype, and testing it. This is our customer-based innovation model." (M3)

This step can include joint R&D projects, coopetition, and partnership with tech companies. The three cases involve testing ideas with customers to define the business model. Thus, developing innovative technologies with high costs and uncertain financial outcomes pushes midsized companies to seek technology partners and cooperate with competitors in technology development (coopetition) as a coping mechanism to balance risk and reward. Consequently, ecosystem-related interactions are essential for innovation.

Notably, regulations and norms (as supra-organizational determinants) heavily influence market operations and, in turn, impact the potential for creating novel business models at this stage.

Finally, *Stage 3* involves creating readiness for agile and consistent business model integration and implies

different critical elements. First, there is a need to balance stability and change by implementing agile working and ambidextrous management and looking for continuous improvement. Second, two key actions to motivate people and push things forward are empowering responsible people based on team leadership and establishing clear roles and responsibilities. Third, as the interviewees highlighted, promoting organizational entrenchment based on building team spirit and an open and engaging atmosphere to redirect people's energy forward is critical. The alignment of corporate culture is crucial to moving these innovation processes forward because of inertia and change resistance. The interviewees emphasized the importance of internal cooperation, which was encouraged by an open and knowledge-sharing culture. Informants also pointed toward internal communication, openness, and information flow as practices to create team spirit, generate employee enthusiasm and satisfaction, and cope with resistance.

> "... it is about internal communication, and so the situation picture. In the company, we have one situation picture, share it, and talk about it. First, we must understand what is happening and accept that this situation is changing. Then we, as leaders and managers, must take care that the people's energy is looking forward to the next steps and how we can utilize this possibility." (M4)

4.4 | Individual-level components: Agency and behavior in BMI

Individual agency and behaviors are central in all BMI stages and drive action-formation mechanisms, defining how things are done at *Level 2*. In *Stage 1*, a proactive approach to opportunity recognition is critical for idea sensing and involves different elements. First, an entrepreneurial mindset is essential for a proactive approach involving attitudes and behaviors such as long-term vision, risk acceptance, and out-of-the-box thinking. Second, a positive attitude is critical in neutralizing inertia from pessimistic thinking and promoting openness and a collaborative atmosphere for new opportunity identification. It includes behaviors such as enthusiasm and seeing threats as opportunities. Third, experience-based intuition is a means of idea perception. While idea suggestions come from many sources, employees play a pivotal role in perceiving which of them hold potential as genuine opportunities, highlighting the need to encourage and stimulate employees' exploration and experiential learning and to try ideas that a priori seem less promising or relevant. Early involvement and assessment of emerging adjacent technologies and markets are critical themes. However, it seems imperative to take the initiative, explore, and learn from emerging things with unwritten rules, and even shape their development, carefully considering threats and opportunities for BMI when possible. Our evidence highlights the importance of intuition based on prior experience in perceiving opportunities.

> "We lean more towards intuition. I cannot say that we have extensively trained our team in this regard. Let's say we go by gut feeling. We start with a superficial internet search to see if there is something deeper to investigate. If that looks interesting, then the intensity increases, and we reach out to someone who can help us go through it more thoroughly. But it is not formalized in any way." (M8)

Consequently, different cognition-based action-formation mechanisms are fundamental. Experience seems critical at all stages, particularly at the first two stages. Thus, new employees with diverse experiences enlighten opportunity recognition, acting as a means of mindset changes and sources of new ideas. Instead, three crucial situational mechanisms determine the focus of attention during the idea-sensing process: industry trends, company strategy, and customers' needs and desires. In this context, while employees act as initiators, middle managers serve as buffers, communicating and advancing ideas while looking for buy-in from the TMT.

In *Stage 2*, successfully developing new business models depends on finding individuals with an innovative personal approach to business model crafting and development. This approach includes different individual characteristics. First, a creative mindset includes skills such as out-of-the-box thinking, innovation-minded individuals, and market orientation. Second, a willingness to take risks involves stamina and stubbornness and enables individuals to challenge the status quo, defy organizational norms, and carry out tasks without authorization when needed (sometimes jeopardizing old businesses). Third, such an approach is grounded in cognitive processes centered on experiential self-reflection underpinned by learning, involving portfolio management and analogical thinking. Some simple organizational rules grounded in experience are also noted (e.g., minimum expected returns for whatever investment). Analogical reasoning is crucial. Netflix and Spotify were names mentioned repeatedly. However, inspiration comes from the banking, telecommunications, and security industries.

Middle managers act as networkers, connecting external and internal stakeholders, promoting interactions, and intervening in challenging situations at the team level.

> "In some phases of the development, sometimes we fear that now we have some challenges, and we cannot solve them. Well, let's take a few steps back and rethink it. That is what I have learned." (M11)

In *Stage 3*, a growth-oriented approach (e.g., step-by-step with strategic thinking) and a business mindset (e.g., accepting challenges and engaging in responsible development and problem solving) are essential for implementing and integrating emerging business models. As change agents, middle managers are crucial in promoting organizational growth.

> "...we have to be in a way more realistic and recognize the causalities and the impacts between different development lines." (M1)

> "I think my way is that let's just start doing and go step by step and by conscious evolution. Maybe not revolution, but evolution and every day." (M4)

> "So, looking at the big picture, not just suboptimizing." (M10)

Table A1 in the Annex summarizes the key findings (including a detailed description of the key mechanisms). Complementarily, Table A2 shows each company's cases prevalence of the framework's aspects (e.g., second-order themes and aggregate dimensions).

5 | DISCUSSION

5.1 | The BMI process

Scholars have called for a better understanding of the intricacies of BMI (Foss & Saebi, 2017, 2018; Spanjol et al., 2024). In particular, innovation management scholars have recently highlighted the need to scrutinize the BMI process, examining its microfoundational aspects (Spanjol et al., 2024). In response to this call, we conducted a multiple case study using the Finnish power electricity sector as a research context. On this basis, we explore and discuss key drivers in each BMI stage (e.g., technology, customer insights, and legislation) and the role of organizational mindsets and culture, core practices, processes, and middle and top managers. In doing so, we examine the interaction mechanisms that drive the interplay between microfoundational elements at macro and micro levels along the three BMI stages (opportunity recognition/ideation, BM specification and design, and integration/implementation).

In our case companies, the innovation process typically resulted in business model adaptation and, only sometimes, in a fully fledged BMI (e.g., business models that are new for the industry). Local search leads to narrow market-specific innovations (e.g., selling solar panels and apps for consumption monitoring). However, successful and more radical BMI require searching for and experimenting with broadening domain-expanding business logics involving complex technologies and business models with uncertain performance outcomes (Pisano, 2017). Our evidence suggests that companies seeking more radical BMI must move beyond local searches to respond to a changing environment. Recognizing the critical importance of the microfoundations of BMI may help companies better address the challenges of the BMI process. As we discuss next, our research identifies key microfoundational components and processes at different levels, including processes and practices that activate internal and external stakeholders and organizational design elements.

5.2 | The microfoundations of BMI

This research investigates how microfoundations for BMI, encompassing organizational design and processes as well as individual characteristics and behaviors, interact to drive BMI in industry incumbents. In doing so, we explore the primary mechanisms steering the interplay of granular, often overlooked, microfoundational elements determining BMI. Inspired by microfoundational insights into analytical levels (Felin et al., 2015), the discussion is organized into three levels and, following the BMI process literature (Gassmann et al., 2020; Morris et al., 2005), three analytical stages. Next, we discuss the generalities and specificities of the key findings presented in Figure 2 from top to bottom, emphasizing each stage's microfoundational components and the mechanisms defining their interplay between the macro and micro levels.

First, supra-organizational conditions drive BMI at the macro level, particularly technology, regulation, and competition trends. Our findings resemble those of previous studies. For instance, Saebi et al. (2017) conclude that external actors, new technologies, and regulatory and market forces are among the main BMI drivers. Thus, the environment is often a BMI driver (Spanjol et al., 2024)

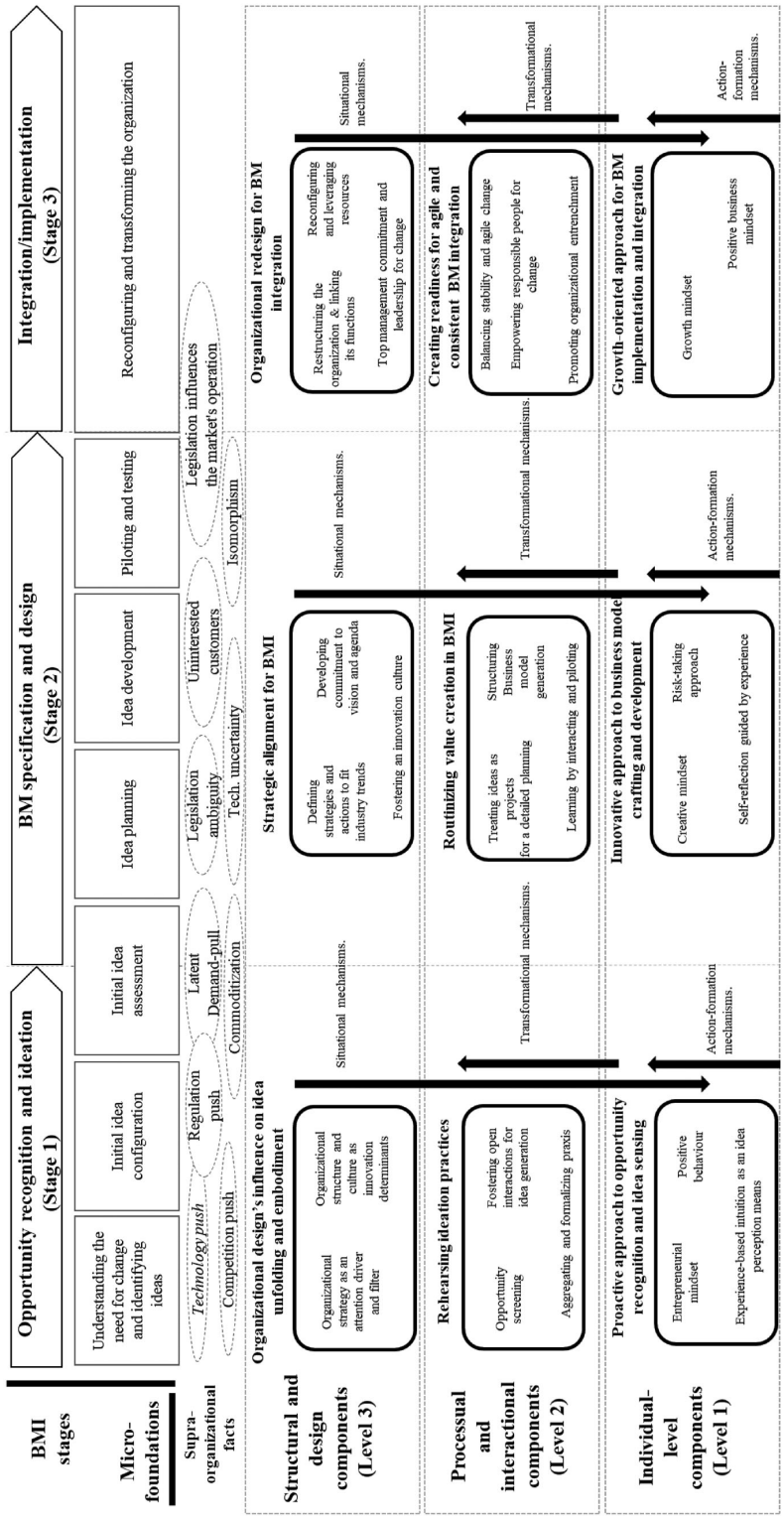

FIGURE 2 Microfoundations of BMI.

or antecedent (Witschel et al., 2022). Nevertheless, there are nuances and particularities. For instance, technology, regulation, and competition are vital determinants during *Stages 1* and *2*, whereas legislation becomes crucial for market operations, steering transformative efforts in *Stage 3*. Moreover, the role of customers as BMI drivers also has a paradoxical impact across stages. While potential latent demand seems to push BMI during *Stage 1*, realizing it into actual sales is challenging because difficulties in building business cases eventually lead to uninterested customers during the piloting in *Stage 2*.

As earlier (conceptual or review) studies concluded, organizational strategy emerges as another situational mechanism (Andreini et al., 2022; Teece, 2007), and our findings add novel and empirical specificity to this insight. Existing research identifies a company's vision as a trigger and enabler of opportunity identification (Ringvold et al., 2023; Sniukas, 2020). Our findings suggest that the company's strategy is a strong situational mechanism in *Stage 1* (Teece, 2007). However, it remains such a mechanism in *Stage 2* since business models develop from strategy choices (Casadesus-Masanell & Ricart, 2010), and business model development requires strategizing and strategic alignment from all organizational members.

This research also confirms that organizational design at the macro level (hard and soft aspects, e.g., structure, culture, and leadership) sets conditions for individual behavior at the micro level. Indeed, recent studies suggest that organizational design elements act as situational mechanisms (Foss & Saebi, 2015; Leih et al., 2015), becoming antecedents (enabling or harming), moderators (driving relationships influencing new BM specifications), or subjects to change during BMI (Foss & Saebi, 2015).

While flatter organizational structures foster innovative behaviors in *Stages 1* and *2*, possibly at the cost of speed and execution, organization design changes define agility and speed of change in *Stage 3*. In this context, efforts are needed to achieve cultural readiness to support innovative behaviors and creative problem solving in *Stages 1* and *2*, respectively, and to break resistance to change in *Stage 3* (e.g., aligning the whole organization to implement the transformation). Our conclusions align with earlier studies suggesting that organizational culture impacts strategic flexibility (Bock et al., 2012). As mechanisms, our findings point to setting incentives to promote desirable individual behaviors (as illustrated and discussed below) and guaranteeing behavioral change in each stage, which is vital to measuring BMI success.

The role of the TMT/CEO and middle management, including leadership, communication, and control methods, is critical in doing so in all BMI stages but presents some particularities and nuances. For example, while TMT leadership support was essential for promoting a creative culture in *Stage 1*, the reliance on traditional organizational structures and routines created inertia (e.g., silos and poor communication) and hindered opportunity recognition due to path dependency. Primarily, the CEO acts as a guide, pivotal in setting the direction, breaking inertia, promoting entrepreneurial behavior in an open environment, and balancing trade-offs through clear corporate objectives (Ringvold et al., 2023). Instead, middle managers act as buffers, advancing ideas and seeking the TMT's buy-in. This research suggests that when stability and risk aversion were historically prioritized, a balanced approach that combines strategic oversight, top-down leadership, and bottom-up innovation is essential to foster BMI in Stage 2. Such an approach calls for setting the proper mechanisms to avoid top-down directives clashing with bottom-up innovation efforts. Thus, TMT members, notably the CEO, act as mediators and arbiters of potential organizational conflicts, whereas middle managers are networkers connecting internal and external stakeholders, promoting interactions, and mediating team disagreements. In *Stage 3*, as previous research concluded (Ringvold et al., 2023), our findings suggest that this transformation requires top-management commitment and leadership for change, which involves breaking with inertial forces rooted in conservative firms from a traditional sector. Thus, TMTs/CEOs act as evangelists, and communication is critical and becomes a key mechanism affecting people's mindsets at the micro level. In this context, middle managers are crucial as change agents, promoting cross-unit interactions and fostering business growth.

Second, given the conditions for individual behavior, action formation mechanisms translate individual behavior and actions into collective interactions at the micro level, where particular attitudes and mindsets are needed at each stage. In *Stage 1*, employees are initiators, requiring particular mindsets for guiding behaviors and interactions (Ringvold et al., 2023). Nevertheless, while individual actors are pivotal in initiating and driving BMI by recognizing and developing novel ideas, they must be ready to challenge existing practices and norms. Some employees must act as innovation champions, take initiative, and interact with colleagues to promote new ideas. Often, the interactions begin informally, and many of these practices are legitimized over time. Indeed, our data suggest that opportunity recognition and ideation draw primarily on spontaneous initiatives steered by more entrepreneurial and initiative-taking members driven by intuition-based experience. Thus, new recruits may help, act as mindset setters, and bring potential innovation champions.

Additionally, during the developmental stage, people's cognition and behaviors (e.g., creative mindset, risk-taking, and self-reflection) are crucial to business model crafting and development and become action-formation mechanisms that impact individual interactions (Helfat & Peteraf, 2015; Lenka et al., 2018). Instead, organizational transformation demands individuals with growth-oriented and business-oriented mindsets for new business model integration and implementation, as these cognitive characteristics act as action-formation mechanisms and impact interactions, managerial practices, and processes (Ott & Eisenhardt, 2020). Indeed, cultivating a growth and business-minded attitude with a positive outlook seems critical in creating organizational readiness for an agile and consistent integration process, which also needs empowering, responsible, and accountable individuals. In this context, middle managers are crucial as change agents, promoting cross-unit interactions and fostering business growth.

Third, BMI as a collective organizational outcome emerges from aggregating individual actions through transformational mechanisms impacting organizational processes and practices and determining BMI as the cumulative effect during the three BMI stages at the level involving processual and interactional components. As shown in Figure 2, these components in our company cases include, in each BMI stage, individual characteristics (e.g., affective, cognitive, and behavioral skills and expertise), leadership styles that lead to different roles for middle and top managers, and organizational processes underpinning sensing, seizing, and reconfiguring capabilities. For example, processes concerning sensing and sensemaking, learning and knowledge sharing, strategizing, value creation, coordination, and integration matter greatly to BMI, as suggested by prior studies (Andreini et al., 2022; Teece, 2007) and as we clarify and exemplify below. Once routinized, these microfoundational aspects result in dynamic capabilities over time (Helfat & Peteraf, 2015; Teece, 2007; Zollo & Winter, 2002). Indeed, the conventional dynamic capability microfoundations of sensing, seizing, and reconfiguring (Teece, 2010, 2018) closely resemble the three BMI stages we identify. Our findings also support Smith et al.'s (2010) conclusion that routines must be in place to address paradoxical demands such as exploration and exploitation, learning and performance, and stability and agility.

However, particularities and nuances exist across BMI stages. For instance, the processual and interactional components include processes for rehearsing ideation practices for opportunity screening at *Stage 1*. Our findings show that interactions often begin informally (being almost praxis), and many of these practices are legitimized over time. Nevertheless, early efforts must seek to aggregate, systematize, and formalize practices (e.g., creating periodical forums) since sensing may occur at all organizational levels (Teece & Linden, 2017). Success depends on enabling cross-organizational, open, and transparent interactions in this context. In *Stage 2*, practices become routinized as ideas progress from assessment to planning and become formal projects. As concluded in earlier studies, value-creation processes are critical (Andreini et al., 2022) and call for steering methodologies, such as project management methods (Sniukas, 2020). Our evidence suggests that process systematization in our cases was typically performed through aggregation based on higher-level formal processes, often following standard project management step-by-step models that treat BMI as product or service development.

Moreover, our findings also support earlier studies' conclusions, suggesting that collective sensemaking and organizational learning are among the five crucial capabilities of BMI (Loon et al., 2020; Ott & Eisenhardt, 2020). In our cases, structuring business model development involves particular artifacts (e.g., using the business model canvas) to aid in brainstorming and sensemaking (Bapuji et al., 2012; Laasch, 2019). Moreover, learning and knowledge shaping from iteration with different stakeholders through piloting and prototyping are also critical processes, as suggested by earlier studies (Andreini et al., 2022; Geissdoerfer et al., 2022; Ringvold et al., 2023). These processes include coopetition and cocreation among different internal and external stakeholders.

Finally, processes for creating readiness for agile and consistent business model integration are at the core of *Stage 3*, which requires agile and ambidextrous change management practices and control mechanisms (e.g., feedback loops and monitoring) to ensure resource synergies, capability leveraging, integration, and smooth operational alignment and adoption of new business models. Additionally, processes for adapting, changing, and integrating systems and reconfiguring resources are needed and must be internally or externally sourced. Indeed, this transformation calls for establishing roles and empowering responsible and accountable individuals. Adequate information channels to secure information flows are crucial to ensuring successful transformation.

6 | IMPLICATIONS

Research into the microfoundations of BMI remains limited and scattered (Palmié et al., 2023; Ringvold et al., 2023; Spanjol et al., 2024). Additionally, most such research rests on the dynamic capabilities framework of Teece (2007), but other relevant microfoundations of BMI are not captured by this framework. In this

research, we examined BMI processes in several established companies in a traditional industry to gain insight into the microfoundations of BMI, which play out across different levels within an organization and across different stages. While not contradicting existing research, our findings add new insights and nuances to understanding BMI.

6.1 | Implications for research

Our research contributes primarily to BMI research (Foss & Saebi, 2017, 2018) and to two related research streams (Kurtmollaiev, 2020): the microfoundation movement in strategy and organization theory (Abell et al., 2008; Felin et al., 2012; Felin et al., 2015) and the microfoundations of dynamic capabilities (Schilke et al., 2018; Teece, 2007).

First, our research provides evidence on microfoundations at different levels, complementing existing research on the microfoundations of BMI and expanding the still limited empirical evidence (Palmié et al., 2023). Most existing research has focused primarily on microfoundations with dynamic capabilities. There is less evidence regarding the framework proposed by the microfoundations movement in strategy and organization theory. Research remains uncommon beyond conceptual works or reviews (Schilke et al., 2018), with only a few empirical exceptions (Mancuso et al., 2024; Ringvold et al., 2023; Sniukas, 2020; Zahoor et al., 2024). To date, Sniukas (2020) and, in particular, Ringvold et al. (2023) represent the only sustained attempts to understand the microfoundations of BMI following the microfoundation movement in strategy and organization theory (Felin et al., 2012; Felin et al., 2015). Our research complements earlier studies by approaching the phenomenon in a different context, that is, traditional companies in a conservative industry. This research extends earlier studies, notably offering detailed evidence concerning the interplay between microfoundational components at various levels. In doing so, it outlines the interactions between microfoundations and often discusses unexplored action-forming (e.g., mindset and experience), transformational bottom-up emergence (e.g., interactions and practices), and situational mechanisms (e.g., strategy and customer requirements). Moreover, this article presents evidence about the role of middle managers in each stage of BMI beyond the crucial role of initiators and forerunners (Ott & Eisenhardt, 2020; Ringvold et al., 2023).

Second, the research adds to the microfoundations of the dynamic capabilities research stream by connecting Teece's (2007) approach and the microfoundation movement (Felin et al., 2015). We have argued that each of the BMI stages we have identified draws on one of the clusters of dynamic capabilities proposed by Teece (2007) (sensing in *Stage 1*, seizing in *Stage 2*, and reconfiguring in *Stage 3*), providing evidence for these microfoundations and related practices in a new context (which materializes at the second and third levels in Figure 2). Moreover, our research also moves toward the microlevel, shedding some light on the critical individual-level components proposed by Helfat and Peteraf (2015) when discussing dynamic managerial capabilities. Specifically, our research illustrates how situational mechanisms (e.g., industry trends, firm strategy, and customer demands) focus attention and set limits for new opportunities searching in *Stage 1*. Additionally, our findings highlight the crucial role of self-reflection guided by experience in *Stage 2* concerning problem solving and reasoning. Finally, as suggested by earlier studies (e.g., Ringvold et al., 2023), communication also plays a pivotal role in our findings as a tool to provide feedback, enact the vision, and promote organizational commitment and entrenchment in *Stage 3*.

6.2 | Managerial implications

Our research also offers a framework that can guide the understanding of the above requirements and may complement other tools already used during BMI (Gassmann et al., 2020; Osterwalder & Pigneur, 2010). Findings may help managers answer questions such as "What does BMI mean regarding strategy work?," "What practices should be required in BMI?," and "How should our HR profiles, organizational processes, and practices be altered to find dynamic consistency according to our strategy?" Next, we offer practical implications and directions for managers to find these answers and promote and implement BMI.

Individuals at all organizational levels, including front-line employees and middle and top managers, are instrumental in initiating, developing, and implementing innovative ideas and driving BMI. Senior leaders must foster a creative culture in their workforce, eliminating rigid business cases (Ringvold et al., 2023) and building a secure environment where innovation is encouraged by setting the right incentives. Mechanisms, such as establishing internal innovation or idea incubation programs to provide employees with the resources and autonomy to explore new opportunities, are needed to promote creative behavior. For example, developing adequate HR practices and incentives is crucial because BMI requires individuals with specific mindsets and teams with certain characteristics (Loon et al., 2020).

Understanding the individuals' profiles that drive BMI is vital for their management to develop them. In addition to hiring innovation champions, training focused on innovative thinking and management can provide employees with skills to challenge the status quo and think outside the box. Of course, upskilling and reskilling activities may be supported by suitable recognition and reward systems that formally acknowledge contributions to BMI to incentivize and motivate people to imitate such behavior.

Individual behavior and interactions define key processes for BMI, such as sensemaking, value creation, learning and knowledge sharing, and strategizing processes (Andreini et al., 2022). Understanding the processes and practices that can lead to BMI is vital for management to implement them. Strategizing is essential, as a steering mechanism and flexible structures support the implementation of key processes. Interaction and collective processes are critical across BMI stages. Managers must break down organizational silos, eliminate communication barriers, go beyond prevailing informal practices, establish communication channels and forums to support open communication and knowledge sharing, and promote cross-functional collaboration. Cross-organizational project teams can also facilitate idea exchange and business model development activities. Empowering employees on these teams to work autonomously by endowing them with some budget and decision-making freedom seems to be a critical success factor. Managers trying to innovate must promote the adoption of agile methodologies, which allow quick prototyping, testing, and refining of new business models. Thus, organizations can respond faster to market or regulatory changes.

Senior managers must frame and adequately communicate a clear long-term vision and agenda that aligns with the organization's strategic objectives while ensuring that all employees understand their position in BMI's ongoing strategic activities. Leaders are vital to stimulating innovation and cooperation, and effective leadership styles can foster an environment where creative processes thrive. Managers must adopt flexible organizational structures that allow agility and responsiveness to new opportunities while preserving controls to balance innovation with operational stability. Radical business model development may require dedicated resources, differentiated governance structures, and longer development and implementation schedules. Additionally, it could involve new specialized cross-unit innovation teams, even ad hoc teams, which should be free to pursue disruptive ideas without being constrained by existing processes and budgets. Finally, BMI should be seen as an ongoing process and continuously promoted through participation in innovation ecosystems that serve as a means for new ideas, technologies, and business model propagation and provide a relatively safe environment that enables rapid testing and scaling up. Thus, managers must look for joint innovation opportunities, including collaboration and partnerships supporting the company's strategic goals. Indeed, proactively engaging with external stakeholders may ensure the viability of new business models. Examples include co-creation with customers, communication with regulators, and participation in industry forums to support BMI. Moreover, not only does past research support our implications, but in complex transitions, Aagaard and Vanhaverbeke (2024) suggest that BMI requires a cross-disciplinary and multi-stakeholder approach to open innovation in somewhat open ecosystems.

7 | LIMITATIONS AND FUTURE RESEARCH

This research draws on a qualitative multiple-case study. A key limitation is that we considered cases where the companies successfully found new business models, such that our findings may suffer from survivorship bias. Studying companies that fail can yield insightful findings. As with every case study, this study does not seek statistical generalization but is used as a methodological instrument for generating theory (Yin, 1994). Nevertheless, we argue that some highly cautious contingent generalization is possible (Pratt, 2009). Thus, our findings may be relevant to other firms transitioning to BMI, especially traditional manufacturers disrupted by digitalization.

Our findings and analysis represent potentially falsifiable insight into the microfoundations of BMI, and a quantitative approach is, therefore, applicable in principle. Thus, our research may suggest new hypotheses about the microfoundational underpinning of BMI, which we would like to test in future research. One potential problem is that datasets that allow measurement of the BMI construct are few, and measurement scales are virtually nonexistent (see Saebi et al., 2019). Given this problem of missing data infrastructure, another way forward is to continue conducting small-N BMI research (Foss, 2021). This would entail researching the microfoundation dimensions of BMI in industries other than the one we considered here. Such research would also allow for more fine-grained and illuminating comparisons across cases and findings concerning such issues as the relative importance of different microfoundational drivers of BMI and how exactly microfoundational factors are causally involved in BMI across different firms and industries.

Finally, we followed a positivist approach when planning and implementing the case study (Eisenhardt & Graebner, 2007; Yin, 1994), which calls for

decontextualizing our findings (Welch et al., 2011). Nevertheless, we recognize that the context is essential in our research and may even be part of the explanation. Moreover, microfoundational explanations rely on a layered social ontology to derive mechanistic explanations (Foss, 2021). Consequently, approaching the microfoundations of BMI using a critical realist lens is an option for future studies.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

ETHICS STATEMENT

The authors have read and agreed to the Committee on Publication Ethics (COPE) international standards for authors.

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APPENDIX A

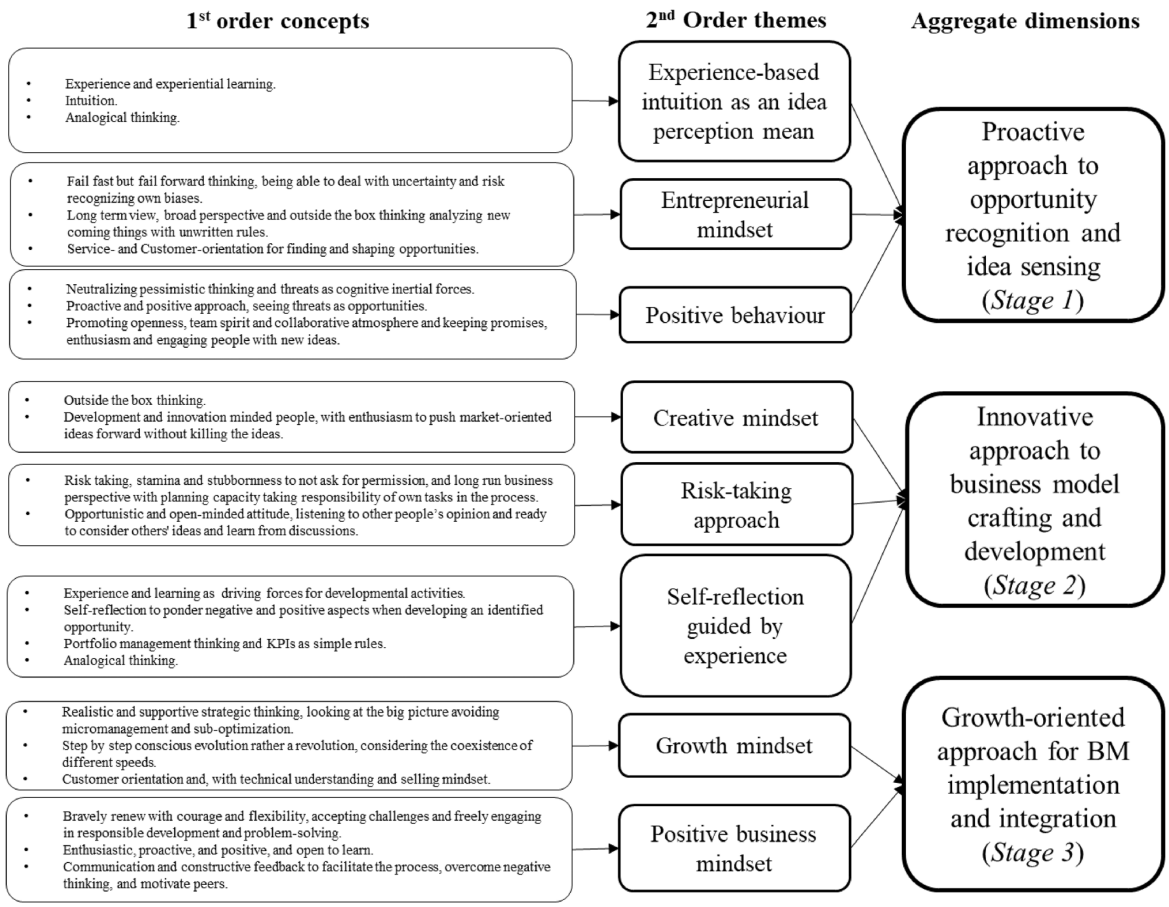

FIGURE A1 Data structure. Individual-level components (Level 1) in each BMI stage.

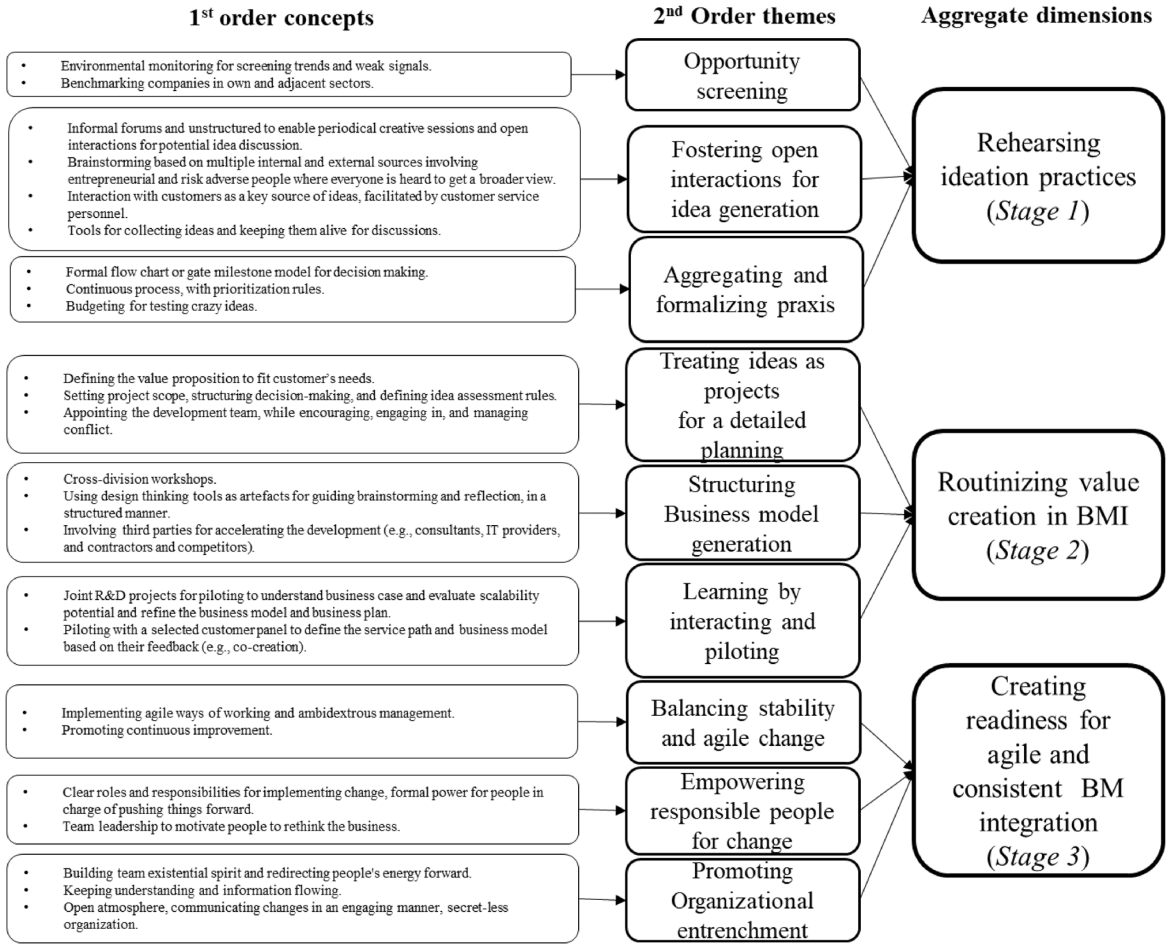

FIGURE A2 Data structure. Processual and interactional components (Level 2) in each BMI stage.

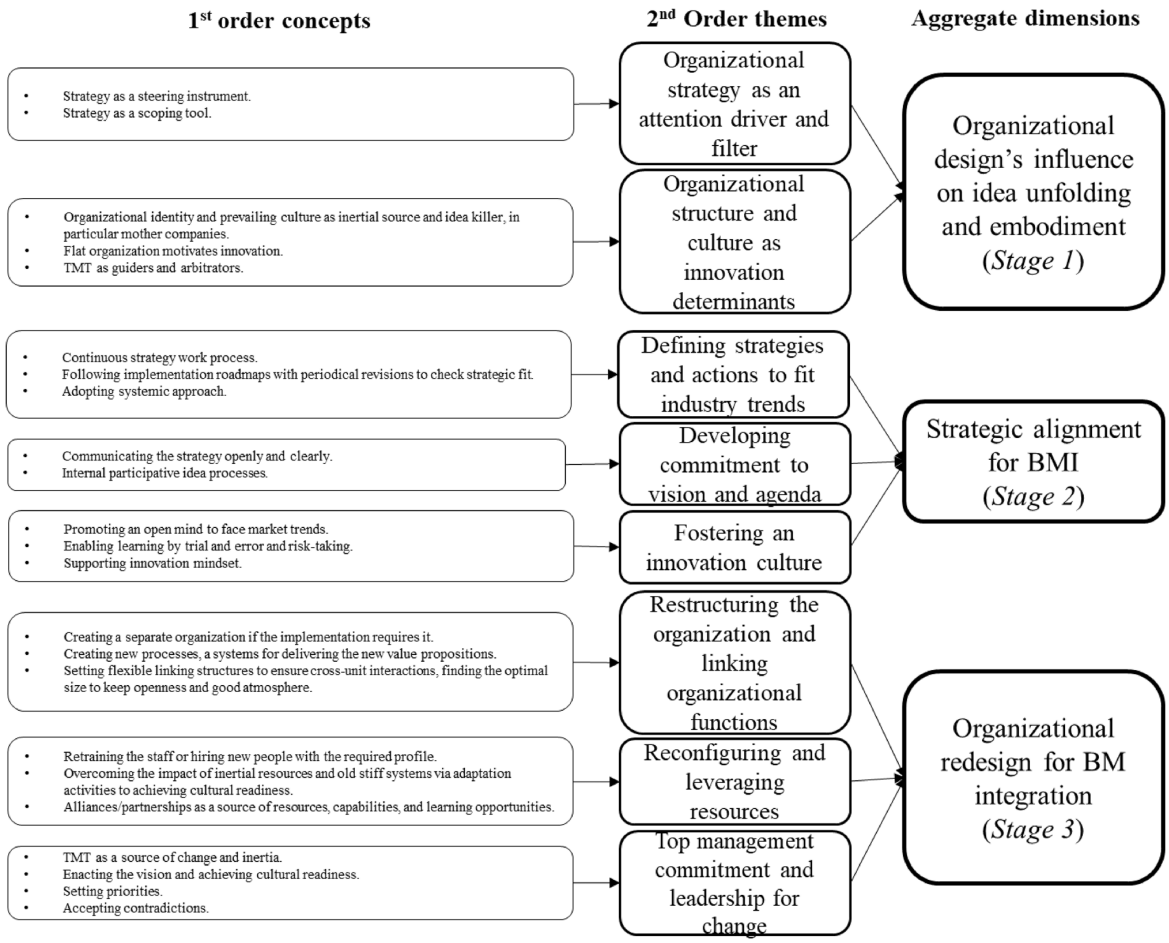

FIGURE A3 Data structure. Structural and design components (Level 3) in each BMI stage.

TABLE A1 Microfoundations of BMI: A summary of the key findings.

Level/stage	Stage 1	Stage 2	Stage 3
Structural and design-level components (Level 3)	*Key elements* 1. Organizational strategy as driver and filter is a steering and scoping instrument 2. Organizational structure and culture are strong innovation determinants defining flexibility and inertia, influencing individuals' perceptual filtering and cognitive framing 3. TMT is essential to promoting individual innovative behavior via incentive setting *Main mechanisms* 1. Industry trends, strategy, and customers' needs drive individuals' attention and influence the search direction and scope at *Level 1* 2. Flatter and culturally ready organizations foster an innovative attitude. The CEO (and TMT) acts as a guide and compass to create an innovative culture and support experiential learning	*Key elements* 1. Formulating a strategy to fit industry trends is a guideline for developing new business models 2. Developing a commitment to the vision and strategic alignment, where participation and communication are essential 3. Fostering an innovative culture to promote trial-and-error and risk-taking-driven behaviors and providing opportunities for exploration and experimentation *Main mechanisms* 1. Legislation, technology, and customer needs are scoping mechanisms for business model development 2. Strategy acts as a steering and scoping mechanism. It sets the shared vision and the developmental agenda and actions 3. Organizational culture influences individuals' mindsets (at *Level 1*), determining innovative behaviors and creative problem-solving 4. TMT serves as a mediator and arbiter for emerging conflicts regarding ideas for BMI, observing strategic alignment 5. Distributing clear and formal communication	*Key elements* 1. Restructuring the organization and interlinking its functions to ensure organizational interactions 2. Reconfiguring and leveraging resources 3. TMT's commitment and leadership to achieving change by enacting the vision, setting priorities, and accepting contradictions *Main mechanisms* 1. Prevailing organizational culture (e.g., cultural readiness) and structure define agility and speed to respond to changes 2. Recruiting new staff is often needed to resource new tasks and positions and will impact behaviors and interactions at *Level 1* and drive cultural shifts 3. The CEO (and TMT) act as change evangelists (crafting change narratives); communication is critical and affects people's mindset (at *Level 1*)
Processual and Interactional-level components (Level 2)	*Key elements* 1. Opportunity screening to benchmark competitors and adjacent industries and formal customer interactions to observe their needs 2. Fostering interactions for idea generation 3. Aggregation and formalization of praxis *Main mechanisms* 1. Employing formal and (mainly) informal market intelligence activities, practices, data/analytics, and tools for opportunity recognition to identify and interpret environmental signals (trends and patterns) and develop new ideas 2. Organizing open cross-organization channels and periodical gatherings for ideation and sensemaking, where	*Key elements* 1. Treating ideas as projects for detailed execution planning includes idea prioritization and following clear implementation rules 2. Structuring business model generation to routinize business model development based on a customer-centric approach 3. Learning and seeking scaling opportunities *Main mechanisms* 1. Using project portfolio management tools (gate models, KPIs, milestones, roles, and project teams) and decision-making frameworks, including artifacts, such as roadmaps and business model canvases, to	*Key elements* 1. Balance stability and change 2. Empowering responsible people based on team leadership 3. Promoting organizational entrenchment by building team spirit and an open, engaging atmosphere to redirect people's energy. Openness and knowledge-sharing culture, internal communication, and information-flowing practices are needed to create team spirit, generate employee enthusiasm and satisfaction, and cope with resistance *Main mechanisms* 1. Implement agile working and ambidextrous (change) management practices and

(Continues)

TABLE A1 (Continued)

Level/stage	Stage 1	Stage 2	Stage 3
	ideas are pre-selected, assessed, and prioritized 3. Introducing stages models for idea aggregation and praxis systematization	facilitate the business modeling process 2. Organizing cross-functional participatory periodical gatherings and channels with external facilitators and design-thinking tools for collective sensemaking and brainstorming, where people collectively interpret opportunities and conditions (and their business implications) and, consequently, ideas are twisted and further developed 3. Participating in joint R&D projects, coopetition, and partnering with tech companies for ecosystem building, learning (process improvement), complementing capabilities, and scaling opportunities via testing, prototyping, and piloting (including some business model experimentation and co-creation with users)	control mechanisms, and seek continuous improvement (e.g., feedback loops and monitoring) to ensure resource synergies, capability leveraging and integration, and the smooth operational alignment and adoption of new business models 2. Adapting or changing existing systems, adopting new technologies, and retraining personnel. The task also involves acquiring resources through integrating complementary competencies and partnership management 3. Establishing clear roles and responsibilities 4. Providing adequate internal communication, promoting openness and information flow to create team spirit, generate employee enthusiasm and satisfaction, and cope with resistance at *Level 1*
Individual-level components (Level 1)	*Key elements* 1. Entrepreneurial mindset, risk acceptance, and long-term view 2. A positive attitude and proactive approach are needed to neutralize inertia from pessimistic thinking and promote openness and a collaborative atmosphere for new opportunity identification 3. Experience-based intuition acts as an idea perception enabler based on experience, intuition, and perception of business potential. Experiential learning and networking in different forums and groups (e.g., fairs or specific industry events) and with various stakeholders are essential *Main mechanisms* 1. Promoting intrapreneurship, exploration, experiential learning, open openness, and a collaborative atmosphere 2. Employees act as initiators (particularly innovation champions). Middle managers are a buffer, communicating and advancing ideas while seeking the TMT's buy-in. New employees come with fresh opportunity-sensing practices and business ideas	*Key elements* 1. Innovative individuals with creative mindsets, strong market orientation, and out-of-the-box thinking are crucial behaviors and characteristics 2. A willingness to take risks involves stamina and stubbornness and enables individuals to challenge the status quo, defy organizational norms, and carry on tasks without authorization when needed (sometimes jeopardizing old businesses) 3. Self-reflection is guided by experience, following analogical thinking, and some simple rules where individual learning is crucial *Main mechanisms* 1. Promoting risk-taking and market orientation behaviors based on clear incentives to influence business model development 2. Middle managers act as networkers, connecting external and internal stakeholders, promoting interactions, and	*Key elements* 1. A growth-oriented approach (e.g., step-by-step with strategic thinking) is a crucial attitude 2. Business mindset, acceptance of challenges, and engaging in responsible and positive problem-solving *Main mechanisms* 1. Using incentives to guarantee behavioral change (e.g., accepting and adapting to new roles and processes) and commitment to change to ensure the effectiveness of the reconfiguring efforts and adoption of new models 2. As change agents or enablers, middle managers are crucial in promoting organizational growth

TABLE A1 (Continued)

Level/stage	Stage 1	Stage 2	Stage 3
	3. Internal communication, effectively using IT tools to follow up and keep opportunity-related ideas alive	mediating in conflictive situations at the team level	

TABLE A2 Prevalence of the framework's aspects by company case.

Dimension		Elements	Case 1 (M1–M4)	Case 2 (M5–M8)	Case 3 (M9–M12)
Individual-level components (Level 1)	A proactive approach to opportunity recognition and idea sensing (Stage 1)	Experience-based intuition as an idea perception means	+	+++	++
		Entrepreneurial mindset	+++	+++	+++
		Positive behavior	+++	+++	+++
	Innovative approach to business model crafting and development (Stage 2)	Creative mindset	+	+	+++
		Risk-taking approach	+	+++	++
		Self-reflection guided by experience	+	+++	+++
	Growth-oriented approach for BM implementation and integration (Stage 3)	Growth mindset	+++	+	+++
		Positive business mindset	++	++	+++
Processual and interactional components (Leve 2)	Rehearsing ideation practices (Stage 1)	Opportunity screening	+	+++	+++
		Aggregating and formalizing praxis	+	+++	+
		Fostering open interactions for idea generation	+++	+++	+++
	Routinizing value creation in BMI (Stage 2)	Treating ideas as projects for detailed planning	+++	+++	+++
		Structuring business model generation	+++	+++	+++
		Learning by interacting and piloting	++	+	++
	Creating readiness for agile and consistent BM integration (Stage 3)	Empowering responsible people for change	+	+	+++
		Promoting organizational entrenchment	+	+++	++
		Balancing stability and agile change	+	+	++
Structural and design components (Level	Organizational design's influence on idea unfolding and embodiment (Stage 1)	Organizational strategy as an attention driver and filter	++	+++	+++
		Organizational structure and culture as innovation determinants	+	+	++
	Strategic Alignment for BMI (Stage 2)	Building commitment to vision and agenda	+	+	+
		Defining strategies and actions to fit industry trends	+++	+++	+++
		Fostering an innovation mindset	+	+++	++

(Continues)

TABLE A2 (Continued)

Dimension		Elements	Case 1 (M1–M4)	Case 2 (M5–M8)	Case 3 (M9–M12)
	Organizational redesign for BM integration (Stage 3)	Restructuring the organization and linking organizational functions	++	+	+++
		Reconfiguring and leveraging resources	+++	+	+++
		Top management commitment and leadership for change	+	++	+++

energies

MDPI

Article

Ushering in a New Dawn: Demand-Side Local Flexibility Platform Governance and Design in the Finnish Energy Markets

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Abstract: Energy ecosystems are under a significant transition. Local flexibility marketplaces (LFM) and platforms are argued to have significant potential in contributing to such a transition. The purpose of this study was to answer the following research question: how do market conditions and stakeholders shape emerging LFM platform governance choices? We approached this objective with an exploratory single-case study by conducting ten semi-structured interviews with key stakeholders in the Finnish energy ecosystem. The results of the content and pattern analyses revealed the key challenges to LFM implementation such as the current regulatory treatment of flexibility, high costs of gadget installations, and ensuring sufficient liquidity in the market. In addition, we also demonstrated that despite such barriers, the Finnish ecosystem is largely pragmatic about LFMs' in its midst. All in all, we contributed to the non-technological streams of LFM literature by developing an exhaustive framework with four distinctive dimensions (i.e., ecosystem readiness, value-creation logic, platform architecture and governance, platform competitiveness) for LFM development, which helps academics, practitioners, and policy-makers to understand how novel platforms emerge and develop.

Keywords: flexibility; demand-side flexibility; local flexibility market; flexibility service; platforms; energy platform; platform governance and design; Finnish energy markets

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1. Introduction

"Either you become a platform, or you will be killed by one" [1]

We live at the cusp of many significant changes that have been taking place in the realms of the energy business, where issues such as decarbonization or decentralization of the energy ecosystem have entered the mainstream consciousness [2]. Occurring concurrently, we have industrial internet gaining momentum in the energy cluster along with a mounting push for consumer empowerment [3]. Under such pressure, the status-quo sees corresponding innovations either as solutions in the market [4,5] or emerging technologies awaiting implementation [6]. One emerging example of such consumer empowerment can be found in the local flexibility marketplaces (LFM) for demand-side management. So, while flexibility markets for larger energy entities have been a regular part of the grid for some time [5], the race to take it to a micro level is a relatively new one. The target is that even small households can react to the optimal consumption design devised by this marketplace [7], increasing grid efficiency and reducing network investments [8,9].

Acknowledging the technological intensity of the energy sector, it is perhaps unsurprising that the literature on local flexibility marketplaces has been mostly technological in scope. However, from a non-technological perspective, we see two significant streams of

research emerging. Firstly, a vibrant stream of literature discusses this development's regulatory landscape [9–11]. Secondly, there is a stream looking at the market's architecture and design, which includes subjects such as business models [12–14], stakeholder roles [15,16], and ecosystem design [7,9,17,18].

Prior studies looking into LFM design have mainly focused on its role in the increasingly localized energy ecosystem gaining momentum in the European Union [19,20]. Controversies and possibilities in making LFM a contagious part of the grid have also been investigated [8]. We can further see a proliferation of literature on prosumers' role in the future energy management schemes, particularly the motivations, roadblocks, and instruments enabling their robust participation [19,21,22]. Previous studies have also examined the changing energy business models due to platform development [23], digitalization in smart grid networks [24], as well as the role of prosumers in the digital energy ecosystem [25].

However, the novelty of LFM increases as we account for the growing prominence of platforms in the energy markets. Platforms act as a foundation upon which an array of firms, together forming an ecosystem, can develop complementary products, technologies, and services [26]. It is the center of the digital economy and creates online infrastructures enabling a diverse range of human activities [27]. In the energy context, platforms are increasingly used to connect consumers to the grid. So, while industries, such as retail, real estate, or social media, have a solid foothold of the platform model, platforms as a phenomenon are relatively recent in the energy sector [23,27]. Moreover, while the prior studies provide valuable insight into LFM and most non-technological aspects are taking place on a platform, it is surprising that there is not much discussion highlighting this integral feature of the LFM. Put differently, there seems to be a dearth of literature combining the platform perspective and LFM developments.

Furthermore, we know that platform development is impacted by market conditions such as industry and firm-level characteristics, organizational networks, and access to customers or supply channels [28,29]. In other words, these external conditions shape the platform's development process and mold its eventual properties. Furthermore, these conditions become even more pressing for emerging sectors, such as the LFM [29]. Stakeholder collaboration is paramount in this development process, and platform governance emerges as a useful concept here. It provides us with strategic frameworks that are grounded in technology and yet are stakeholder-driven, thus helping us to activate novel platforms in their broader context [1].

Therefore, this paper tapped into this opportunity by answering the following research question: how do market conditions and stakeholders shape emerging LFM platform governance choices? Through answering this question, we developed a framework with four focus areas in the LFM platform development process that requires careful consideration. For further contextualization of this framework, we conducted a case study within the Finnish energy ecosystem, as it has been labeled as one of the 'smartest grids' in Europe [30]. The same authors [30] also noted that a demand-side flexibility management platform is under development in this market, thus further validating the suitability of this study in the Finnish setting. Finally, the study identified market conditions and stakeholder issues relevant to the LFM development in this ecosystem.

Our motivation for undertaking this research rests on the idea that, in the fast-moving LFM design discussions, integrating platform perspectives can expedite this process. Platform literature provides us with access to varied development strategies [26,31], adoption frameworks [32,33], and consumer interaction pathways [34,35], among others. Since LFMs qualify as platforms, we can import frames to develop business models, control mechanisms, and governance structures for this marketplace. Ignoring this perspective, we fear there might be a risk of putting efforts behind reinventing the wheel.

The contribution of this study is threefold. First, this study contributes to the non-technological streams of LFM literature and opens a niche. Merging platform literature with the flexibility marketplaces, we developed an exhaustive framework for LFM development

in the Finnish energy ecosystem. We believe this framework yields analytical value in understanding and developing other energy ecosystems, especially within the EU context. Another contribution of this study is the identification of *Ecosystem Readiness* as a distinct dimension to the novel platform development process. This dimension sets the tone for the platform development process as a whole. We believe that the addition of this foundational focus area transcends the LFM sector and helps to understand novel platform development processes better. Second, the findings hold essential insights relating to platform development for the practitioners in the energy cluster. It presented lessons for potential LFM operators as well as other stakeholders that could be impacted by this development. Issues such as how the LFM's emergence impacts the energy sector, potential frictions among stakeholders, and their solutions were considered. We further identified significant challenges and opportunities associated with the LFM development in Finland. Third, this study offers comprehensive insights for policymakers concerning local flexibility marketplaces. This paper is the first such study in the Finnish context, and we identified several policy barriers and areas where further refinement is needed. In addition, we registered a willingness among regulators to accommodate such marketplaces in the ecosystem, particularly in geographical areas where the system operators can utilize the LFM to procure flexibility competitively.

The rest of the paper is structured as follows: Section 2 presents the literature review on LFMs and platform governance, followed by a preliminary theoretical framework. Section 3 describes the methodology for this paper. Section 4 outlines the findings from LFM and platform perspective, and in Section 5, the two perspectives are merged to develop the unifying LFM development framework. Finally, Section 5 concludes the paper with this paper's limitations and further research possibilities.

2. Theoretical Background

2.1. Local Flexibility Marketplaces

A local market in the LFM context can be viewed as an institutional framework enabling the trading of flexibilities [5,17], and where flexibility is understood to be the possible generation and consumption adjustment upon a signal (i.e., price) [36]. The boundaries of an LFM are almost always understood through spatial constraints, limited to geographical entities such as neighborhoods, towns, or small cities [37]. A broad framework of LFM can be found in Ramos et al.'s [5] proposal suggesting that these markets are 'long or short-term trading actions for electricity flexibility in a certain geographical location, voltage level, and system operator, given by grid conditions of balancing needs, where participants in a relevant market can be aggregated to provide flexibility services' (p. 28). Many relevant stakeholders are typically part of the LFM, such as the distribution system operators (DSO) and transmission system operators (TSO), balance responsible parties (BRP), the consumers and prosumers, and the market operator itself [37,38]. The system operators and the BRPs buy flexibility from the consumers, prosumers, or aggregators [5]. However, although central in most frameworks, due to the lack of negotiation power and flexibility volume of the end consumers, the role of the aggregators is not deemed mandatory across proposals.

Designing such a market, one must consider the regulatory landscape that it operates in. For instance, in a classical regulated semi-competitive market, the competition is on the supply side, whereas only the TSO could be on the procuring end [5]. However, a recent EU amendment in the regulation made it possible for DSOs to procure flexibility for their grid management [39]. Another aspect fundamentally determining the market design is the technological reality of the given ecosystem. The penetration of distributed energy resources (DER) is a principal matter here, other prominent requirements being the capability of smart meters, ICT infrastructure, and grid topology [5,17]. A market design form can take various forms such as centralized optimization, game theory variants, models based on auction theory, and simulation models [37]. The most common formulations for LFMs are the centralized models, which can take two avenues based on their

objectives: maximizing social welfare or minimizing operational costs. When it comes to LFM operationalization, Ramos et al. [5] proposed two possibilities: a sub-market of the wholesale market or a novel exchange platform run by the system operators or a third party. However, the latter option of system operators in charge of this market is a contested topic as it might compromise fair competition in the market [38]. As a result, both these operators have been barred by EU regulations from operating local markets [39].

The centrality of the system operators to this market also necessitates close coordination between the TSO and the DSO and multiple DSOs if they are active within the LFM [5,38]. Due to the in-depth knowledge that the DSOs have on their network customers, they must act as neutral arbitrators in the marketplace while ensuring system stability, power quality, technical efficiency, and cost-effectiveness [38]. Several authors [15,40] have proposed market designs focusing on DSO problem solving, congestion, and voltage violations. In the EU, market-based procurement of flexibility by promoting DER integration in the grid is essential [15]. TSOs, on the other hand, face a different question: whether they should participate in the LFM directly or settle in a broader role facilitating the market [38].

Lastly, local features, too, are central to the flexibility market's design, and often these features are encapsulated in the form of an energy community where the LFM could play an important role. Local energy communities (LEC) can bring DER's in a particular vicinity in the market; the upward trajectory of prosumer participation complements in this regard [18,37]. However, the role of LFMs in LECs is not mandatory, but considering that we are moving towards heightened use of technology among households and with DER penetration rising, a strong case can be made in favor of LFM's [17]. The placement of aggregators plays a crucial role in these communities. New business models are incentivized through DER aggregators, making the flexibility trading more sustainable; the needed regulatory changes are currently underway [37]. The centrality of the aggregators in the local market can also be found in specific energy community designs where they play a crucial role in electricity production and consumption, settlements, and contract fulfillment [17,32]. We can summarize the principal components of LFM design as depicted in Figure 1.

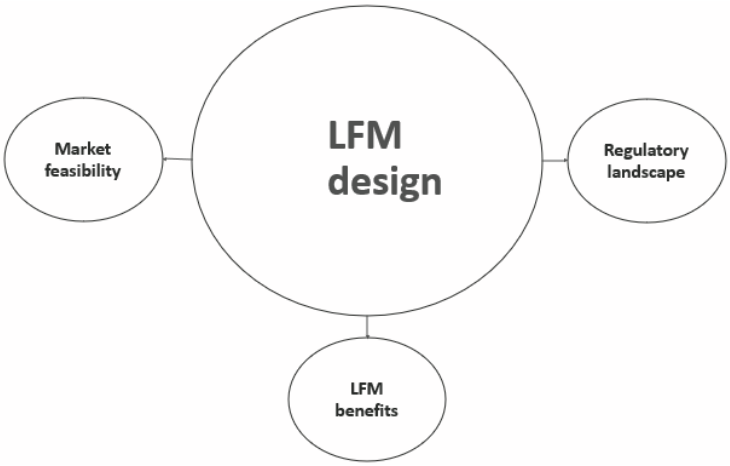

Figure 1. The components of LFM design.

2.2. Platform Governance

Moving on to platform governance, it is apparent that LFM shares many characteristics with platform development and design models. Though platforms are not a recent phenomenon [41], a contemporary understanding is intimately connected to the current digital economy. Many of the largest and most influential companies today are revolving around platforms, and adopting a platform model is seen as an existential move in many industries [1]. Prominent examples of industries operating on a platform can be found in

social media (Facebook, Twitter), e-commerce (Amazon, eBay), or search-engine platforms such as Google. Perhaps because of its centrality in the digital economy, the current view on platforms was initially mainly technological, but the platforms were later studied as a prominent business model. According to Gawer and Henderson's [33] view, platforms are a component of a dynamic technological system with a very strong interdependency among the sub-components. This system can exchange a broad consortium of services, content, software, or novelty exchange such as smart contracts [1]. Network effects, meaning the influence a network's structure exerts on user behavior [34], play a central role in mobilizing this value exchange within a business ecosystem [1,42]. While most platforms operate with an external focus, there are also platforms with a more inward focus, used predominantly to facilitate a firm's in-house product development, though sometimes along with its development partners [42].

Platform governance can be perceived as the framework guiding the platform's decision-making process [31]. Furtenau et al. [43] stressed four focus areas relevant for this stage: strategy and governance, technical architecture design and standardization, community building, and engaging with the broader ecosystem. In a general setting, Tiwana et al. [31] proposed that platform governance is a function of the platform's decision rights, control mechanism, and the proprietary versus shared element of the platform. We can further identify ensuring economic viability [42], ecosystem development [42], regulatory landscape [1], and transparency and communication channels design [1] to be the prominent issues in platform governance.

The economic viability of the platform calls into question many considerations; among them, pricing is an important one [42]. Business models become relevant here as they provide the framework to enable the platform's economic engine. We can also identify the platform's transaction partners, their value propositions, and how the platform operator connects to them [35]. However, economic viability cannot come as the sole strategic matter in the early stages of a platform, and issues such as risk-sharing [42], regulations [1], competitive landscape [35], and technological environment [44] should also be considered. Regulations are an apt topic, particularly as Fenwick et al. [1] pointed out; specifically, the current regulatory frameworks governing the market are not equipped to enact a thriving platform culture. Especially for a sensitive industry such as the energy sector [45], this issue is even more pressing, as Furstenau et al. [43] pointed out; besides coping with laws and regulations, it is also imperative to adhere to informal expectations (e.g., data security, quality control). Investigating platform governance, we summarize such issues as *platform strategy* in our proposed framework in Figure 2.

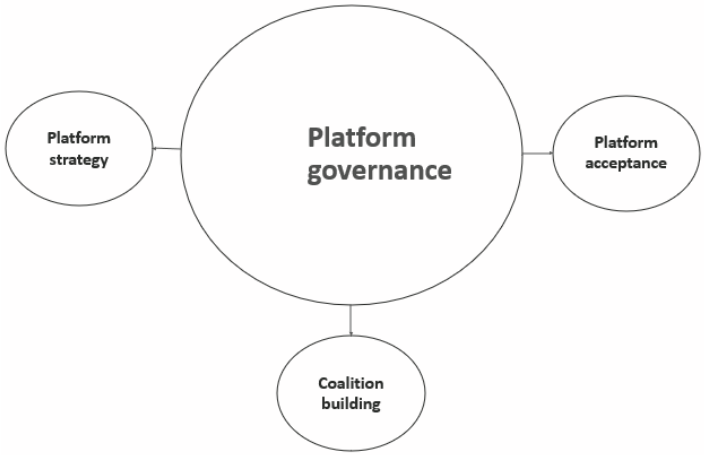

Figure 2. The components of platform governance.

Platforms also require collaboration. More specifically, platform operators or developers must enact an innovating ecosystem for the platform partners [42]. Complementing that goal, Euchner [44] proposed that a value-adding network should be established, leading to collaborative innovation. A complementing business model becomes relevant here, along with an environment that nurtures it [42]. Furthermore, platform governance should make the threshold to join the platform as low as possible for its target user group to develop a thriving ecosystem and start the practice of sharing the benefit from the get-go [44]. However, there are endemic challenges to the platform's ability to develop an ecosystem, such as the ones identified by Adner et al. [46]: execution risks, co-innovation risks, and adoption chain risks. Additionally, we can also add challenges such as developing coherent internal processes in the partner companies [42] and creating a winning strategic positioning for the platform [43]. We summarize these issues in the category of *coalition building*.

Moreover, the perceived usefulness and the perceived ease of use are the principal determinants of user adoption of a novel technological innovation, which aligns with the technology acceptance model proposed by Davis [47]. Moreover, for a platform's long-term success, the reliability and security of its technological base must also be stressed [1]. For a novel platform, communication becomes paramount, as it reaches out to its ecosystem and builds an ongoing dialogue to develop trust and credibility [1]. If done correctly, the new technology generates a positive perception of its usefulness, which results in an increased intention to use it [41]. We classify this stage as working towards *platform acceptance*.

2.3. Theoretical Framework

Based on the above discussions, we conceptualize the domain of our inquiry in the following framework in Figure 3. The intersecting area between platform governance and LFM design perspectives, at the center, becomes our focus area going forward. In analyzing the intersection, we consider the platform design framework provided by Tura et al. [48]. The framework enables us to holistically investigate the stakeholder influence and market forces on the LFM by going through the following problematic areas common in platform design: platform architecture, value creation logic, governance and practices, and the platform's competitive atmosphere [48].

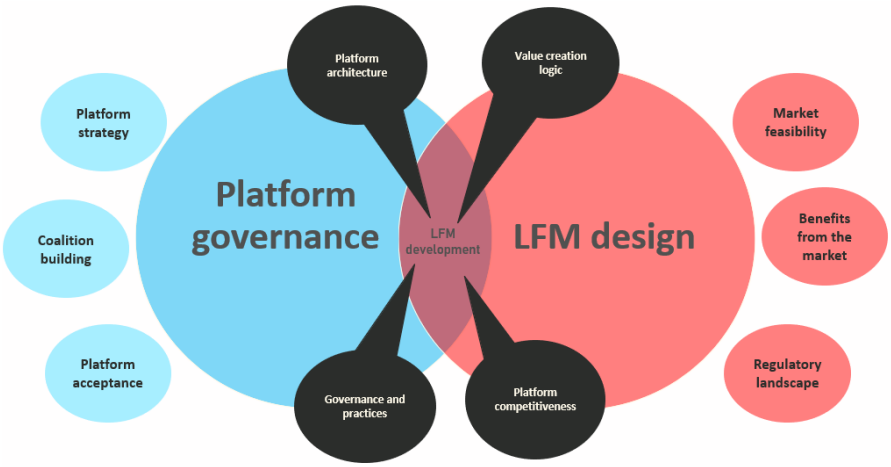

Figure 3. The preliminary theoretical framework: Platform governance and stakeholder influence on local flexibility marketplaces.

3. Methods

We opted for an exploratory single-case study to investigate the LFM governance phenomenon since it provides the opportunity to examine selected issues in greater depth and detail [49]. Exploratory case studies are suitable when answering 'how' or 'why' questions and explaining presumed casual links that may be too complex for surveys or

experimentation [50]. Moreover, since the phenomenon in question, LFM markets, is still in the emerging phase, the standardized quantitative methods would not have been a good fit in this instance. Known for its attention to context [51], a single-case study design provided us with the framework to examine the factors forming the Finnish energy sector holistically—people, policies, organizations, and technology—and their interrelationships as we blend the platform perspective with the perspective of LFM.

Since the operation of LFMs depends on its possible integration in the energy grid, studying the actors on this plane is necessary. Therefore, we first mapped out the stakeholders that an LFM would need to engage within the Finnish energy ecosystem: regulators, system operators (TSO, DSOs), aggregators, balance responsible parties, and industrial actors. We then went a step ahead and studied a few emerging LFMs in Europe from a platform perspective. Our aim here was to develop a benchmark for the potential Finnish LFM.

The sample size in a qualitative inquiry depends on the scope, resources at disposal, and the purpose of the study [52]. We employed a purposeful sampling method to decide on these organizations. Yin [50] defines purposeful sampling as when cases are selected because they are rich in information and offer practical manifestations of the phenomenon of interest; furthermore, sampling aims to gain insight about the phenomenon and not a statistical generalization.

In the sampling process, naturally, the TSO came as the primary party to be consulted with. In Finland, a single TSO entity is in charge of the nationwide electricity transmission. Therefore, we opted for multiple perspectives from this organization and settled with a Senior Corporate Director, who has a birds-eye view of the ecosystem and a Specialist with expertise on the flexibility marketplaces in Finland. In the next step, we chose a DSO operating in the countryside that also has retail operations. To get a diverse sense of the retailer perspective, we approached and interviewed a retailer from the capital region of Helsinki. This particular retailer is also active in a BRP role, allowing us to probe both angles. We opted for senior executives with flexibility market expertise from both these organizations. Aggregators are key in bringing smaller consumers to the LFM, and we opted for an operational aggregator from the south-western Finnish city of Turku. It can be mentioned that aggregators are a new addition to the Finnish grid, and this particular entity is the sole commercial aggregator in the country.

Moreover, to get a sense of the industrial actors vis-à-vis the LFM, we chose two organizations in proximity to the energy sector, where one is from the manufacturing sector while the other from the service side. The manufacturing company operates in the forestry industry and is active in the balancing markets. The energy services firm is one of Finland's most prominent energy consulting houses and has significant in-house know-how of the Finnish energy sector. In both cases, we interviewed veteran experts, respectively being a Vice-President and a Director. Finally, we opted for the regulator and industry interest groups' points of view, since both these operators are connected closely with policy making. We interviewed two senior experts from the industry interest group and the Deputy Director General from the energy regulator in charge of the system operators. This set of stakeholders from the Finnish energy ecosystem has shown to be appropriated from the saturation perspective and provides a good balance between the study's depth and breadth.

Ten semi-structured interviews were conducted with the selected stakeholders. Semi-structured interviews enable thematic questioners while allowing the possibility to modify elements of the questioner case by case [53]. From the interviews, three were conducted online, while the rest were held face to face; all the interviews were recorded and carefully transcribed. We conducted two separate interviews from the TSO (interviews B and C), while for interview E, we held two separate sessions with the same contact. Following a semi-structured philosophy, the interview guide was divided into three sections. The first section probed the general state of the Finnish energy ecosystem and the suitability of the LFM in this context. Issues such as barriers and opportunities were investigated

here. This sector was common throughout the interviews. The second section was more interviewee-specific, meaning depending on their organization's role and their individual experiences, we had a set of more specific questions. Finally, the third section was kept open for a free-flow discussion to follow any interesting lead that may have arisen during the interview. Detailed information on the interviews can be found in Table 1.

Table 1. Interviews from the Finnish energy ecosystem.

Interviews	Date	Duration	Interview Type	Organization Type	Interviewee Position
A	5.9.2019	101 min	Face to face	Industrial actor/Energy services	Development Director
B	28.1.2020	67 min	Face to face	TSO	Corporate Advisor
C	29.1.2020	69 min	Face to face	TSO	Specialist
D	30.1.2020	57 min	Face to face	Retailer/BRP	Head of Unit, Risk Management
E	30.1.2020 12.2.2020	70 min 81 min	Online Face to face	Retailer/DSO	Business Director
F	29.1.2020	58 min	Face to face	Industrual actor/BRP	VP, Energy Markets
G	11.2.2020	55 min	Face to face	Energy Regulator	Deputy Director-General
H	11.2.2020	61 min	Online	Energy industry interest group	Experts
I	12.2.2020	54 min	Online	Aggregator	Operations manager

The second set of interviews were conducted with four LFM projects in various stages of their development (Table 2). These were chosen from Europe as they operate in relatively similar conditions vis-à-vis the regulatory landscape, market conditions, and technological benchmarks, among other factors. We investigated their best practices guided by our theoretical framework and subsequently developed an interview guide focusing on three themes: business models, platform design and governance, and the regulatory landscape. Two of the LFMs in question are research-oriented, while the remaining two have commercial ambitions. However, the UK case is the only example of being in an entirely commercial operation. The executives interviewed here have all been part of the development process. Much like the interviews in the previous stage, these interviews were semi-structured as well. Finally, the benchmark developed from this round was juxtaposed with the findings from the Finnish ecosystem. In doing so, it was possible to adopt more realistic scenarios during our analysis of the Finnish ecosystem.

Table 2. Interviews from European LFM projects.

Case	Date	Location	Interview Type	Duration	Type	Interviewee Position
1	10.2.2020	Netherlands	Online	52 min	Interview	Business Consultant, Smart energy
2	17.2.2020	UK	Online	36 min	Interview	Project Manager
3	21.2.2020	Norway	Online	30 min	Interview	Senior Consultant
4	5.3.2020	Germany	Online	31 min	Interview	Analyst

The data analysis started with a content analysis of the interviews by identifying, coding, and categorizing the primary patterns in the data [52]. Once the transcribing was complete, the coding began following a two-step process. Firstly, the raw case data were assembled, consisting of the transcripts, notes from the interviews, and secondary sources. Secondly, several case records were constructed, organizing the raw data based on the themes identified in the theoretical framework. Subsequently, a pattern analysis was conducted by condensing these case records as we searched for recurring regularities in the data [52]. For a more visual representation of the data, we constructed a data structure

following [54] (Figure 4), where the most critical patterns identified in the previous step were placed as first-order themes. It was followed by grouping them into the six theoretical pillars found in the outer circles in Figure 3. Lastly, they were further aggregated into the two central pillars of this study: platform governance and LFM design. Finally, a case study narrative was written in the form of findings (Section 4), where all the identified patterns were discussed in detail [52].

Figure 4. Data structure.

4. Findings

4.1. LFM Design

Section 4.1 presents the findings on the LFM design elements, where three principal sections are highlighted: the marketplace's feasibility, benefits, and the regulatory landscape. A summary of the findings can be found in Table 3.

4.1.1. Market Feasibility

When gauging the feasibility of the LFM, the need for enough liquidity in the marketplace repeatedly came up from all sectors of the ecosystem. It was pointed out that the intraday markets are fragmented enough, resulting in limited liquidity in each case. This notion of markets turning into low-liquidity islands have been put forward as a potential roadblock to the LFM implementation, as stressed here in Interview A: *'we have to make sure that all resources and all (EU) member states get to all of those marketplaces and we have actual liquidity that makes use of the technology. Otherwise, we will be stuck on an island'*. Furthermore, if this market wanted to have industrial players in its midst, then offering enough liquidity emerged as a decisive factor: *'you just want to hope that the markets are very liquid, that you have all the flexibility offered in the markets (to manage large imbalances)'* comments a senior industry manager from Interview F.

Table 3. Summary of findings on LFM design dimensions.

Focus	Design Components	Principal Findings
LFM design	Market feasibility	Ensuring liquidity is paramount. The entry barrier needs to be low for direct users. Aggregators are needed to activate the LFM. Discerning the flexibility needs between TSO and DSOs. Datahub increases the possibility for demand response. The supply-side should be prioritized in generating the network effect.
	LFM benefit	Create new values for flexibility. Can enable localized trading. Incentivizing customers to lower overall consumption. Countering high spot prices. Sharing monitory savings with customers. Offering a market-based flexibility solution to the DSOs. Can instigate DSO cost savings.
	Regulatory landscape	The current regulatory setup is geared towards centralized generation. Legislation is geared towards network investment. Specific TSO regulations are restrictive. OPEX vs. CAPEX situation is relevant for flexibility usage. No significant regulatory barrier towards aggregation. CEP emerges as a significant factor in defining DSO roles. Sandbox regulations can be restrictive.

One way of generating such liquidity is through accommodating enough prosumers. Lowering the participation threshold from 100 KW to allow household-level loads is still considered inefficient for the grid and unlikely to occur soon. However, the Finnish TSO acknowledges the need to activate smaller players to utilize full flexibility potential, and lowering this threshold emerged as a gradual process, as elaborated by a specialist in the Finnish TSO in Interview C:

> *'already in our current processes . . . we are (going to) smaller sizes, the minimum size, which is often something that the smaller market players would like to have. That should you have five megawatts, why cannot it be one megawatt, to be able to offer something.'*

The solution for the time being lies in aggregation, and significant background work on aggregation rules is taking place, primarily focusing on business models and regulatory frameworks. Another aspect that requires greater attention in activating aggregators here is the coordination framework between DSOs and aggregators. It has emerged that this cooperation needs to be active and real-time, and the greater the aggregation is, the bigger the need for a framework maintaining this contact.

Flexibility requirements are different for transmission and distribution system operators. Though both require flexibility to balance their systems, their needs come at different levels of the grid. For example, the TSO needs flexibility at a central level, whereas the DSO needs are somewhat regional or local. This attribute calls for the LFM to offer services accordingly, especially when a resource can be valuable for both parties. An example can be found here in Interview H:

> *'(The) platform needs to somehow to control who is buying and from whom, because if you have a resource that (part of an aggregation) can be valuable for the TSO . . . but the same resource can be a single resource valuable for the DSO . . . (then) the platform has to manage how and who eventually buys it.'*

The launch of the Datahub, the Finnish TSO's centralized information exchange, will occur on February 2022. Interested parties can access data related to accounting points and contract information from here. The Datahub will also integrate the electricity consumption data from the smart meters to this exchange, and therefore it could play a significant role in streamlining the LFM with the ecosystem. Reflecting how this development is relevant for the LFM feasibility, a specialist in the Finnish TSO reflects in Interview C:

> *'If somebody else (an aggregator) is trading my energy . . . then I might give my data (from the Datahub) to the aggregator, so they have more information to work on. So, they could see my address and, what kind of heating I have and, if I have a battery and solar panels, and how my consumption was going last year, that kind of information can be given to some other party with a click of a button, so then the Datahub gives access to some other party (LFM).'*

We must pay special attention to attracting simultaneous supply and demand to the platform to foster a network effect. Our findings suggested that creating demand is the less-tricky matter in this instance, as the energy need (alternative flexibility) is on an upward trajectory. The issue, which must be addressed on the demand side, relates to regulations, which can help streamline this demand. Moreover, it was suggested that in an early stage of platform operations, system operators might assist with generating demand: *'when this kind of local flexibility markets start, in the beginning, there might not be the demand and then . . . we need to be the market makers and doing some buying'*, suggested in Interview C. However, we do not notice such institutional support on the supply side, especially when it comes to the smaller consumers, where the emphasis was placed on aggregation.

4.1.2. LFM Benefit

Our findings indicated that an LFM can bring new value to flexibility, especially since it opens a fresh avenue for flexibility trading and invites previously untapped flexibility to the market. We can further highlight the scenario that the energy production in Finland is going towards an inflexible place, especially as it continues to rely on nuclear and brings wind energy into the mix. An LFM in this context is in an excellent position to steer flexibility to that equation: *'a lot of money involved in flexibility, and there will be (even) more money because the production structure of Finland is going to a direction where there (it) is less and less flexible'* commented the Business Director in Interview E.

In the evolving energy landscape, it might be soon enough that we see a situation in which EVs, PVs, or household storage capacities are commonplace in residential neighborhoods, and an LFM has the potential to emerge as a facilitator of such localized energy trading. A possible arrangement can be that these household participants only trade among them within the neighborhood, bypassing the grid operators. Furthermore, an LFM can be handy in incentivizing consumers to lower their overall consumption through increased demand-side management. It can also incentivize the end consumers to avoid high spot price hours. For the retailers, this possibility promises increased stability in their estimation process. As a result, the retailers will increase their savings, and with LFM, it could further be possible to share the monitory benefits with a more extensive consumer base. The Business Director from a large retailer explains in Interview E: *'Demand-side management creates (for) us, a possibility of saving money, pure money from our side. And then, of course, we should have some kind of a system where we can compensate part of the money to the customers as well'*.

An LFM makes it easier for DSOs to procure flexibility competitively. As discussed earlier, the DSO flexibility needs are projected to be local, often in remote areas. Procuring flexibility in those locations could be tricky, especially if there is no competition involved in the process. A senior energy regulator sees LFM as a potential solution in Interview G:

> *'We do not like that the DSO will purchase (flexibility through) contracts with one participant only. That will be inefficient. And that is why if there is a platform to provide services to different DSOs, for example, it will be a more open and market-based solution.'*

An LFM also has the potential to generate savings for DSOs, especially if flexibility can substitute investing in networks. Once again, this comes quite handy for isolated locations where distribution lines often need high investments, resulting in higher energy costs. If flexibility can alleviate some of the energy need from there and substitute grid investments, LFM might emerge as a cost-saver for the DSOs.

4.1.3. Regulatory Landscape

The rebuilding of the electricity network has been underway for quite some time in Finland, driven by regulations emphasizing network investments. It emerged that such investments typically favor grid reinforcements over flexibility deployment. Our findings also indicated that the grid developments leave the smartness of the grid at the endpoint combined with centralized production resources. The Development Director for an energy services firm comments in Interview A:

> *'All of the networks are now facing huge problems with the existing regulation, so they are quite reluctant to make collaborative efforts because all of their focus is on rebuilding the network because of the Network Electricity Act.'*

We also noticed that specific TSO regulations could be construed as restrictive in participating in an LFM, especially for industrial actors. For instance, the reactivation period after being downregulated is often too little for large players. After a certain downregulation period, the reactivation period could be anywhere between two to twelve hours in large productions, but the TSO regulations call for a much faster reaction. A company in the forestry sector finds this a particular barrier in being active in an LFM, as observed in Interview F: *'and our experience has been that the rules (from the TSO) are often quite restrictive'*.

How costs incurred from flexibility are treated, as either operational expenditure (OPEX) or capital expenditure (CAPEX), has significant consequences. It is not beneficial to increase OPEX, and regulation currently treats flexibility as OPEX, providing a bottleneck that reduces deployment. When operators avoid network investments, they end up with higher OPEX, favoring network reinforcement. A solution can be to treat flexibility as CAPEX; until we see that change in regulations, optimizing flexibility remains difficult. For instance, we can highlight a TSO point of view on this matter from Interview C: *'if using flexibility increases OPEX . . . it is not a viable tool in comparison of network reinforcements'*.

However, in the upcoming regulatory model, which will be implemented in 2024, flexibility will be considered CAPEX. The aim is to increase options for the DSOs: *'(in this regulatory model) the DSOs can use flexibility or other services* to *have a choice, not only built more cables, which is the case today'*, noticed a TSO Specialist in Interview C.

The regulations on aggregation and aggregators are slowly taking form as the Finnish energy sector witnesses their arrivals in specific markets. It is noteworthy that independent aggregators can already be active in markets with capacity components. The question of balance responsibility becomes relevant here, and as it stands now, capacity trading by independent aggregators is allowed as long as it is not affecting the balancing responsibility of others. For the DSOs, there are no obvious regulatory barriers in sourcing aggregated flexibilities, yet, up until 2024, when flexibilities are treated as OPEX, the market incentives are relatively limited to do so.

The European Clean Energy Package (CEP) is a positive development for increasing flexibility use. The CEP mandates that the member states create favorable conditions for increased demand response usage in their grids, emphasizing that flexibility should be treated as an alternative to network investments given the conditions are right: *'(CEP mandates) they should use flexibility for grid purposes. And regulators should create conditions that incentivize this'*, says a senior expert in the Finnish TSO in Interview B. This package has been implemented in Finland by 2020 and is currently going through a trial phase. When implemented fully, it will influence the role of the DSO as a buyer of flexibility, as it ensures non-discrimination among various grid stability tools. Furthermore, the CEP will also address the barrier for smaller consumers and prosumers being a part of flexibility marketplaces.

Finally, we have noticed an ambiguity regarding regulatory sandbox legislation. It can be an issue impeding the LFM development in case a trial run is required. This problem becomes particularly apparent if an actor in a trial run wants to scale up their activities. A senior regulator commented, *'our current legislation is not very straightforward on that'* in Interview G. Scaling up of operations might be needed in some instances where a

larger sample size or geographical area is needed to simulate a realistic setting. Under current legislation, it might not be easy to accomplish as the extent of the sandboxes is not clearly defined.

4.2. Platform Governance

Section 4.2 presents the key findings concerning platform governance, including strategy, platform acceptance, and coalition building (see Table 4).

Table 4. Summary of findings on platform governance dimensions.

Focus	Governance Dimensions	Principal Findings
Platform governance	Platform strategy	The network situation must be considered. The installation cost of the flexibility gadgets remains high. Demand response-friendly smart meters by 2025. Little willingness to lower the 100 KW market participation threshold. Market-based pricing is preferred.
	Platform acceptance	Profitable participation for the market participants. Forecasting and real-time information feature important for BRPs. Reliable delivery is needed from the supply side. Ease of use and a user-friendly reporting process. Automated bidding makes it easier to reach prosumers. Ensuring platform transparency. Penalties should be equal for all parties. B2B vs. B2C communication should be designed separately. Double taxation for prosumers in certain situations.
	Coalition building	Coordination with DERs is still a challenge. Stakeholder coordination (TSO-DSO; DSO-DSO; DSO-Aggregator). Convincing the end customers remains a challenge. New marketplace acceptability. Designing retailer-aggregator value chain. Balance responsibility for independent aggregators.

4.2.1. Platform Strategy

For platforms wanting to break into the energy sector, the network and the stakeholders in the ecosystem should be carefully considered when designing the strategy concerning entry and positioning logic. According to our informants, the overarching Finnish grid strategy is spearheaded by network investments; for instance, a development director from an energy services company comments in Interview A: *'(in Finland)* we are *digging up the entire distribution system and installing cables. Doing so means that the distribution component here will be far longer used and far more used than in many other countries.* From a platform perspective, this implies that the network's ability to connect with DERs is limited, as not enough smart technology is integrated. Moreover, since a principal reason for this focus is rooted in ensuring the security of supply, this situation is unlikely to change shortly.

Not all smart meters in Finland currently have the required interface for demand response management, adding another layer of complexity for DER-platform integration. This situation casts a profound effect on designing profitable business models that want to bring households into its fold. The state agencies are in the process of updating these, and by the year 2025, there should be enough smart meters capable of responding to demand response signals. However, until then, we require flexibility enabling gadgets to be installed on the premises. These gadgets, along with their installation, make for a high cost: *'the cost (per household) can be as high as 700–1000 euros, and if that cost is not repaid at a reasonable period of time then it is a difficult business case'*, commented an aggregator Operations Manager in Interview I. It appeared that any real business case would entail sharing this cost with the prosumers, having implications for the platform's operatory and financial schemes.

Furthermore, a 100 KW threshold is currently in effect to join the energy marketplaces in Finland, which constitutes an obstacle for household-level consumers from directly

taking part. As abovementioned, from an LFM platform perspective, which wants to activate end consumers, this comes as a roadblock and stresses the platform's adaptability to aggregation services. Our findings indicated a strong momentum in favor of this barrier since lifting this limit raises the risk of increased operational costs for the whole system; as stated by a market regulator, *'of course, we would like consumers and prosumers to be more active in markets. But it has been problematic if it actually increases the whole system operating costs'* in Interview G.

Coming to the possible economic models in the platform marketplace, we observe a clear preference on market-based approaches; a TSO specialist in Interview C says: *'our main principle is that price is formed on the markets, and when there is enough liquidity, the flexibility is used where there is the most value for it'*. The energy market is strongly liberalized in Finland, and instruments to influence the prices (subsidies, regulatory incentives) are not preferred. The market regulators, in this respect, are unwilling to follow the French or German models vis-à-vis regulated consumer prices or subsidizing energy storage systems. Instead, they want to leave it to the market and work towards a change in DSO tariffs on household batteries. Therefore, any economic strategy of the platform must brace itself for market-driven pricing for its product offerings and allow true competition among its participants. Moreover, system operators cannot own or operate batteries in Finland as they must purchase them from third parties, bringing opportunities for an LFM platform since it is a market-driven avenue to such DER services.

Put together, these issues are will influence the way an LFM platform operates in this particular ecosystem. However, when addressed carefully, the challenges listed here can also act as catalysts that might give the platform a realistic chance of surviving in the ecosystem.

4.2.2. Platform Acceptance

Concerning the platform's acceptance by the energy ecosystem, there exist similarities between the industrial consumers and their household counterparts, with their need for monetary benefits in participating in flexibility arrangements. This could be seen in this statement by a potential industry participant in Interview F: *'I would need to be fairly confident and sure that this is going to be a profitable decision'*. Similar sentiments are also echoed from the household side of the market. Furthermore, for industrial participants, the profitability of participation should also be weighed against the potential layer of organizational complexity it might add. In other words, the system integration with the platform should be seamless, requiring little effort from the participants' side. Superior customer service and ease of navigating the platform were also mentioned, as could be seen with this aggregator in Interview I: *'it should be easy to use and the reporting process as easy as possible'*. Therefore, operators should carefully consider user profitability, friendly experience, and integration with existing frameworks when conceptualizing the platform schemes.

Platform transparency is essential to attract and maintain adoptions. An important issue here is delivering what is sold. In the event of a delivery failure, the penalties should be laid down. In this instance, our findings indicate that the penalties set by the Finnish TSO are an acceptable remedy: *'they (penalties for non-delivery) can be like the ones that Fingrid already has on their market'*, stated an aggregator operations manager from Interview I. It was also mentioned that the penalties for delivery failures should be similar for participants regardless of their size or position in the market (e.g., aggregators or DSOs). Another point of emphasis is that the platform must also clarify the aggregator rules concerning their suppliers, ensure fair play, and ward off any potential loopholes: *'if there is an independent aggregator (it); the same connection point has two suppliers. And the rules between these two suppliers must be clear enough. And fair enough. Otherwise, there might be a place for loopholes'*, reflects a TSO specialist in Interview C.

Coming to the BRP point of view, the platform must ensure that the flexibility suppliers can indeed keep their end of the bargain: *'when it is the decision not to invest on the (electricity production) but the flexibility, then it kind of requires quite trustworthy security from the platform*

side', stresses the Head of a BRP Risk Management unit from Interview D. As a remedy, we can highlight the experts' suggestion from the energy industry interest group, who stressed the need for prosumer verification as a tool ensuring supplier accountability, based on agreements with the aggregators, in Interview H: *'different verification methods are needed by different marketplaces . . . (and in case of a flexibility market) verification requirements should be based on what would be acceptable for aggregation to verify'*.

Market liquidity was stressed as an antidote against high volatility, which can be ensured by high prosumer participation in the platform. Automated bidding in the platform has been recommended to encourage such participation as prosumers might not have the needed knowledge to participate in the bidding themselves. As observed by a TSO expert from Interview B, *'(it may be so) customers will never participate directly in this existing market because it is too complicated for them . . . the bidding process is especially difficult for them'*. Domain automation has been suggested to alleviate this issue, making it easier for other smaller players to be part of the platform.

Another factor that might influence prosumer participation in the marketplace is double taxation, which applies when exporting energy to the grid and repurchasing it for consumption when needed. However, it was not seen as a significant barrier, as there are no taxes incurred for self-consumption: as *'taxation is not so big problem for these small customers'*, because *'many are charging their batteries from their own production and free from the electricity tax'*, as observed by industry experts in Interview H. However, considering the uptake of EVs, we can see a potential problem stemming here when households can participate with the grid to a greater extent: *'in the future, if, for example, charging and discharging EVs would come into a question, maybe there could be a problem with double taxation'* reflected the experts. Therefore, the recommendation for the flexibility platform is to stick to the power or frequency-based markets and not in energy markets, to ward off double taxations further.

4.2.3. Coalition Building

Regarding coalitions in and around the flexibility marketplace, we observed the need for cooperation frameworks among the different grid players, namely, between the TSO and the DSOs and among the DSOs themselves. This issue represents a much-discussed area that determines many future possibilities concerning flexibility utilization. A specialist from the TSO comments in Interview C, *'(regarding inter DSO cooperation) it is a timely question . . . that we are actually thinking a lot about (and) many of our people focusing quite heavily on exactly that topic'*. When designing the coordination framework, Finland is looking at the Dutch model as a promising option. In the Netherlands, the DSOs have developed a joint platform to communicate the grid bottlenecks and deploy flexibility as a potential solution.

Moreover, regarding TSO-DSO cooperation, the Dutch model employs a platform as well. Therefore, Finland could opt for a similar setting as it addresses this issue. However, a significant difference between the context of these two countries can be found in the number of DSOs. Whereas the Netherlands only has five DSOs, in Finland, the number is well into the 70s [55].

Coordinating with the end resources appeared as another roadblock in achieving the full flexibility potential. The Development Director from an energy advisory firm views the offerings to solve this issue as unstructured; he further comments in Interview A: *'to solve this we have very heterogeneous offering out there if we can provide structure to that, if we can provide the capability to that then it (flexibility marketplace) is easily implementable'*. Although we register a cautious optimism for a flexibility marketplace, we should also highlight a certain reticence towards adopting this platform, which might appear primarily among the well-rooted industrial players. For instance, a senior executive from a large industrial organization states in Interview F, *'I have been working in this sector for so many years, and I am so accustomed and used to working with the existing markets'*. While this mental disposition is

not a decisive driver, it does present an obstacle in adopting a new marketplace, especially if it falls short of providing a clear business case.

The challenge to bring end consumers to a flexibility platform is a prominent one. For instance, the topic of flexibility or its benefit are well known to larger stakeholders. However, a regular consumer might not be familiar with the phenomenon or its benefits. Therefore, convincing them to participate remains difficult. For example, the Business Director from a large retailer explains in Interview D, *'it is very difficult to explain to normal people, domestic customers, how the market works and what flexibility actually is and what benefits the customer might get from the flexibility'*.

Moreover, there seems to be a lack of specialized infrastructure in this case. A Development Director from the energy services provider highlighted the need for B2B-centric communications to evolve to reach out to the end customers. As elaborated in Interview A, *'a principal challenge right now is the lack of endpoint spokesperson. The networks, suppliers, TSOs are all very established and can talk to the stakeholders. But the endpoints of the transition and the forming groups do not have to say in the matter'*. This situation calls for specialized B2C communication regimes for the platform.

Lastly, aggregators are emerging in this ecosystem, and their roles and responsibilities have been slowly taking shape. Particular attention should be paid to the incumbent actors in the marketplace that could be impacted by aggregators (e.g., retailers or the BRP). We noticed a degree of anxiety among the retailers with some facets of the possible business models. As a senior executive from a retailer elaborates in Interview D, *'(among the) four different types of aggregation models proposed . . . the most brutal was so that the aggregator would just aggregate and all the energy that is not consumed would be then counted as an aggregators profit'*. This model, proposed by the Smart Grid Task Force, places retailers in an awkward position because it allows the aggregator to profit through the energy the retailer had bought in the first place. The possible repercussion for such rules could be the reluctance to admit aggregators in the ecosystem, which in turn hurts the prospects for a flexibility marketplace, as evidenced in this statement from a large retailer in Interview F.

> *'If somebody gets hurt, this somebody will do everything to prevent flexibility from happening. And if this somebody is an electricity sales company, that has a relatively strong, grip of the customer and has very good channels of communicating with the customer and so forth'.*

Therefore, the platform must ensure an acceptable profit-sharing mechanism concerning the unconsumed energy, as conveyed in this retailer statement in Interview D: *'in the more acceptable models, there is some settlement price for the energy that is not then consumed that how you share somehow the profit'*.

Finally, the issue of balancing responsibility for the aggregators emerged as a matter of importance. If aggregators are required to take full balance responsibility, that will entail a 24/7 operational activity on their part, which might serve as an entry barrier for smaller operators, with particular implications for the aggregator dynamics within the platform. On the other hand, from the retailer's point of view, it appeared that they prefer aggregators taking on the balance responsibility by themselves. As observed by the Head of Risk Management from Interview D:

> *'if the aggregators are playing, so that that the seller of the initial energy is going to pay the bill, then they are not welcome. But if the aggregators, for example, if they would take the balance responsible for themselves, then why not.'*

5. Discussion

The blending of perspectives from platform governance and LFM design, as expressed using Tura et al.'s [48] platform design framework, served as the starting point of our discussion. As expressed in Figure 3, we considered the following areas: platform architecture, value creation logic, governance and practices, and platform competitiveness. However, after analyzing the Finnish energy ecosystem, a new and distinctive area emerged that was

not fitting in the pre-determined fields. This area concerns the readiness for the ecosystem to accept and adopt such a platform and is a precursor to further platform developments. Therefore, we amend the original framework by introducing a new dimension: *Ecosystem Readiness* (see Figure 5). We also merge *Platform Architecture* with *Platform Governance and practices* since both areas have a more internal platform-centric focus and complement each other well in the context of a novel platform.

Figure 5. The modified theoretical framework, with the critical impact areas in LFM development.

5.1. Ecosystem Readiness

For an LFM to operate in the Finnish energy landscape, the overall electricity network situation must be considered designing the operational and business models. The network's conditions and its development considerably affect DER integration with the LFM since the network's ability to connect to distributed resources remains limited, affecting the value propositions of the platform's potential partners [35]. Besides the network, risk-sharing among the platform participants has been stressed for platform design [42]. Here we stress the need for the specific mechanisms that allow sharing the upfront costs of flexibility gadgets and their installations at a household level. Our findings indicated that this sum can reach anywhere between 1000 to 1500 euros due to the high labor costs in Finland. This cost increases the threshold for investments for any platform operator, and its solution should include a cost-sharing regime with the consumers. Relating to this topic, Euchner [44] identified the technological environment as a significant denominator in the platform's ecosystem, and here we stress the smart meters situation in Finland. Currently, not all smart meters can be used for demand response integration; however, by the year 2025, all these meters will be updated to accommodate demand response, which might significantly influence the technological investments needed for the stakeholders.

Furthermore, the integrational capability of smart meter technology also depends on the advent of Datahub, the Finnish TSO's centralized data exchange. Datahub comes into active operation on February 2022, which impacts DER integration with the grid, corresponding to Olivella-Rosell et al. [17] and Ramos et al. [5]. The next challenge for the Finnish ecosystem is to ensure technological reliability, which ushers in further momentum to the platform development [1]. Another major challenge in this ecosystem is ensuring direct prosumer participation in the energy markets. Euchner [44] pointed out that the threshold to participate in the platform should be low enough to accommodate the needed userbase; however, with the LFM, households face barriers most prominently in the form of

a 100 KW energy output requirement but also in terms of knowledge gaps and insufficient monetary incentives.

The solution for the time being lies in the aggregation of prosumer-generated electricity, but the LFM should move towards direct prosumer involvement in the long term. Aggregation in this ecosystem is an emerging concept, and the rules concerning independent aggregation are still taking shape. The regulatory authorities should move towards codifying the rules between aggregator's suppliers to ensure fair competition. Otherwise, we may run into what Adner et al. [46] termed 'adoption chain' risk in the platform's ecosystem.

Lastly, regulatory sandboxes for LFMs are not well defined in Finland, and this might prohibit platform growth. In particular, for an LFM platform wanting to test the market by conducting large-scale tests might run into a problem as the size and scale of sandboxes are not defined.

5.2. Platform Architecture and Governance

Tura et al. [48] proposed investigating platform leadership, ownership, and platform governance and operations rules. The design problems studied here are managing the platform, ownership nature, the internal rules and processes governing the platform itself or its services.

Designing the governance structure of the LFM platform requires careful consideration of the regulations and legislations present in the energy ecosystem. The burden of regulatory constraints starts already at the ownership stage, as not all entities are allowed to own and operate this platform. As Bouloumpasis et al. [38] pointed out, the system operator participation in the LFM is a contested topic as it might stand in the way of fair competition. We have seen this fear reflected in EU regulations barring both TSOs and DSOs from operating such markets [39]. We have also seen the impact of this legislative decision already in a Norwegian LFM platform that started as a TSO venture but had to disassociate themselves from any ownership and operational influences on the platform. Therefore, in the Finnish context, too, this platform must be owned or operated by a party not related to system operators.

Following that, Ramos et al. [5] proposed two possibilities regarding the operationalization of the LFM, either as a sub-market of the wholesale market or a novel exchange platform run by the system operators or a third party. Unfortunately, regulation already crosses out system operators from this equation, and we do not have enough data from the wholesale markets in Finland to judge the other possibility. However, our findings validated the possibility of LFM operating as a third-party operator, particularly in localized settings, where ownership entities may include energy communities, housing companies, or municipalities.

Developing the governance mechanisms also includes penalty rules [48]. We have noted that the non-delivery of services to be a big concern among the potential stakeholders. It appeared that market parties agree on the Finnish TSO's penalty regime for transactional issues and would welcome similar instruments in the LFM. It is also imperative to ensure that penalties are non-discriminatory towards the participants, regardless of their size or grid status.

Furthermore, developing comprehensive platform governance rules are particularly apt, as Fenwick et al. [1] observed that the current frameworks governing the market are not equipped to enact a thriving platform culture. Moreover, there is a high degree of informal expectations for the regulated energy sector that must be sustained, such as data security [37]. In this regard, the subscription to the GDPR and promoting this fact to the public will help the platform gain consumer confidence. The platform must also focus on developing coherent internal processes in the partner companies [37], as it generates synergy and reduces the risks of misalignment, leading to lesser needs for punitive measures.

Moving on to platform architecture, deciding on the market structure (i.e., two-sided vs. multi-sided) and identifying and including the relevant stakeholders are crucial decisions [48]. Thus, platform strategy is vital in this phase as it sets the course for architecture development. Gawer and Henderson's [33] view of platforms (as a component of a dynamic technological system with a strong interdependency among the sub-components) is especially suitable here because, in order to facilitate energy flexibility, LFM platforms' must also facilitate exchanges of communication, knowledge, and financial transaction among other services. This suggestion is also in line with Fenwick et al.'s [1] proposal of platforms as a system facilitating a broad consortium of services.

In designing the platform's market structure, the economic viability of the platform calls into specific considerations. For example, Gawer and Cusumano [42] identified pricing as a central question in the platform business model. In Finland, we have registered a stakeholder preference towards market-driven pricing. Unsurprisingly, price manipulation instruments such as subsidies or regulatory incentives are deemed unnecessary in Finnish energy markets.

In developing the platform architecture identifying key actors are necessary [48]. According to Jin et al. [37], LFM boundaries are usually understood through spatial constraints. As such, this already tilts the LFM stakeholder landscape to a more geographic setting. Our findings were consistent with this suggestion, as we noticed LFMs' to have particular suitability for remote locations. However, regardless of its location, it is still operating in conjunction with the grid and must consider the system operators: DSOs' are immediately relevant, and the TSO, too, if the platform aims to be active on a national level. Following Bouloumpasis et al. [38], other important actors needed to activate an LFM are the balance responsible parties, the consumers and prosumers, and the market operator. Here we propose to add the regulatory authorities to this list; LFM platforms are still a novel concept, and as such, intimate consideration of the regulatory bodies facilitates its development process.

5.3. Value Creation Logic

Value creation logic concerns defining the platform benefits and how the platform actors instigate this value. It further constitutes delineating stakeholder roles, evolutions, value propositions for the different participants, and the revenue model for the platform and its participants [48].

First off, we see evidence of the need for profitable stakeholder participation, as stressed by Gawer and Cusumano [42]. This sentiment is echoed in commercial entities such as industrial actors and smaller entities such as prosumers. Therefore, designing the value propositions, the financial incentives should be considered carefully. However, as we hinted in the previous section, reaching out to end consumers is made difficult by an output requirement of 100 KW in Finland. These circumstances call for the involvement of aggregators in the platform. Aggregators are a new concept to the current grid, and its regulatory and business frameworks are taking shape. A critical issue to consider here is being mindful not to affect any of the incumbent players with this development adversely. Retailers, for example, could be negatively impacted as aggregators take place in the ecosystem. To avoid an impasse, aggregator business models must ensure that profits will be shared with the retailers when both parties are involved in a transaction. Lastly, concerning aggregators, we find more symmetry with the LFM design frameworks considering aggregators, and if a flexibility marketplace wants to involve end consumers in its midst, their role is nearly unavoidable in the Finnish context.

Communication plays an essential role in facilitating stakeholder roles and the value chain, cf. Fenwick [1], as the platform reaches out to its potential userbase and develops credibility. However, our findings indicated that the traditional B2B communication in this ecosystem needs to evolve to reach the end consumers. In addition, we noticed a dearth of awareness regarding flexibility or its benefits among the end consumers. Furthermore, it becomes easier to establish a positive perception of the demand response utility with

effective communication, which is paramount to attracting and retaining a user base [41]. Therefore, both the platform operator and its stakeholders on the buying side must develop B2C communication frameworks to start an ongoing dialogue with the consumers.

With adequately exercised communication, it also becomes easier to establish the potential benefits for the actors on the platform, an essential factor stated by Davis [47]. In this regard, among the potential institutional stakeholders, typically on the buying side, we have noticed a pragmatic attitude towards an LFM platform. This platform can complement efforts to reduce overall energy consumption for the retail sector, especially during the high spot-priced hours. Furthermore, this platform also can offer some relief to the increasingly rigid energy production, as Finland is increasing its share of nuclear and wind energy. Once they have been initiated into the marketplace, the end consumers or prosumers will have monetary incentives to utilize their DERs to extract the highest flexibility potential.

As proposed by Esmat [40] or Minniti [15], the DSO's role in this platform is particularly noteworthy through their LFM frameworks revolving around DSO issues. Our findings validated the literature with DSO utility from the LFM concerning congestion management, voltage violations, and alternative grid re-enforcement. We could point out that these issues have manifested in a UK-based flexibility platform currently in commercial operation. This UK-based platform is designed with DSOs exclusively on the buying side. In the Finnish context, we have registered a resonance with this design where system operators exclusively occupy the buying side. In general, the regulatory authorities in Finland are receptive to the idea of competitive sourcing of flexibility for the DSOs, especially in remote locations, where an LFM can enact market competition.

Finally, the TSO role is also essential to this platform. Although the EU regulations bar TSOs from operating an LFM platform, they can purchase flexibility at a central level. In the EU, there is an ongoing discussion, as Bouloumpasis et al. [38] pointed out, as to should the TSO participate directly in the market or play a facilitating role. In Finland, we have seen a willingness for the TSO to be a direct party in the LFM, initially adopting a buying role if sufficient demand is not being generated.

5.4. Platform Competitiveness

The last area identified by Tura et al.'s [48] platform design framework relates to the competitive atmosphere of the platform. This issue encompasses ensuring easy access, addressing the chicken-and-egg problem, and the growth prospects of the platform. Firstly, the chicken and egg problem is a common issue for platform design, referring to the difficulty of attaining a critical mass to garner a positive feedback loop [56]. In other words, demand and supply are interdependent and it is difficult to generate one without the other. It is even more relevant for a novel platform, and as such, our findings indicated that a higher degree of effort should be placed on the supply side. Since the energy demand is constantly increasing and energy production is becoming inflexible, demand response is on a good trajectory.

Moreover, we have seen the willingness among the institutional players, such as system operators, to be the market maker if there is not enough demand initially. The supply side is more unorganized and requires more effort for mobilization. On the other hand, households being the smallest target suppliers, an effective organization requires much effort, especially in a novel platform.

Jin et al. [37] observed that most formulations of LFM models are centralized, which can take two propagations based on their objectives, social welfare, or minimizing operational costs. Therefore, deciding on the intent of the LFM is very important in the current climate. Firstly, we have to consider the technological landscape, where not all smart meters can enact demand response, erecting a barrier to end-consumers profitability. Adding to that is the current situation of flexibility being treated as OPEX, which prefers grid reinforcement. However, this situation will change in 2024 when the new regulatory model goes into effect.

Therefore, it remains a challenging ordeal for an LFM platform seeking profitability in the short term. However, the ecosystem does believe in the long-term commercial prospects for this marketplace as DER penetration intensifies and battery technologies are improving. The EV figures are believed to be a good indicator in this regard. At least for the time being, it might be better to opt for LFM models that maximize social benefits given the existing conditions. Neighborhood-based energy communities and LFMs operated by housing companies where the goal is to promote sustainability rather than profit could be the use cases of this frame. Furthermore, we also see credence for social welfare maximizing LFM models from existing platforms which, among other issues, finds it difficult to compete with the Spot market price. One such platform from Germany admitted that price alone cannot be the competing point for such platforms and that a social angle is needed to sustain it.

Based on the above discussion, we revise the theoretical framework proposed in Figure 3. In addition, the intersecting region containing the LFM development focus areas is elaborated with the key findings of our study.

6. Conclusions

With the increasing technological possibilities in the grid and the overall regulatory and political reality in Finland, the momentum propelling LFMs can only increase. Taking platform perspective into account, we can facilitate this novel idea further to design optimal governance and business models for the demand response markets. The primary contribution of this paper was to serve as a starting point to that discussion.

For policymakers and practitioners, this study identified various LFM implementation challenges. The critical barriers are relevant now but that can potentially be solved in the near term are the OPEX treatment of flexibility, prioritizing network reinforcement over demand response, and the high costs for smart device installation at the household level. On the other hand, more long-term challenges arise from the Finnish grid's focus on traditional network development, often unable to connect DERs at the endpoints. Moreover, a significant challenge remains in garnering an attractive financial return for LFM participants, which is more applicable for smaller consumers.

However, this paper also identified many possibilities for an LFM in the Finnish context. As the energy production mix becomes inflexible, it calls for flexibility on the demand side. The ongoing implementation of the CEP opens up new avenues for demand response. Furthermore, we observed a positive view from the regulators who see this platform as promoting the free market principles for flexibility procurements. In the liberalized energy markets in Finland, this is an important benchmark.

Theoretically, this paper introduced platform perspective to LFMs and contextualized a platform development framework in the novel LFM development. However, a significant contribution of this paper was the addition of a new dimension to novel platform development: *Ecosystem Readiness*. While adopting a platform development framework, we noticed that for novel platforms, especially in emerging sectors, the more significant ecosystem readiness appeared as a distinct and foundational dimension for platform development. We believe that the utility of this addition to the platform development framework could potentially help understand the novel platform development processes better.

The main limitation of this research was the lack of primary data from operating LFMs. As we do not have such marketplaces in Finland, we had to rely on similar European projects. Except for one, all these platforms are in a development phase. Consequently, the data garnered from there were often hypothetical. We also had to consider the differences in the market context and the platform focus. Even after contextualizing the findings to a Finnish setting, there could be a gap in its appropriation. Our principal source of data was the Finnish energy sector, and by casting a wide net, we collected broad and holistic perspectives. However, doing so meant that we had to forfeit the opportunity to go deeper into actor perspectives.

Thus, we recommend highlighting the actor-specific flexibility requirements in future research on this topic (for instance, actor-centric LFM design particularities). In addition, a study devoted to the regulatory challenges and opportunities to LFM services in Finland would also be timely. Lastly, another prominent contribution to this topic could be to look into the aggregator-retailer interaction in a flexibility context.

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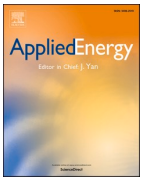

Prosumer flexibility as an enabler for ecosystem value co-creation: A resource integration approach from the Finnish electricity markets

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HIGHLIGHTS

- tEffective resource orchestration across emerging and incumbent actors accelerates novel technology adoption and prosumer flexibility (PF) scaling.
- Frameworks that balance innovation with incumbent welfare can ease resistance and promote ecosystem-wide synergy.
- DSO business competencies must improve to enable commercial flexibility.
- Retailer-led energy literacy programs can boost consumer engagement in PF initiatives.
- Policy support for rural grid upgrades and prosumer incentives can accelerate PF deployment.

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ABSTRACT

Energy ecosystems increasingly embrace prosumer flexibility to integrate intermittent renewable sources into the energy mix. However, our understanding of actor roles, interactions, and market dynamics related to prosumer flexibility integration remains limited. We address this gap by exploring how prosumer flexibility can facilitate value co-creation among ecosystem actors and the resources necessary for effective integration within the Finnish electricity ecosystem. To this end, we conducted an exploratory single case study in Finland, involving 24 semi-structured interviews, 18 with key stakeholders and six with flexibility platform operators active in various European markets. Our results reveal several challenges in implementing prosumer flexibility, including barriers to integrating novel actors such as aggregators in the value chain, limitations of rural distribution networks in supporting large-scale flexibility operations, and gaps in energy literacy programs. Despite these challenges, there is a generally optimistic outlook toward prosumer flexibility adoption. We further contribute to the energy prosumption literature by incorporating the Service-Dominant Logic concept into prosumer driven value co-creation. We identify a critical phase of 'resource harmonization,' where emerging and incumbent actors align their resources to adopt novel energy technologies and provide a comprehensive framework for facilitating value co-creation through integrating these technologies.

1. Introduction

With households directly or indirectly causing 70 % of global greenhouse gas (GHG) emissions, addressing this segment is among the most important avenues for energy transition [1]. Accordingly, we observe a noticeable emphasis on novel technological interventions to incentivize optimal consumer habits, develop smart home energy systems, and prepare the grid infrastructure for flexible interactions [2–4]. Prosumer flexibility (PF), which enables household prosumers to actively manage and adjust electricity consumption in response to grid

Abbreviations: BR, Balance Responsible Party; *Capex*, Capital Expenses; *CEP*, Clean Energy Package; *DER*, Distributed Energy Resources; *DSM*, Demand Side Management; *DSO*, Distribution System Operator; *DR*, Demand Response; *EU*, European Union; *EV*, Electric Vehicles; *ESS*, Energy Storage System; *GHG*, Greenhouse Gas; *HEMS*, Home Energy Management System; *ICT*, Information & Communication Technology; *IoT*, Internet of Things; *OpEx*, Operating Expense; *PF*, Prosumer Flexibility; *PV*, Photovoltaic; *RI*, Resource Integration; *SDL*, Service Dominant Logic; *SDG*, Sustainable Development Goals; *TSO*, Transmission System Operator; *UN*, United Nations; *V2G*, Vehicle to Grid.

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requirements, has emerged as a critical solution inhabiting these characteristics [5]. Such flexibility is paramount for the energy transition, as it strengthens the foundation for increasing the share of intermittent renewable sources, namely wind and solar, into the energy mix [4]. Consequently, it is integral to realizing the Sustainable Development Goals related to energy efficiency (SDG 7) [6].

Enabled by demand-side management (DSM) or demand response (DR), PF provides tools that can transform traditionally passive consumers—who primarily consume electricity without actively influencing grid dynamics—into prosumers actively managing and contributing energy back to the grid [7,8]. DSM or DR occurs through smart appliances, electric vehicle (EV) charging, heat pumps, and behind-the-meter or solar PV-battery systems, allowing flexible consumption timing [5,9]. These measures are considered among the least costly and most environmentally friendly means of adding flexibility to the power system, particularly when compared to supply-side interventions [10,11].

However, as energy consumption has historically been associated with a passive role for consumers, the literature on prosumption-oriented flexibility is relatively recent [12]. Gough et al. [9] conducted an exhaustive literature review and identified electrification of end-use sectors, digitalization challenges and opportunities, and community energy systems among core PF research streams. Moreover, there are burgeoning studies on prosumer business models [13–15], participation [7,16], [17,18], and collective self-consumption in smart grids [19–21]. These studies examine how prosumers can be organized and connected to the grid, their impact on grid stability and efficiency, and the optimizing role of demand-side flexibility in prosumer-grid interactions. Consequently, studies on prosumer communities are relevant, touching on areas such as prosumer values [22–24], community success factors [8,25], and the diffusion of novel energy technologies [26–28].

While grid independence is an important goal for many prosumers (c.f., [24]), they remain part of a complex and interconnected ecosystem [29,30]. For instance, a European household with solar panels will likely hold a contract with a power retailer, which, in turn, operates in a pan-European electricity network and markets [31]. Therefore, whether individually or collectively in energy communities, prosumers are integral to this ecosystem [29,32]. Interconnectedness opens up promising opportunities to explore the dynamic between actors, elements, and innovations within the electricity ecosystem. An untapped opportunity here is the question of value co-creation between the prosumers and the ecosystem they are part of. This opportunity is relevant as [5] established that participating in demand-side flexibility (i.e., DR or DSM) is inherently co-creating. Yet, the PF literature has largely overlooked how prosumers interact with the broader ecosystem they are embedded in [10,33].

Moreover, future energy systems often place prosumers at their center, and a lack of engagement risks system-wide transition [33]. This shift in the electricity sector resonates with a classical understanding of value co-creation, especially that of Service-Dominant logic (SDL), a theoretical perspective that conceptualizes value creation as a collaborative process between actors rather than a unidirectional transfer from producers to consumers [34,35]. DSM-driven PF provides a compelling example in this context by facilitating household engagement in energy markets through technologies like smart appliances, EVs, and battery storage systems (c.f., [7]). These technologies can transform passive consumption patterns into **flexibility contributions** in line with grid requirements, often requiring minimal intervention from the user [4]. However, research exploring the blurring lines between energy suppliers and end consumers is still developing [34,36]. As such, a crucial aspect of this value co-creation is resource integration (RI), which is necessary for successfully integrating innovations into the ecosystem [37,38]. Investigating RI is further needed as PF is enabled by a novel technology that may not naturally align with the existing ecosystem [39].

Against this backdrop, this paper aims to address the above gap by exploring the link between DSM-driven PF and its ecosystem by investigating the RI process. In doing so, we seek to answer the following research question: how does prosumer flexibility facilitate value co-creation in the Finnish electricity ecosystem, and what resources are needed by the ecosystem actors to enable this integration? To this end, we employed qualitative methodologies and conducted an exploratory single case study to examine the Finnish electricity sector's PF development and integration process. Exploratory case studies are ideal for studying 'how' questions and can shed light on complex causal links that may be difficult to investigate using surveys or experimentation [40]. Moreover, since the research field on PF is still emerging, a standardized quantitative approach may not be the appropriate choice. Using a single case also allows context-sensitive examination of the factors (e.g., people, policies, technology) forming the ecosystem and their interrelationships as we attempt to understand the possibilities and challenges associated with RI vis-à-vis PF interrelationships [41,42].

The contribution of our study is threefold. First, it introduces SDL to energy prosumption literature, conceptually strengthening and broadening the discussion on ecosystem-wide value co-creation through RI. In particular, we recognize 'resource harmonization' among the ecosystem actors as a key driver of value co-creation in novel technology adoption. Second, our findings hold comprehensive insights on PF development for practitioners in the EU electricity sector and utilize the resource harmonization framework to pinpoint specific resources necessary for shared value creation. Third, this study offers valuable insights for policymakers in the Finnish electricity sector. It identifies several areas requiring further refinement, particularly concerning energy literacy, the development of system operator capabilities, and the impact of recent amendments to electricity market regulations.

Thus, our study contributes to aligning novel technologies with the prosumers who could eventually adopt them. By comprehensively studying the actor roles, interactions, and market dynamics related to PF, we respond to [34] critique of the existing prosumer literature, which often overlooks the significance of corporate roles and the necessity of adapting business models in the market. Furthermore, while the need for and benefits of PF are clear regarding the energy transition [43], its ability to succeed in that goal is far from guaranteed [32]. Therefore, this study adds to the effort to increase the impact of PF.

The rest of the paper is structured as follows: Section 2 reviews the literature on PF, electricity ecosystem, value co-creation, and RI, culminating in a preliminary theoretical framework. Section 3 outlines the methodological approach. Section 4 presents the findings, while Section 5 discusses the ecosystem-wide implications of PF adoption and its associated challenges. It then develops propositions and introduces a refined theoretical framework. Finally, Section 6 concludes by discussing the study limitations and directions for future research.

2. Theoretical framework

2.1. Drivers for prosumer flexibility during rapid market evolution

The traditional role of customers as passive electricity consumers is changing due to new possibilities, such as selling excess energy and offering demand flexibility to the grid [11]. Moreover, the complementary between distributed generation (e.g., solar PV) and variable demand-based prosumption (e.g., DSM) nurtures a symbiotic relationship in promoting prosumption [44]. Although, between the two, variable demand offers a more accessible and cost-effective route toward prosumption, requiring only access to smart appliances or devices capable of enabling flexible consumption [5]. This idea aligns with Gough et al.'s [11] definition of prosumer flexibility *as an instrument enabling DSM programs*. However, the seeming accessibility of variable demand does not guarantee a smooth adoption, as it still calls for a modification in prosumer behavior [45].

On the topic of PF adoption, organizing prosumers into communities is a recommended approach. For instance, [46] observed that social

interactions significantly affect prosumers' decision to adopt smart grid technologies. Prosumer communities also address the unpredictability of individual prosumers due to climatic conditions or resource gaps [36,47]. Therefore, prosumers might be better off aggregating their resources and joining the grid as a competitive unit. This approach also helps with energy literacy and addresses the issue of forecasting accuracy, which is difficult to achieve in an individual setting [11,48].

Gough et al. [11] suggest that the technological requirements for PF have matured, but regulatory and market barriers remain. Moreover, it gets trickier as prosumer markets tend to be more complex than existing electricity markets due to the inclusion of heterogeneous and emerging actors [49]. As a result, challenges arise in areas such as incentive and tariff design, information dissemination, business models, and fairness and privacy policies [11,34]. Notably, distributed flexibility varies across prosumption domains. Kubli et al. [5] found that onboarding heat pump users is more challenging than EV or storage-integrated PV system users due to its direct impact on personal comfort.

Similarly, in their survey of Finnish households, Sridhar et al. [50] found that prosumers require comparable compensation levels to participate in distributed flexibility initiatives involving heating (through electric heating or heat pumps) and other electric loads, such as household appliances and EVs. Differences also exist between early and late-stage prosumers, as early-market adopters are found to be more intrinsically motivated than their late-market peers [17]. Market designers must also consider the matching of different technological components and their effect on PF adoption. For instance, pairing energy storage and DSM increases the prosumption rate [51], whereas energy storage systems (ESS) alone are deemed uneconomical for households or in a community setting [52].

The emerging smart grid differs fundamentally from the traditional utility grid in its ability to intelligently integrate prosumers by accommodating their behaviors and actions [53]. In transitioning to smart grids, smart meters play a fundamental role [17], allowing real-time interaction with the grid and facilitating the participation of novel energy technologies such as HEMS, ESS, and V2Gs [11]. Moreover, the Internet of Things (IoT) facilitates the 'Internet of Energy', supplying real-time data to various stakeholders and easing the prosumption journey [54]. However, despite the benefits, the transition to a smart prosumer grid also presents challenges around managing increased complexity arising from numerous connected devices and handling large amounts of prosumer data [11]. Good engagement strategies focusing on prosumer acceptance drivers [36] and employing digital communication channels such as mobile applications have been prescribed to address these challenges [55]. The rollout tempo of smart grid technology is also essential, especially given our experience with solar PVs, with its rapid diffusion creating operability issues in many markets [8]. Fig. 1 presents the summary of this discussion.

2.2. Actor interdependencies and emerging value propositions in the electricity ecosystem

The impact and effectiveness of prosumer flexibility can only be fully appreciated within the broader context of the electricity ecosystem. Accordingly, successfully adopting PF requires high levels of interaction and interdependence among ecosystem actors [56,57]. It is not just an emerging technology; it involves an emerging network of actors, business models, and governance regimes [57]. The actors in this ecosystem are individuals or organizations who can make decisions and exchange information with other participants [58]. The successful integration of PF thus depends on the independent and aggregate roles these actors play, where the role is the intended external behavior of an actor [58]. It is important to stress that the evolution of roles for many actors has been ongoing since the liberalization of the Finnish electricity markets began in the late 1990s [59]. This shift meant developing a service-based operation for the newly decoupled companies, which was not an easy role to assume for an industry that historically viewed customers as 'loads' [59]. Indeed, for certain actors (e.g., retailers), this new role was relatively easier to grow into [60]. However, it is still problematic for actors not directly contacting customers (e.g., DSOs) [61]. This role ambiguity challenges PF since the contract models needed to facilitate its adoption call for multilateralism among the actors [62]. Moreover, the ongoing energy transition is increasingly blurring the line between end consumers and suppliers, making customers uncertain [34]. This, coupled with the cynicism many consumers harbor toward the liberalized energy markets [63], underscores the importance of clarifying and solidifying the roles of various actors within the ecosystem.

Moreover, emerging actors, such as prosumers or aggregators, challenge the traditional top-down value chain of the electricity market [34]. Gough et al. [11] suggest that this transformation should consider the ecosystem actors' welfare as it will ultimately determine the value it offers to society. This conclusion aligns with Adner's [64] idea that discrete actions are necessary for value propositions to emerge in an ecosystem. For example, Brown et al. [14] identified a mutually beneficial relationship between prosumer business models that promote real-time local consumption and the willingness to reduce the need for peak charging and expensive network updates. Besides, with intermittent DERs rising, the value pools for flexibility services are expected to double by 2030, and when DSOs can procure flexibility to manage grid constraints, it will further increase the value of prosumption [14]. However, since this value relies on the ecosystem's PF adoption, nurturing trust and credibility among the actors is crucial for developing value propositions [65].

Lastly, interaction has been identified as a critical driver for ecosystem value creation [66]. For PF, interactions can occur at the ecosystem level through contracts, profit, or risk sharing [36] or at a platform level through the collaboration of flexibility aggregation systems, DER suppliers, customers, and prosumers [67]. However, new entrants offering PF may not align with incumbents, leading to conflicts over time due to power shifts, as seen with emerging solar PV providers' interaction with incumbent power utilities in Sweden [2]. Moreover, interactions also take place between government interventions, such as energy policies and participatory regulations [68]. We can summarize the discussions on the electricity ecosystem as expressed in Fig. 2.

2.3. Facilitating value co-creation through prosumer flexibility integration in electricity ecosystems

Value co-creation is a collaborative process involving customers and

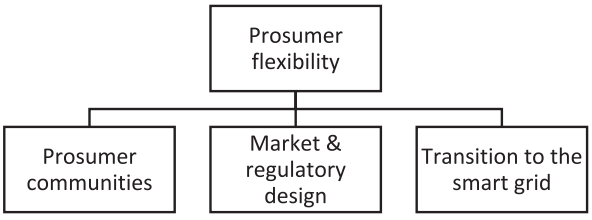

Fig. 1. Drivers of prosumer flexibility.

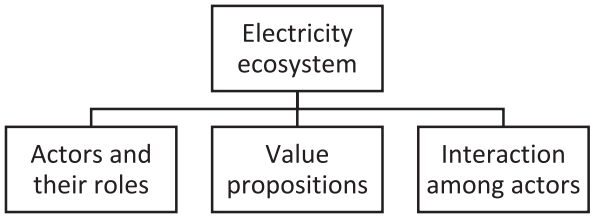

Fig. 2. Evolving electricity ecosystem in the context of prosumer flexibility.

suppliers to produce mutually beneficial outcomes. Customers actively participate in this process by designing and developing products, services, or experiences and contributing their insights, ideas, and efforts [69,70]. Initially observed in sectors with high customer engagement, like financial services and healthcare, Prahalad and Ramaswamy [69,70] note that customer dissatisfaction often leads to novel solutions. As technology became more accessible and customer awareness grew, value co-creation expanded into sectors with traditionally lower levels of user involvement, including electricity consumption [69,71]. DSM emerges as a prominent example in this regard, where the low involvement nature of electricity consumption and the strong momentum of routines and inertia kept the cost to switch to dynamic consumption traditionally high [5,72]. However, as technological advancements and consumer awareness increased, there was a noticeable shift among prosumers to engage in the co-creation of flexibility in their consumption patterns [5].

As value co-creation gained attention from marketing scholars, it branched out in multiple directions, with different conceptions of the process [73]. According to the SDL perspective, value co-creation occurs at various levels and is impacted by the social contexts, networks, and systems in which the co-creation occurs [35]. Moreover, SDL states that products are merely a means to convey a service, making service the fundamental unit of exchange, regardless of the traded object [35,74]. Therefore, customer-supplier collaboration is necessary for value creation across product categories. Notably, with the blurring of division between consumers and suppliers, this collaboration is becoming increasingly relevant for the electricity ecosystem [34]. For instance, in the utility sector, companies are transforming from mere energy suppliers to providers of peace of mind by investing in digital technologies [55]. Consequently, it motivates customers to change their electricity consumption behavior, resulting in long-ranging influences on the ecosystem [75].

However, despite progress in understanding the co-creation process, research on collaboration is lacking in some areas, particularly in how companies organize themselves and the resources required at the actor level to facilitate co-creation [71]. This gap exists, although resource integration is a fundamental proposition from the SDL perspective [76]. Additionally, Mele et al. [77] suggested that a firm's ability to match its resources to those available in its ecosystem enhances co-creation possibilities and contributes to the evolution and success of the ecosystem. This integration drive is further supplemented by market forces that compel firms to act as resource integrators in any ecosystem as they seek to co-create value [66]. Multiple drivers influence the RI process, which can be divided into two streams based on the setting (c.f., [78,79]) and the orientation (c.f., [37,39]) of the RI process. Our paper examines both streams and sheds light on three core drivers of this process: complementarity, redundancy, and asymmetry.

Gummesson and Mele [66] define resource complementarity as resources that supplement each other and must be incorporated collectively to form a whole. Achieving resource complementarity is often challenging in highly regulated sectors such as electricity, and this attribute can affect the value co-creation possibilities of the ecosystem [79]. Resource redundancy refers to resources similar in a category and possessed by multiple actors [66]. These resources should be combined to promote a shared understanding and facilitate the transfer of tacit knowledge. However, its challenges must also be highlighted to depict the RI process accurately. As such, asymmetry in the resources represents the prohibiting factor of unequal access to resources (e.g., finances, knowledge, network, or competencies) among the actors, hindering value co-creation [39]. It applies aptly to the transitioning energy landscape [36].

Our literature review proposes a dynamic framework for RI that considers the relationship between complementarity, redundancy, and asymmetry in enabling PF in the electricity ecosystem. The framework draws on insights from previous research by Mele et al. [77] and Dehling et al. [39] and is illustrated in Fig. 3.

3. Methods and research setting

3.1. Research strategy

Using a qualitative research strategy, we conducted an exploratory single-case study to investigate the integration of prosumer flexibility (PF) in the Finnish electricity ecosystem. This method is apt for addressing 'how' and 'why' questions and aligns with our research objectives [40]. This approach offers several advantages for this study. First, the field of PF is still nascent, with limited prior research providing a foundational understanding of the topic. A qualitative, exploratory approach allows us to capture the nuanced nature of the environment surrounding PF integration, including stakeholder roles, technological implementations, and policy implications, thereby addressing the foundational gap [80]. Second, exploratory case studies allow for a context-sensitive analysis of the ecosystem's interrelationships between the constituent components (e.g., people, policies, technology). This permits studying complex causal links and emergent patterns in PF-enabled value co-creation, which may be difficult to identify through

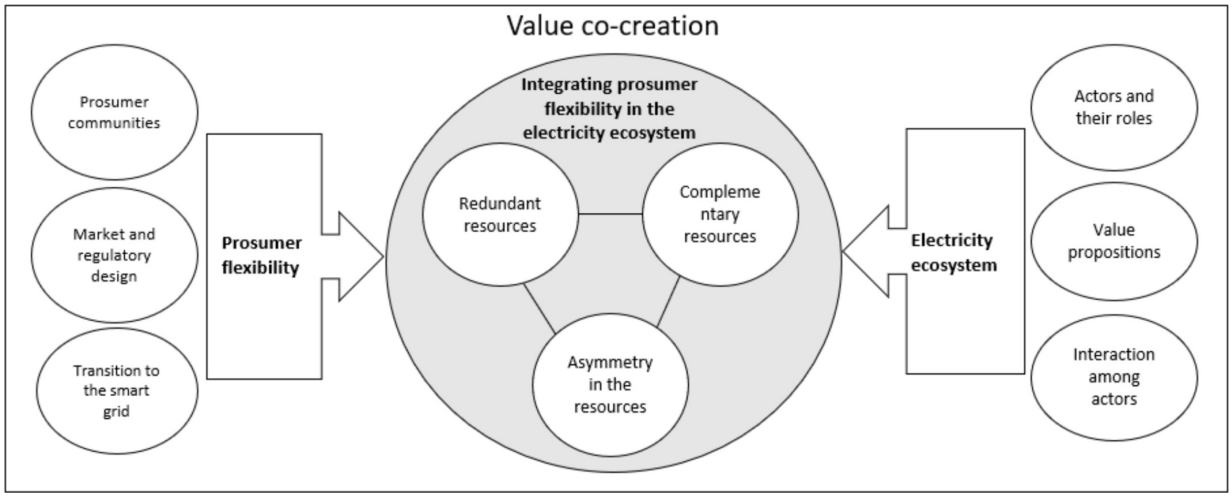

Fig. 3. The conceptual framework for prosumer flexibility integration in the electricity ecosystem.

quantitative surveys or experimental methods [41].

Moreover, a single-case study is justified when the case is unique and provides a revelatory opportunity for researchers to investigate previously inaccessible phenomena [40]. Accordingly, the Finnish electricity ecosystem presents an exemplary case with a highly developed smart grid, a system-wide approach to demand-side flexibility development, and renewable energy integration [81]. Studying the juncture of these developments from a PF-driven resource integration (RI) and value co-creation perspective could yield nuanced insights that might be obscured in a broader, multiple-case study setting.

3.2. Case context and data collection

We employed the ecosystem architecture development method that Ma [58] proposed to conceptualize the Finnish electricity ecosystem. It blends theories from system engineering, business ecosystems, and ecology and has been previously applied in electricity sector conceptualizations (cf., [82,83]). Following [83], the ecosystem boundary in the current setting can be set by the geographic/cultural frontier of Finland and the target domain of the country's electricity sector. According to [67], the main incumbent actors in this ecosystem are energy producers, market operators, transmission and distribution system operators, power retailers, industrial and domestic consumers, and various independent service providers (e.g., technology and balance responsibility providers).

With the boundary set, we employed a purposeful sampling method to select the organizations in this ecosystem. Yin [40] defines purposeful sampling as selecting cases based on information richness and offering practical manifestations of the phenomenon of interest. In addition, it aims to gain insight into the phenomenon that goes beyond statistical generalization. Given its centrality to flexibility operations, the TSO appeared as a primary actor with which to consult. In Finland, a single TSO entity oversees nationwide electricity transmission. We opted for an in-depth perspective from this organization and settled with a Senior Corporate Director with a birds-eye view of the electricity ecosystem and a Specialist with competencies in PF. In the next step, we picked a mid-sized DSO with electricity retail operations in eastern Finland. We then opted for a DSO of a similar size from the western part of the country. Lastly, we interviewed a large electricity retailer from the capital region of Helsinki. This way, we registered a diverse perspective regarding geography, organizational size, and operational roles. For these interviews, we sought senior experts with a background in flexibility projects and familiarity with customer affairs.

Moreover, to get a sense of the industrial actors on PF, we chose two firms with a long history in operations in the electricity sector, one from the manufacturing side, while the other provides industry services. The former is a major forestry company with operations in the balancing markets, and the latter is a prominent energy consulting firm with expertise in developing flexibility services. Experienced managers were interviewed in both cases, with the ranks of a Vice-President and a Director.

[84] identified regulators, policymakers, and interest groups as integral to the energy ecosystems. Consequently, we interviewed two Senior Experts from the local electricity industry interest group and a Deputy Director General from the Finnish energy regulator, overseeing the system operators. Moreover, [14] identified novel entrants such as platform providers, aggregators, community groups, and non-endemic technology firms eager to access the increasing value pool as relevant actors. Consequently, we included the sole commercial aggregator in the Finnish electricity sector in this discussion. To get the perspective of prosumers and community groups, we sought a diverse perspective regarding geographical spread, community development, and technological orientation. We interviewed a CEO and a Project Manager from a community renewable energy development company based in a north-eastern Finnish city. Next, we interviewed the Head of Co-Innovation of an energy consulting firm specializing in smart prosumer communities and active in multiple locations within the country. Lastly, we identified two community energy groups active in the Finnish countryside, one run by the local municipal body and the other a citizen initiative, and interviewed the lead organizer in both instances.

February 2022 saw the beginning of a global energy crisis with the Russian invasion of Ukraine. This compelled us to initiate an additional data collection round to discern this significant event's repercussions on PF and the broader electricity ecosystem. This phase materialized in three interviews where we first interviewed a Development Director from an energy services company with operations in electricity retail, solar PV, and EV charging. Then, we moved on to a mid-sized electricity retailer with nationwide operations. Here, we interviewed the firm's Development Manager. We also interviewed the senior vice president of customer services from an energy services company based in south-eastern Finland, which operates in electricity retail, distribution, and comprehensive solar PV packages. In total, 17 semi-structured interviews were conducted between September 2019 and May 2022. These were conducted on a rolling basis, with each round of interviews transcribed, coded, and analyzed before returning to the field for further data collection. This iterative process allowed for continuous data validation until saturation was reached. Data saturation is reached when no new information or themes are observed, ensuring the collected data is comprehensive and sufficient to substantiate the study's findings [85]. Seven interviews were conducted in person, while the rest were through Zoom.

To further ensure the robustness of our findings, we conducted an additional interview in June 2024 with a Market Analyst from a Helsinki-based energy consulting company. The firm is involved in various flexibility market initiatives across the EU, and the interviewee is a veteran flexibility regulations expert. Although this interview provided a more recent perspective, it did not reveal any new patterns in our data, reinforcing our conclusion that data saturation had been achieved.

The extended timeline reflects the study's aim to capture significant and evolving developments in the Finnish energy landscape. Strategies such as revisiting earlier themes during later interviews ensured temporal consistency across the dataset [86]. Key contextual factors included temporary disruptions to energy community engagement during the COVID-19 pandemic, the Ukraine War's impact on Finland's energy policies, and the anticipated challenges stemming from the 2023 expansion of nuclear power. These developments were subsequently incorporated into the analysis. By addressing pre-existing and evolving factors, the dataset offers a nuanced understanding of the country's electricity sector during a period of noteworthy transition.

Furthermore, a semi-structured interview method was chosen for its ability to integrate thematic questionnaires while allowing the possibility for modifications during conversations [87]. The interview guide was developed through a combination of theory-driven and data-driven approaches. Thematically, the guide was informed by prior flexibility literature and industry reports. Simultaneously, its iterative design allowed emergent themes to shape subsequent rounds of interviews. The interview guide was divided into three sections. The first section probed general sector overview and flexibility services suitability, using literature and industry reports to prompt discussion and establish a baseline. The second section had thematic prompts tailored to the interviewee's organizational role and expertise. This phase involved discussing specific organizational practices, with company reports and personal professional profiles (via LinkedIn and public web sources) consulted beforehand to inform the questioning. The third and final section was open for a free-flow discussion to pursue emergent insights that came up during the interview. Appendix 1 presents the interview questions, while Table 1 provides an overview of the Finnish ecosystem interviews.

Several interview facilitation strategies were applied to ensure a smooth flow of conversation and comprehensive data collection, guided by [86,87]. Open-ended questions were used as a foundation, with the interviewer frequently employing prompting and probing techniques to

Table 1
Interviews from the Finnish electricity ecosystem.

Interviewee code	Duration (min)	Organization role	Job title
E1	69	TSO	Specialist
E2	67	TSO	Corporate Advisor
E3	101	Industrial actor/Energy services	Development Director
E4	57	Retailer/BRP	Head of Unit, Risk Management
E5	70 + 81	Retailer/DSO	Business Director
E6	61	DSO	Head of Sales
E7	58	Industrial actor/ BRP	VP, Energy Markets
E8	55	Energy Regulator	Deputy Director-General
E9	61	Energy Industry Interest Group	Experts
E10	54	Aggregator	Operations Manager
E11	63	Renewable Energy/ Community Management	CEO/Project Manager
E12	80	Energy Services/ Community Development	Head of Co-Innovation
E13	61	Municipality/Energy Community	Municipal Chairman
E14	58	Energy community	Energy Community Leader
E15	48	Energy Services	Development Director
E16	150	Retailer	Development Manager
E17	60	Energy Services	SVP, Customer Services (B2C)
E18	37	Energy Services	Market Analyst

encourage deeper reflection. Active listening was integral, with the interviewer summarizing key points and asking clarifying questions to understand participant perspectives accurately. Flexibility in the sequencing and phrasing of questions allowed conversations to adapt organically to participants' responses. Additionally, storytelling was encouraged, with participants invited to share personal experiences and concrete examples rather than limiting responses to abstract concepts.

Hack et al., [82] concluded that the 'digitalization drive' in the European energy sector is not a regional standalone, and due to the interconnectedness of the electricity systems, a cross-border perspective is preferable. We addressed this point by including six European flexibility platforms in the interview process operating in relatively similar regulatory landscapes, market conditions, and technological benchmarks. Furthermore, the necessity of a platform perspective in PF development is well documented (c.f., [14,67]). These interviews addressed this critical gap since no operational demand-side flexibility platform exists in the Finnish market. Four selected platforms have commercial ambitions, while the remaining two are research-oriented. The experts from these interviews have all been part of the platform development process, making them suitable candidates to highlight the integrational issues within the ecosystem. Similar to the Finnish interviews, we used a semi-structured format, and further triangulation was achieved through a detailed benchmarking exercise. In the benchmarking process, we investigated issues such as the value propositions of these platforms for the ecosystem and their potential to enable flexible prosumer interaction with the grid. The interviews were conducted online between February 2020 and May 2024. Cross-validating the Finnish ecosystem findings with insights from this interview round increases our results' applicability across a broader European context. Table 2 provides an overview of these interviews.

3.3. Data analysis, validity, and reliability

The data analysis was conducted in three stages, with some iteration. Following [86], it began with a content analysis where raw data from transcripts, interview notes, and additional materials were assembled. An initial coding phase applied descriptive labels directly to the data, capturing patterns emerging from participant statements without theoretical imposition. In the second stage, several case records were constructed by grouping the coded data into emerging patterns identified across the dataset. A pattern analysis followed, in which recurring themes across the case records were identified and further condensed to reveal overarching patterns within the dataset [86].

Table 2
Interviews from flexibility platform providers.

Interviewee code	Duration (min)	Operation location	Job title
P1	52	Netherlands	Business Consultant, Smart Energy
P2	36	UK	Project Manager
P3	30	Norway	Senior Consultant
P4	31	Germany	Analyst
P5	68	Croatia	R&D Project Manager
P6	55	Portugal	Innovation Manager

To further refine the analysis, the third stage employed the Gioia methodology [88] to construct a data structure visually representing the progression from raw data to higher-order theoretical themes (Fig. 4). The first-order concepts emerged directly from the interview data. These concepts were then grouped into nine theoretical second-order themes in Fig. 3. Finally, they were aggregated into the three central pillars of this study: prosumer flexibility drivers, electricity ecosystem, resource integration, and value co-creation in the PF context. Appendix 2 presents an example of the coding process, including representative raw data, content codes, and the progression to theoretical themes.

The principal author primarily conducted the coding process to ensure the consistency of criteria; however, the co-authors validated the coding throughout this process. Moreover, following [89], extensive data triangulation was used to maximize the study's internal validity. As such, we reviewed numerous materials from the selected organizations (e.g., publicly available financial and technical data, industry reports, press releases, etc.). In addition, three of the authors of this paper had been involved in a national project to conduct a feasibility study of a demand-side flexibility market in Finland. The project involved significant research and industrial actors from the country's energy sector. Notes and memos from the project workshops, seminars, and meetings were used to validate the interview data.

4. Findings

This section presents the main findings from the interviews, organized according to the data structure detailed in Fig. 4. In line with [86], selected participant quotes are included in the text to illustrate central themes and represent participants' views directly. Additional supporting evidence in the form of illustrative quotes is provided in the Annex.

4.1. The drivers of prosumer flexibility

4.1.1. Prosumption pathways through prosumer communities

The interviews revealed a general willingness among prosumers to engage in community-based frameworks, particularly when incentives align with their interests. Prosumers were perceived as more open to sharing data, modifying consumption schedules according to price signals, and participating in energy-sharing schemes with their neighbors. However, several participants emphasized the challenge of engaging "ordinary consumers" (non-prosumers) in such initiatives due to limited domain awareness of DR mechanisms and widespread distrust toward energy companies' motives. A business director for a power retailer observed:

"It is very difficult to explain to ordinary people, domestic customers, how the market works, what flexibility is, and what benefit they might

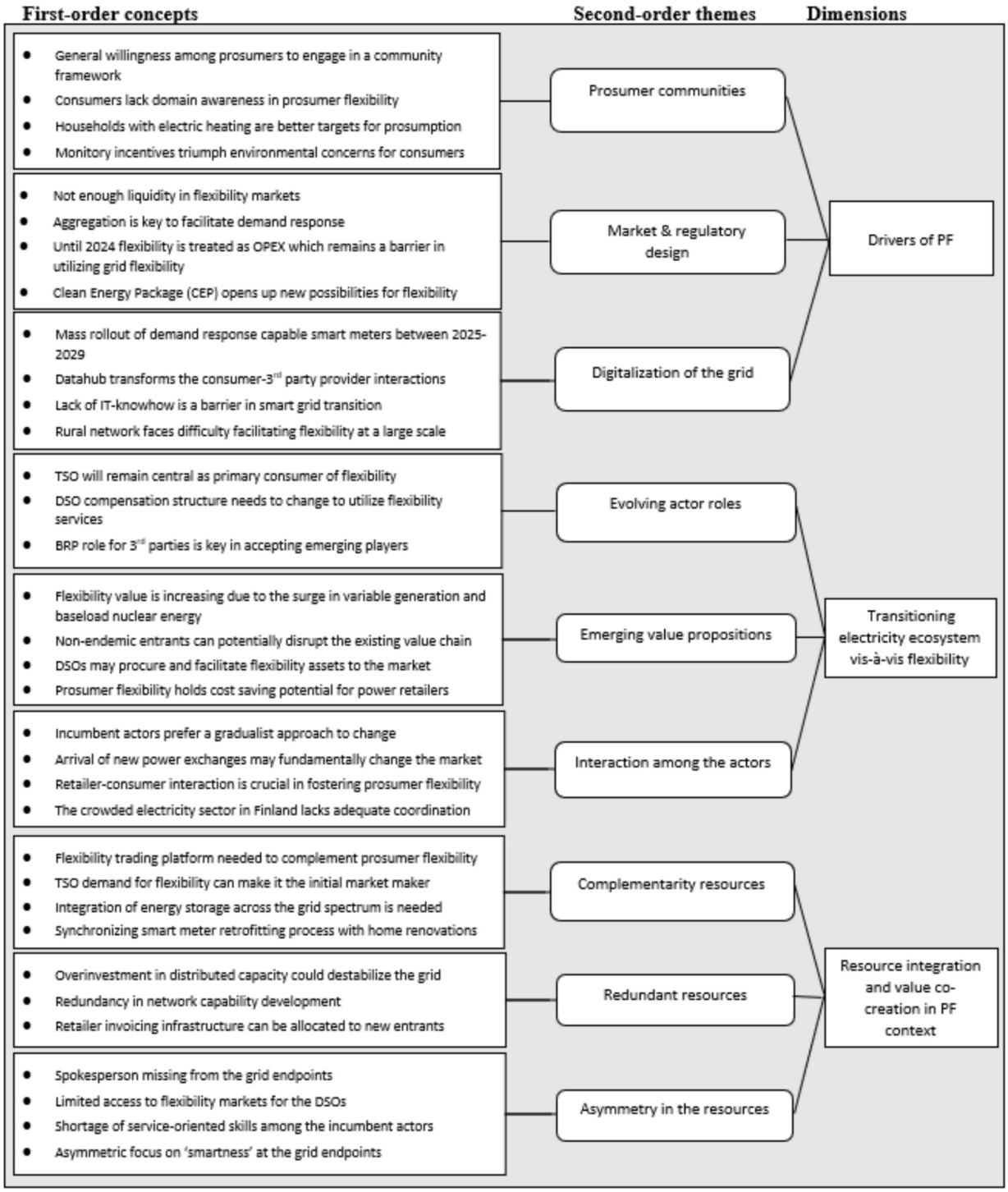

Fig. 4. Data structure.

gain from it. Customers are, how would I say, healthy-minded people, which means they are somewhat suspicious, what scheme the utility is up to now."

Given these reservations, several interviewees identified households with electric heating as promising candidates for greater flexibility participation. Such households offer the potential for flexible load control due to the high energy density of electric heating systems. Furthermore, technologies like heat pumps and smart cooling systems were frequently mentioned as critical enablers of prosumption, especially as their adoption grows.

When examining the underlying drivers for prosumption, most interviewees consistently pointed to monetary incentives being more compelling than concerns over sustainability. This perspective was consistent across both industry and community sectors. One community leader argued that a pragmatic approach emphasizing comfort and habitability, particularly for remote energy communities, would be more effective than promoting sustainability alone. Similar concerns were found in another energy community representative, who described the "sustainability-driven waste" phenomenon, where functional household appliances are prematurely discarded in favor of newer, smart technologies.

4.1.2. Market and regulatory design shaping prosumer flexibility

Ensuring liquidity in flexibility markets emerged as a recurring concern among interviewees regarding the influence of PF on the development of PF. Several actors contended that high liquidity would enable efficient price formation, resulting in better utilization of flexibility. A dominant suggestion to counteract market fragmentation was to allow flexibility to be bid across multiple markets, ensuring that it is directed toward areas with the highest demand. Additionally, aggregation was frequently highlighted as a critical strategy to enhance market liquidity and automate the consumer end of the process. It also helps bypass barriers stemming from entrenched consumer habits and the appeal of convenience.

Interviewees also reflected on the appropriate bid size for household flexibility participation. There was a general preference for maintaining a low threshold for market entry, mainly when third-party intermediaries are not involved. This approach was crucial for smoothly incorporating prosumer-grade flexibility into market operations. Moreover, regarding the pricing mechanism for flexibility, the consensus strongly favored market-derived over subsidy-based approaches. This preference extends to PF-enabling devices such as EVs or home battery systems.

Significant **regulatory barriers** were also identified, particularly by participants representing DSOs and TSOs. One of the most cited challenges was classifying flexibility-related costs as operating expenses (OpEx) rather than capital investments (CapEx). This regulatory treatment discourages grid operators from opting for flexibility solutions over traditional grid reinforcements. A DSO sales manager explains:

"The regulatory environment does not incentivize grids to use flexibility as the profit comes from investments. That is a very important reason for forgetting flexibility…(since) DSOs do not profit from making savings. Also, if you avoid investments, you have higher operational costs, which is punished."

4.1.3. Digitalization of the Finnish electricity grid

The ongoing digitalization of the Finnish electricity grid was generally well-received by the stakeholders. Enhancing the "smartness" embedded within electricity meters at the consumer level emerged as a cornerstone of this effort. According to the participants, the next-generation smart meters are poised to streamline the bi-directional flow of energy and data and are compatible with the imminent transition to 15-min balance settlement intervals. However, participants acknowledged that full implementation will take time, with many meters operational only by 2029.

Several stakeholders indicated that data management is a significant aspect of modernizing the electricity grid. The introduction of Datahub – a centralized information exchange operated by the TSO - heralds a transformative era for the Finnish electricity sector, revolutionizing consumer-service provider interactions. However, despite these advancements, the inadequate ICT capabilities among DSOs were noted as a significant barrier to the grid digitalization effort. It was particularly apparent in these parties' failure to join the Datahub exchange on time, resulting in several delays. Concerns about the rural grid's ability to handle large-scale flexibility were raised. A senior DSO executive described the infrastructural limitations:

"…if all the customers were taking their high peak demand at the same time, the truth is that the distribution network in the rural areas cannot pass that electricity. Whether it goes that direction or comes back from the customers, the network is not strong enough… so when we talk about rural networks, the DSO will face problems if the new world is such that you have a low spot price for one hour and everybody consumes electricity or fills their storage exactly at the same time."

4.2. A transitioning electricity ecosystem

4.2.1. Evolving actor roles and responsibilities

The roles and responsibilities within the Finnish electricity ecosystem have continued to evolve since market liberalization [59]. Nevertheless, despite these shifts, interviewees indicated that the central responsibility of the TSO in maintaining system balance would remain constant, positioning it as the principal user of flexibility services while keeping most other market participants on the supply side.

Simultaneously, several participants noted the expanding role of the DSOs due to the anticipated rise in demand for flexibility at local levels. However, it was mentioned that their current compensation structure largely relies on grid investments and distribution fees and is not aligned with the emerging flexibility needs. Further complicating matters, the potential role conflicts between DSOs and third-party operators were mentioned as adding to the challenge of encouraging flexibility at the distribution level. Interviewees also noted the historical emphasis of DSOs in enhancing the security of supplies as an obstacle to the development of flexibility services. The regulatory frameworks that once were designed to ensure stability and security are now seen to be a double-edged sword, impeding the adaptability required in this fast-evolving landscape. A participant from a DSO noted:

"In this industry, people think very traditionally, with a historical burden where everything new is always a threat."

Electricity retailers, meanwhile, are grappling with the implications of rising third-party players (e.g., independent aggregators) attempting to adopt flexibility-enabling roles. Several interviewees suggested that these third-parties need to assume a balance-responsible role to gain acceptance from retailers. Resolving this issue is central because of retailers' proximity to customers and the necessity of aggregators in DSM. However, the situation is not as straightforward for the third-parties. Stepping into the BRP role is considered burdensome for smaller entities due to the costs of maintaining a round-the-clock operational presence. Furthermore, the economics of sharing profits from unconsumed energy was mentioned as introducing specific challenges. If aggregators are compelled to buy and sell flexibility in the day-ahead price, their financial viability is undermined.

4.2.2. Emerging value propositions in the ecosystem

Interviewees highlighted that the Finnish electricity ecosystem is undergoing a significant restructuring, driven by shifts in generation capacity and market demands. A notable surge in variable renewable generation, particularly wind energy, contributes to greater system unpredictability. Simultaneously, the rising share of nuclear power in the baseload supply has made the market less flexible [90]. Compounding this structural shift, some interviewees indicated that the need to reduce the reliance on natural gas, necessitated by the ongoing energy crisis, further increases the value of flexibility services.

This situation is placing new demands on distribution networks. With the increasing trend of prosumption and the growth of small-scale flexibility assets, several interviewees suggested that DSOs might soon find themselves procuring and facilitating these assets in the market in addition to their regular distribution duties. Moreover, the accelerated adoption of EVs further complicates this transition. Interviewees identified EV growth as a source of load pressure on the grid and a valuable flexibility asset. Technologies such as vehicle-to-grid (V2G) systems, where EV batteries feed energy back into the grid, were mentioned as promising flexibility solutions. Some participants expressed optimism

that PF could assist DSOs in managing EV-related load growth and balancing consumption and generation more effectively.

Retailers in the electricity sector view PF with growing interest as they recognize its promise in managing energy imbalances and navigating expensive peak hours. Several pilot programs focusing on such services are currently being developed. The ongoing energy crisis catalyzes this arena, incentivizing retailers to develop flexibility-driven business models. Notably, interviewees indicated that PF allows retailers to innovate beyond pricing to appeal to a broader customer base.

4.2.3. Collaboration and competitive interactions among the actors

Participants repeatedly emphasized the highly interconnected nature of the electricity network, which complicates the implementation of radical innovations. Due to the system's delicate balance, even minor alterations can lead to substantial ramifications throughout the network; consequently, established players favor a gradual approach to change. They further note that any major disruption in the existing value chain could trigger significant resistance from entrenched stakeholders. In the words of a veteran utility manager:

"This is a chain of values...If the chain of value is created so that somebody gets hurt, this somebody will do everything to prevent flexibility from happening. And if this somebody is an electricity sales company, he does have a relatively strong grip on the customer... So it would be a lot better that nobody gets hurt, so everybody works in the same direction."

Despite this interconnectedness, interviewees also pointed to transformative shifts within the ecosystem. For instance, emerging non-traditional players introduce unpredictability and challenges to established roles. These new entrants often bypass traditional constraints utilities face, leveraging their technological infrastructure and existing customer bases.

Furthermore, several interviewees highlighted the impact of political decisions in setting the course for business model development. A case in point is the EU's policy of an open market, which welcomes competition between power exchanges. The Nordics has traditionally relied on Nord Pool for hourly electricity prices; however, the entry of new exchanges could pave the way for a diversified pricing mechanism. Additionally, participants stressed how the historical certainty of uninterrupted power supply is under increasing pressure, necessitating a pivot in retailers' business models. They noted that retailers must recalibrate their communication strategies, moving from the traditional narrative of constant supply assurance to a more nuanced service offering emphasizing grid flexibility.

Lastly, the Finnish electricity ecosystem is rather crowded, with 53 electricity retailers and 77 DSOs (excluding high-voltage ones) [90]. Feedback from interviewees highlighted a prevailing lack of coordination within this saturated market. Further complicating matters, many retail entities have instigated aggressive price competition to solidify their market positions. Such competition affects market development, resulting in a lack of priority for offering innovative products or services.

4.3. Resource integration and value co-creation in the context of prosumer flexibility

4.3.1. Resource complementarity for prosumer flexibility adoption

The adoption of PF depends heavily on resource complementarity, where different assets and capabilities collectively enhance value creation. Actors require various complementary resources to effectively engage in value co-creation, as resources are more impactful when they work together to achieve system-wide benefits [77]. Accordingly, several interviewees indicated that integrating a flexible trading platform into the Finnish electricity market would simplify the flexibility-sharing process and increase customer domain awareness.

A recurring theme among interviewees was the need for a marketplace capable of handling small-scale flexibility loads. This need arises from a market barrier commonly described in the literature as the "chicken and egg" dilemma, where supply and demand for a novel service struggle to develop concurrently [91]. However, several participants noted that the TSO's high demand for system flexibility positions it as a potential initial market maker.

Energy storage was also identified as a critical complementary resource for PF. From individual households to community energy setups (e.g., EV and behind-the-meter batteries) and the broader grid infrastructure (e.g., utility-scale), battery systems are expected to bolster self-reliance, harmonize grid operations, and usher favorable flexibility trading opportunities.

However, the current smart meter infrastructure presents a significant barrier to effective PF integration. While the next-generation smart meters are crucial for DSM, full deployment in Finland is not expected until 2029. Until then, households interested in participating in flexibility programs would face significant retrofit costs, including expensive equipment upgrades and installation fees. An innovative proposal emerged from the interviews to address this, suggesting that meter upgrades could be synchronized with other home construction or renovation activities.

4.3.2. Resource redundancies and its implications

Resource redundancy is noticed when multiple actors possess resources that are similar in category [66]. Accordingly, the interviewees indicated that the current trend of investing in distributed capacity (e.g., wind or solar PV) is not always optimal from the systemic perspective. Such overdevelopment of capacity – and the associated capabilities – might contribute to a grid imbalance and create resource scarcity in other areas of the system. Furthermore, several participants highlighted a redundancy in network capability development, especially within the zoned areas in distribution networks. An overinvestment here implies that the physical infrastructure (e.g., cables, substations, transformers, etc.) in the urban areas will be enhanced more than is required, slowing down the adoption of more efficient or sustainable technologies in power distribution.

Beyond physical assets, operational redundancies were also identified, particularly concerning billing mechanisms. Retailers, by their long-standing presence in the market, possess sophisticated billing systems, and through a partnership with them, novel entrants could utilize this resource. A senior manager from a power retailer explains:

"When discussing one domestic customer, you know billing is big. If you enter a (flexibility) market where hundreds of thousands of households can enter, you must have a billing system for hundreds of thousands of households. And in the end, you may compensate or invoice a few euros per month. Then, the billing system itself more or less doubles the cost. Whereas we (retailers) have a billing system already, and we have to invoice those customers anyhow."

4.3.3. Resource asymmetry among the actors

Interviewees highlighted significant resource disparities, particularly for DSOs, when compared to TSOs, in accessing flexibility markets. This imbalance has resulted in limited flexibility service growth at the distribution level, emphasizing the need to cultivate DSO-driven flexibility. Another critical resource gap identified during the interviews was the shortage of service-oriented skills within the electricity industry. Some participants point to a prevailing 'engineer mindset' as a cultural barrier, suppressing the emergence of a more customer-centric approach. One industry professional candidly described this challenge:

"I am an engineer; I have a master's degree in engineering and am very proud of it. However, one problem is that too many engineers are in this field. We like machines; we believe in generators and not in the forward market."

Lastly, the ongoing modernization of Finland's electricity grid has attracted criticism for its asymmetric focus on "smartness" at the endpoints (e.g., households) instead of smart infrastructure across the distribution network. This approach, critics argue, could lead to an overdependence on the endpoint resources (e.g., DERs, HEMS) when

similar outcomes might have been achievable through smart control mechanisms within the grid. Moreover, another prominent concern is the absence of a spokesperson for the endpoints. It is crucial for PF because both consumers and prosumers are located at grid endpoints and do not have the means to collaborate effectively within the ecosystem, hindering value co-creation.

5. Discussion

The Finnish electricity ecosystem is experiencing prominent structural changes, revealing tensions that challenge and shape the path toward PF adoption. These challenges manifest across market competition, evolving actor roles, consumer engagement, regulatory frameworks, and resource integration. This section explores the frictions and outlines pathways to balance these tensions, emphasizing strategies for achieving ecosystem-wide value co-creation.

5.1. Ecosystem modifications and market competition: Navigating resistance

The Finnish electricity ecosystem is undergoing significant structural changes driven by market saturation and evolving business models. The saturated market has led to intense price competition, leaving little room for innovation or investment in flexible solutions. These challenges echo observations by [59], who noted shifting roles in the Finnish electricity sector following market unbundling. A central feature of this evolution is companies transitioning from energy suppliers to energy services, a shift corroborated by [55]. However, this shift mainly introduces tensions for actors distanced from direct consumer interactions, also emphasized by [61].

Adding to this complexity is the entry of non-traditional actors, such as power cooperatives and aggregators, which complicates the current value chain and increases the chances of conflict between novel and incumbent players [49]. Retailers, historically the primary touchpoints for consumers within the electricity grid [7,59], are increasingly challenged by the rise of third-party intermediaries and the expansion of smart metering systems. This shift reshapes traditional ecosystem dynamics and could potentially spark friction. Evidence also points to a growing convergence among consumer and retailer aspirations for an interactive, bi-directional grid engagement. This inference is backed by a marked 63 % annual increase in partial self-generation contracts in Finland [90]. The energy crisis stemming from the Russia-Ukraine conflict acts as a catalyst, increasing consumer involvement in their energy consumption patterns and prompting retailers to enhance their service offerings centered around energy efficiency.

Despite these advancements, established players often resist disruptive innovations due to concerns over losing market shares or compromising existing value chains [64]. This resistance underscores the need to balance innovation with incumbents' welfare, as Gough et al. [11] echoed. Cultivating symbiotic relationships among ecosystem actors through innovative business models and operational frameworks offers a pathway to mitigate this resistance (c.f., [13]). For instance, adaptable energy schedules and decentralized energy storage [36] provide opportunities for prosumer value co-creation with distributed flexibility. Moreover, entrepreneurial initiatives, such as heat pump-based DR solutions (e.g., Kapacity.io), illustrate the potential synergies between prosumers and the ecosystem actors.

Thus, we propose the following:

Proposition 1. Collaborative frameworks that balance innovation with incumbent welfare can minimize resistance and nurture synergies among ecosystem actors.

Proposition 2. Streamlined market coordination and reduced fragmentation can enable the prioritization of innovative flexibility solutions, particularly in competitive environments.

5.2. Actor roles and responsibilities: Tensions in evolving ecosystem dynamics

The emergence of novel actors within the Finnish electricity ecosystem has intensified tensions related to evolving roles and responsibilities. This is concerning because Effective adoption of PF relies on high interaction and interdependence among actors, as highlighted by [57]. These interactions are necessary at the ecosystem level and within platform-specific engagements [36,56]. However, challenges arise in defining and allocating balancing responsibilities for new entrants, such as independent aggregators. Resonating with the conclusion by [67], we recognize the need for third party operators to assume balancing responsibility in order to be seamlessly integrated into the value chain by the retailers. Additionally, we extend the literature by incorporating profitability challenges for aggregators—such as the high costs of maintaining 24/7 operations and difficulties establishing fair price differentials when compensating suppliers at day-ahead market rates.

Thus, we propose the following:

Proposition 3. Addressing operational bottlenecks and establishing fair pricing mechanisms for third-party actors are critical in enabling their participation in balancing responsibilities and enhancing prosumer flexibility adoption.

5.3. Consumer engagement and energy literacy: Bridging knowledge gaps

Consumer engagement remains a significant challenge in transitioning to a flexibility-driven electricity ecosystem. Prior research has established a positive relationship between energy literacy and consumer participation in energy efficiency behaviors, as demonstrated in the Finnish context by [48]. Our findings further align with this, indicating that higher energy literacy increases the likelihood of consumer participation in DSM flexibility programs. However, our analysis suggests that current energy literacy programs are insufficiently adapted to meet the demands of a rapidly evolving electricity ecosystem. A critical limitation in existing programs is the prevailing narrative, which emphasizes thrifty energy consumption while neglecting the operational realities of a flexible grid. This outdated messaging fails to communicate the present reality, where intermittent renewable generation necessitates periodic consumption spikes. Accordingly, there is an urgent need to update the energy literacy initiatives provided by educational institutions such as schools, energy communities, and cooperatives.

Compounding this issue is widespread consumer skepticism toward corporate-driven energy efficiency campaigns, a sentiment also noted by [63]. Our analysis suggests that the roots of this skepticism partly lie in the consumer knowledge gap concerning the changing status quo of the electricity sector. Consumers have internalized the ecosystem's historical assurance of uninterrupted power supply, whereas the current reality calls for the grid to take on a more active role in shaping consumption patterns. The ecosystem is aware of this shift; however, the messaging to end consumers is yet to be adequately adjusted.

This gap is critically essential because PF may not achieve its intended impact if consumers are not informed about concepts such as 'flexibility' and 'congestion' and do not understand their changing roles in the ecosystem. Retailers, as the primary contact points for electricity consumers, are ideally positioned to bridge this gap. They can educate consumers on flexibility's mechanics and tangible benefits by delivering updated energy literacy programs. This approach aligns with recommendations by [60], who emphasize the importance of retailer involvement in promoting flexibility initiatives. Tailored energy literacy campaigns that address the "how" and "why" of energy consumption patterns can demystify key concepts, reduce skepticism, and encourage greater consumer engagement in PF initiatives.

Thus, we propose the following:

Proposition 4. Retailer-led energy literacy programs that explain

flexibility concepts and their tangible benefits can enhance consumer engagement in prosumer flexibility initiatives.

5.4. Policy and regulatory interventions: Addressing structural barriers

Policy and regulatory misalignments remain significant obstacles to the widespread adoption of PF in the Finnish electricity landscape. Our findings emphasize the cost-saving potential of flexibility services in the Finnish distribution network, supporting prior conclusions from [14]. However, despite their potential value, capacity constraints in rural networks pose a substantial barrier to scaling PF solutions. In particular, recent amendments to The Electricity Market Act in Finland have complicated matters by extending the deadlines for DSOs operating outside zoned areas (i.e., rural networks) to meet their network development and investment obligations. Initially set for 2028, this deadline has been pushed back to 2036 [90]. This exacerbates infrastructural delays, creating prolonged hurdles for implementing flexibility services. Moreover, our analysis aligns with [43] observation that low spot prices could lead to grid congestion in such areas and conflicting signals from retailers and the DSOs to prosumers regarding electricity consumption.

Our findings suggest that without targeted improvements to the non-zoned rural grid and more proactive support for flexibility initiatives, such inefficiencies could escalate, potentially involving emerging actors (e.g., aggregators, VPPs). This scenario mirrors broader trends in smart grid technology diffusion, where rapid technology adoption has resulted in operational inefficiencies and grid instability [8].

To address these structural barriers, DSOs must transition from their traditional focus on supply reliability toward more proactive roles in localized flexibility service development. However, our findings reveal a persistent innovation-averse culture among DSOs. This reluctance is evidenced by only a minority of DSOs exploring or piloting flexibility projects despite regulatory incentives such as R&D support and requirements to include flexibility in network development plans [90]. One approach to address this could be to mandate system operators to develop collaborative projects with service-oriented partners. An example of this can be found in Germany, where the SINTEG initiative by the federal government fosters partnerships among various stakeholders, including DSOs, technology, and service providers, to co-create solutions [92].

Thus, we propose the following:

Proposition 5. Targeted capacity-building initiatives, including ICT proficiency and service-oriented skills, can enhance DSOs' ability to integrate prosumer flexibility services effectively.

Proposition 6. Policy frameworks prioritizing grid upgrades and incentivizing prosumer participation can accelerate the adoption of flexibility services, particularly in underserved rural areas.

5.5. Resource integration challenges: Balancing complementarity, redundancy, and asymmetry

Effective RI is crucial for successfully adopting PF within the electricity ecosystem. Our findings reveal key tensions surrounding resource complementarity, redundancy, and asymmetry, which must be addressed to optimize resource utilization. Collaboration across multiple levels—micro (e.g., prosumer-to-prosumer), *meso* (e.g., prosumer-to-retailers), and macro (system-wide) is necessary to facilitate a resource matching process [35,71].

A key challenge arises from resource asymmetry based on actor incumbency in such circumstances. Incumbent actors like system operators, retailers, and energy companies frequently overinvest in conventional capacities like network infrastructure while underperforming in critical areas such as ICT capabilities. Conversely, emerging actors might lack financial resources or established market relationships despite excelling in technological innovation, exemplified by V2G or cloud-based DR services. Resource redundancy further complicates this landscape. For instance, overlapping investments in specific urban infrastructure components may create inefficiencies, while rural areas remain under-resourced and underdeveloped for flexibility integration. However, resource complementarity offers opportunities for collaborative advancement. For instance, while some emerging actors lack invoicing capabilities critical for flexibility service delivery, established retailers possess underutilized infrastructure, such as billing systems, that could be leveraged for PF expansion.

To resolve these tensions, we introduce the concept of resource harmonization, emphasizing the need to bridge gaps between incumbent and emerging actors. Resource harmonization focuses on balancing resource availability across the ecosystem, nurturing collaboration, and enhancing the operationalization of PF (Fig. 5). Although classifying actors by incumbency is familiar in the electricity sector (c.f., [93]), the novelty of our research lies in focusing on RI dynamics during early-stage technology adoption. Resource harmonization encourages collaborative business models and shared technological platforms by addressing redundancy and complementarity, reducing asymmetry across ecosystem actors. This approach paves the way for greater value co-creation.

We further propose the following,

Proposition 7. Resource harmonization through collaborative initiatives and innovative business models can enable value co-creation and enhance the operationalization of prosumer flexibility.

6. Conclusion

While the value of flexibility is uniformly anticipated to rise, our findings indicate varied levels of preparedness in the Finnish electricity ecosystem. This discrepancy is particularly evident when integrating flexibility services closer to grid endpoints, home to prosumers. However, PF's significance resonates throughout the ecosystem, highlighting the value chain's interconnected and often delicate nature among ecosystem actors (e.g., as discussed in [29,32,33]). Although specific studies have identified PF's potential in enabling customer engagement with the energy infrastructure (c.f., [5,17]), comprehensive exploration remains in its infancy. This literature gap becomes noticeable when examining the value co-creation potential of distributed flexibility. Addressing this, our study explored the resource integration aspect of value co-creation in the Finnish electricity ecosystem through the prism of PF. To achieve this, we conducted an exploratory single-case study and identified key actors and their resource attributes concerning this technology, leading to several important contributions.

6.1. Theoretical contribution

This study contributes to the energy prosumption literature by incorporating SDL as a framework to conceptualize electricity consumers as active participants in value co-creation. By emphasizing the shift from passive consumption to active engagement, this paper lays the groundwork for more dynamic and interactive energy markets, challenging traditional consumer roles and enabling innovation and adaptability in business models within the energy sector. Our paper is among the first to apply the value co-creation framework to the PF literature and, to our knowledge, the first to incorporate SDL into this domain.

Additionally, we extend SDL literature by examining resource matching within an interdependent ecosystem undergoing early-stage innovation diffusion. SDL research has predominantly focused on the interaction side of resource matching- such as dialog, learning, and resource transfer (c.f., [66]) our findings extend this perspective by examining resource alignment within an evolving ecosystem. Specifically, we align with [37], who identify resource matching as a necessary precursor to RI rather than a simultaneous process (c.f., [39]). We observe notable resource differences based on actor incumbency and term the subsequent matching process 'resource harmonization',

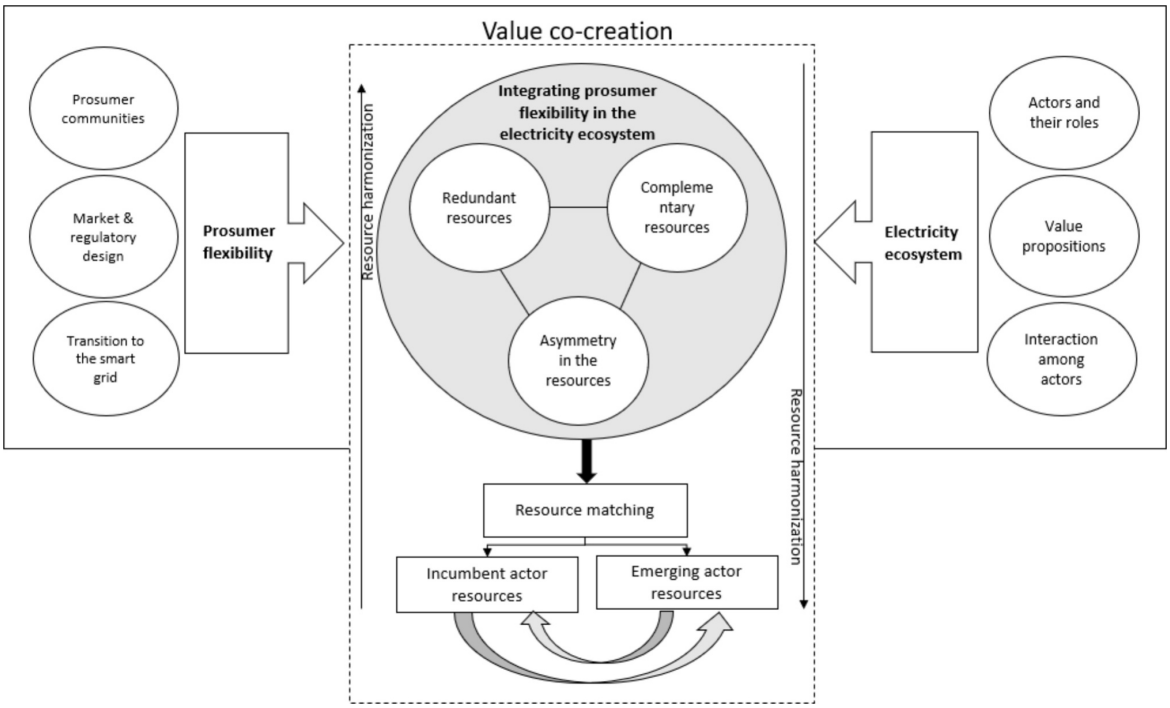

Fig. 5. Modified theoretical framework.

providing a nuanced understanding of how different actors align their resources to collectively co-create value.

Building on these insights, our study integrates multiple dimensions of PF development and ecosystem characteristics into a cohesive, actionable model, visually represented in Fig. 5. This approach addresses critiques by [34], who observed that prosumer literature often narrows on system optimization and transaction design, overlooking actor roles and the necessity for adaptive business models.

6.2. Practical implications

Our study offers several important insights for practitioners and policymakers within the energy sector. For practitioners, the resource harmonization framework is valuable for identifying and leveraging stakeholder synergies. For instance, our findings highlight how the lack of invoicing capabilities among new market entrants hinders PF implementation despite the availability of underutilized invoicing infrastructure within established retailers—offering a clear avenue for value co-creation. Similarly, addressing residential consumers' lack of domain awareness presents another opportunity. Retailer-led energy literacy campaigns can play a pivotal role in bridging this gap, using digital communication tools such as mobile applications to reach a wider audience effectively. Fig. 6 visually illustrates these dynamics. We believe the application of this framework extends well beyond PF and could offer valuable insights into RI dynamics within the broader energy sector.

Moreover, for policymakers our findings emphasize the need for targeted interventions addressing several structural barriers. First, energy literacy programs must evolve to reflect the realities of a flexibility-driven energy system. Collaborative efforts among educational institutions, energy communities, and retailers should deliver updated, context-specific initiatives that explain the role of consumer behavior in grid stability and environmental outcomes while emphasizing practical benefits like EV charging optimization and storage-integrated PV systems. Second, policies should incentivize DSOs to adopt a more proactive role in flexibility service development. Capacity-building initiatives targeting ICT proficiency and service-oriented skills are essential to enable DSOs to manage flexibility solutions effectively. Mandating DSOs to collaborate with service-oriented partners, as seen in Germany's SINTEG initiative, could further accelerate innovation and ecosystem-wide integration. Finally, recent amendments to The Electricity Market Act in Finland explicitly extended the deadline for rural DSO infrastructure development risk, prolonging bottlenecks in non-zoned rural areas. Policies must prioritize grid upgrades in these underserved regions and incentivize DSOs to proactively integrate flexibility solutions into their network development plans.

6.3. Limitations and future research

As an early contribution to an emerging research area, our study has certain limitations that can pave the way for subsequent investigations in this critical domain. First, our research does not include a flexible platform from the Finnish electricity ecosystem. While flexibility platforms are crucial for advancing PF, no commercial platforms are available in the Finnish market. To address this, we have incorporated data from six European flexibility platforms. This approach assumes that relatable market conditions, including regulations and operational environments, allow us to draw informed comparisons. Future studies could fill this research gap by including insights from a local flexibility platform when it becomes available in Finland.

Second, our study focuses on prosumer communities rather than individual prosumers as the primary analysis unit. This approach might result in missing out on the nuances of individual behaviors and preferences, especially if community representatives hold biased views. Additionally, this study does not distinguish between homeowners and tenants within the prosumer category. Considering the implications of this distinction, particularly in contexts where access to flexibility solutions may vary, future research could explore these dynamics more comprehensively.

Third, our interview data from the Finnish ecosystem seems to lean

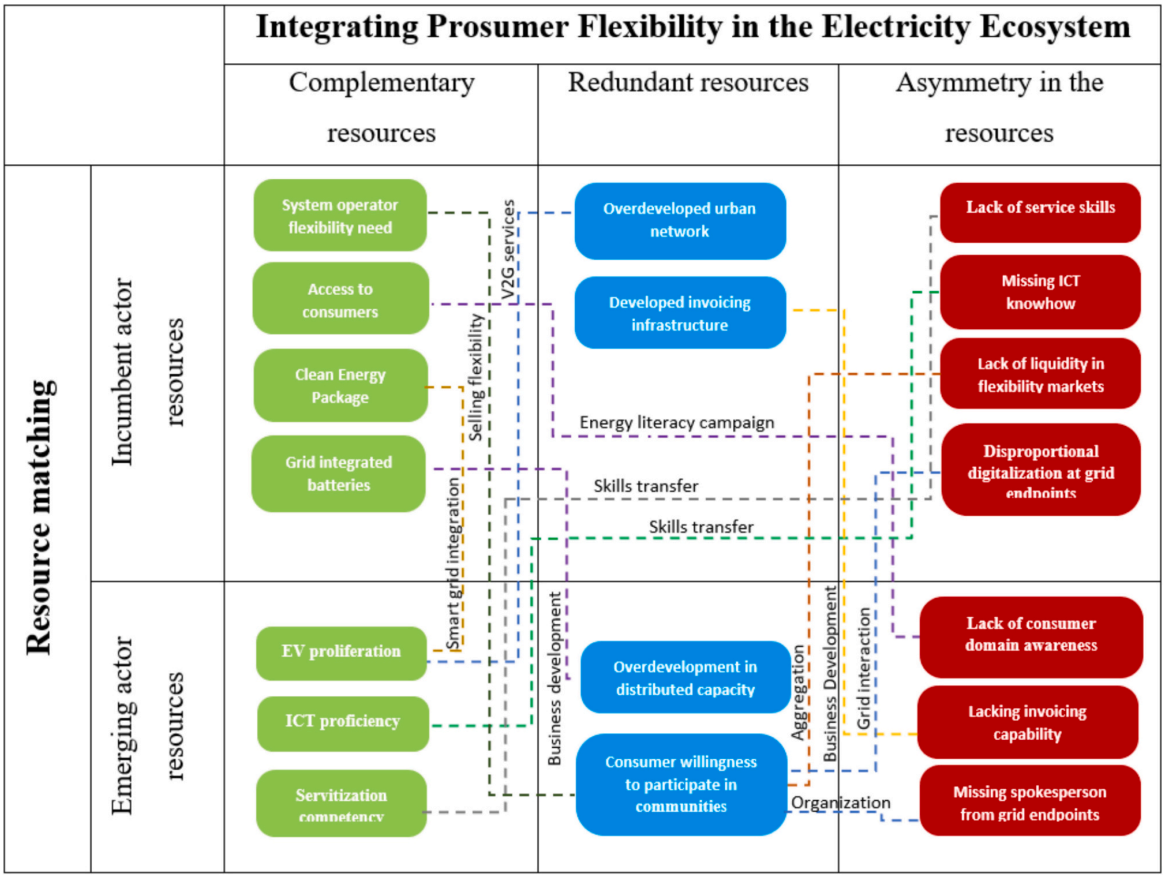

Fig. 6. Examples of value co-creation through resource harmonization.

toward incumbent actors, at least in quantity. Even though we tried to ensure that the managers interviewed from incumbents had experience in demand-side flexibility projects, this could still introduce certain biases into our analysis. Future investigations can go deeper into the perspectives of emerging actors, with particular emphasis on individual prosumers engaged in flexibility programs. Furthermore, while our study broadly conceptualizes DSM to include both operator-driven and actor-driven initiatives, comparative research focusing on these distinct dimensions of DSM-enabled PF could offer valuable insights.

Lastly, we believe conducting a multiple-case study as confirmatory research on our proposed resource harmonization framework would be worthwhile. This could ensure a detailed examination of variations across different contexts, enhance the generalizability of our findings, and offer deeper insights into effective implementation strategies in diverse regulatory and market environments.

CRediT authorship contribution statement

Nayeem Rahman: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Rodrigo Rabetino:** Writing – review & editing, Supervision, Methodology. **Arto Rajala:** Supervision, Funding acquisition. **Hannu Makkonen:** Writing – review & editing, Conceptualization.

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.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apenergy.2025.125814.

Appendix B. Interview Guide.

General Questions for All Actors

1. How feasible is implementing prosumer flexibility (PF) in Finnish energy sector, considering market readiness, stakeholder willingness, technical preparedness, and financial transaction mechanisms?
2. What are the three biggest barriers to implementing PF in Finland?
3. What benefits do you foresee from a local demand-side flexibility market?

TSO-Specific Questions

1. What are the most critical features needed in a flexibility marketplace from a TSO perspective?
2. How should TSOs and DSOs collaborate to facilitate flexibility services effectively?
3. What mechanisms could ensure effective coordination of flexibility resources across multiple stakeholders?

DSO-Specific Questions

1. How do you decide between grid reinforcement and flexibility solutions in network planning?
2. What pricing mechanisms would work best for flexibility services in your operations?
3. How should DSOs screen and select flexibility service providers to ensure reliability?

Retailer-Specific Questions

1. How does PF influence your retail strategies and interactions with consumers?
2. How should risks and responsibilities between retailers and aggregators be distributed?
3. What role can retailers play in bridging consumer knowledge gaps about flexibility and its benefits?

Regulator-Specific Questions

1. What regulatory changes are required to enable DER participation in ancillary services in Finland?
2. How can regulations better support smaller prosumers/consumers to overcome participation barriers, such as the 100 kW limit?
3. What steps is Finland taking to align with the EU Clean Energy Package (CEP) and Guideline on Electricity Balancing (EBGL)?
4. How can free-riding in balancing responsibilities be avoided when customers sign contracts with multiple providers?

BRP-Specific Questions

1. How can demand-side resources improve portfolio optimization and passive balancing?
2. Should licenses be issued to third parties for trading flexibility, and what safeguards would be needed?
3. What is the impact of Finland's Datahub on BRP operations, and how could it facilitate flexibility?

Aggregator-Specific Questions

1. What challenges do aggregators face in organizing and integrating prosumers into the current system?
2. How should aggregators manage a diverse consumer composition (e.g., households vs. industrial participants)?
3. How does Finland's Datahub impact aggregator operations, and how can it be optimized for flexibility services?

Energy Community-Specific Questions

1. What incentives and motivations drive energy communities' members to participate in PF programs?
2. Are members willing to engage in peer-to-peer energy trading, and what tools or platforms would facilitate this?
3. Would your members be interested in trading energy with neighbors? How would they feel about real-time energy monitoring?
4. What are the key challenges for energy communities in adopting PF practices, and how can these be mitigated?
5. Are there any concerns about current energy consumption habits within your community? What potential areas for reduction do you see?

Flexibility Platform Operator-Specific Questions

1. What flexibility products or services do you currently offer? Could you describe their adoption and reception?
2. What is your pricing model for flexibility services? How do you screen stakeholders and establish contracts?

3. How do you ensure data security and privacy for stakeholders using your platform?
4. What are the main challenges you face in the Finnish energy ecosystem? Are there specific regulatory barriers or conflicts between grid reinforcement and flexibility deployment?
5. What role do you see energy communities playing in the development of prosumer flexibility? How are they integrated into your platform?

Appendix C. Example data analysis process.

Illustrative participant quotes	Content analysis and the resulting codes	First-order concepts from pattern identification	Second-order themes (theoretically informed)	Theoretical aggregate dimensions (final abstractions)
"We concentrated on electrical heating because the possibilities for flexibility are the best when you have electrical heating. You have a boiler where you heat your water, and then you have radiators or (roof) heating or whatever, floor heating, which you can also adjust" (E5)	Electrification of heating; load control; flexibility potential	Households with electric heating are better targets for prosumption	Nurturing prosumer communities	Prosumer flexibility
"First, you need to have something that uses electricity or produces it, like a boiler or floor heating, for example. There are service providers who offer smart boxes or something to your boiler, and they can control it. But, if you have oil-heating, then there is nothing you can do." (E1)	Electrification of heating; smart boxes; load adjustability			
"Flexibility is part of the solution because there is a lot of discussion about sector integration. In Finland, a lot has been done to use the flexibility of heating to give more flexibility to the electrical grid. As heating gets more electrified, there will be more flexibility for the grid." (E18)	Electrification of heating; sector integration; flexibility potential	The value of flexibility is increasing due to the variable generation and baseload nuclear energy	Emerging value propositions	Electricity ecosystem
"Regarding the Finish electricity production system, we are heading toward more nuclear in the mix because of Olkiluoto. But, the property of nuclear energy is that it is not very adjustable; you always push it with full power. So the base power runs steadily through the year, and it is everything else but flexible, and then we will have more and more wind power. And we know the problem: you get the power when the wind wants to produce it." (E5)	Nuclear baseload; Renewable variability; inflexibility of production			
"If we have more electricity systems based on variable renewable generation or solar… Then, the consumption patterns typically do not match. Traditionally, we have a fixed consumption pattern, and the power generation pattern matches that consumption… If you go into the future, you will have an unpredictable production pattern, and consumption should match that. And this is then, of course, a challenge. I would say consumption has a huge role because you have the seasonality (wind), seasonality (– sun), and sometimes the not-so-windy times can take several days or weeks." (E7)	Renewable variability, consumption mismatch, seasonality			
"In fact, the more renewable sources in the network, the energy will be less of a problem because there will be more and more energy produced, but flexibility will be key to the market. Especially if you want to get rid of natural gas from the system, which is the primary source for flexibility now." (P5)	Renewable energy; flexibility market; reducing natural gas reliance			
"At the beginning of local flexibility markets, there might not be enough demand and, then we are thinking that maybe we [the TSO] need to be the market makers and doing some buying." (E1)	TSO, as a market maker	TSO's demand for flexibility can make it the initial market maker	Complementary resources	Resource integration, Value co-creation
"And this flexibility as such, of course, who needs flexibility is [the TSO]. They need to balance the Finnish power system. So, they need to purchase flexibility from others because they do not have any capacity. So there is a natural buyer of flexibility, and then everybody else is more or less seller." (E7)	TSO as market maker; system balancing; market roles			

Data availability

The data that has been used is confidential.

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