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Dynamic Capabilities in Electrical Energy Digitalization: A Case from the Norwegian Ecosystem

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Abstract: This paper aims to identify the dynamic capabilities required for electrical energy service providers to transform toward a digital and platform-based business models in the context of the current energy transition. The paper contributes to two fields: Information systems in the domain of platforms ecosystems and digital services innovation through the usage of dynamic capabilities theoretical lens and the field of energy informatics in the domain of digital business models and service innovation. Through the case study approach we investigate the case of Norwegian electrical energy provider TrønderEnergi and how the company is moving toward a fully digital business model and how the company build the dynamic capabilities required for the digitalization era. Through semi-structured interviews, the study managed to identify several activities related to each capability and then classified these activities under three main activities, which are: sensing, seizing, and transforming, and then classified them into sub-capabilities and identified activities related to each sup capability. The paper concludes with managerial implications for practitioners and initiates an empirical extension for the dynamic capabilities theoretical lens.

Keywords: digitalization; dynamic capabilities; distributed renewable resources; digital ecosystems

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1. Introduction

The electric energy ecosystem is changing. The changes include integrating remotely distributed renewable resources (DRR), such as wind turbines and solar power farms, transforming the grid smarter to react and adapt to changes and increasing customer engagement and centricity. These changes of the power system have revolutionary impacts, which can only be tackled if it is digitized, so digitalization of the power system is of critical and important concern [1].

Digital platforms became a phenomenon among electrical energy service providers. Dynamic capabilities play a role in such a transition toward delivering decentralized electrical energy services [2]. Dynamic capabilities are defined as the organizational ability to integrate, build, and reconfigure internal and external competencies and resources to interact with a rapidly changing ecosystem and industry [3]. Digitalization is grounded in lowering the operating costs of the firms.

In context of electrical energy services, the transition into digital and platform based business model opens the arena for new players to enter the energy ecosystem. To succeed in such a competitive market and ecosystem, one needs to be market-aware and dynamic and be able to deal with ecosystem changes and market dynamics. This may be harder for incumbents than for new and "young" providers whose products and services are built to be fully digital from the start [4]. Another perspective in an energy marketplace is that digitalization, meaning the ability to adjust to the new digitalized world with its

cybersecurity challenges and the increased inter-dependencies between IT and Operational Technology (OT), will disrupt the market [4].

The current energy transition is driven by five main forces which are : Digitalization, Decentralization, Decarbonization, Democratization and Deregulation [5]. (Digitalization) means move toward digital platform business model in order to provide innovative services. Such transition will allow to utilize and connect distributed energy resources through platforms; as a result this will help in achieving (Decentralization) and provide the electricity for every one (Democratization), this will lead to restructuring the existing market model and remove the monopolies control over the electrical energy sector and allows for more competition between the participants to buy and sell electricity by permitting market participants to invest in solar power farms and distribution lines. Generation owners then sell this wholesale electricity to retail suppliers (Deregulation), as a result, this transition will help in reducing the harmful emissions (Decarbonization). One major milestone of this transition is those service providers in the energy sector are moving toward decentralized, digitalized, and platform-based business models.

The recent energy transition aims to achieve the above mentioned 5 D's through the utilization of CPS (cyber-physical systems), data science, ML (Machine Learning), IoT (Internet of Things), and DLT (Distributed Ledger Technologies). Understanding how and under what conditions electrical energy services providers are creating and capturing value is of high priority and still an unanswered question. From this point, this paper investigates how digitalization and platformization reshape value creation in the context of the Norwegian electrical energy digital value chain from dynamic capabilities theoretical lens.

In the context of the current energy transition, different business models, such as Smart Energy Service Providers, smart grids, and Virtual Power Plants, started to exist. A study by Palmie et al. [6] proved that startups more adopt these models than incumbents. This observation indicates that startups are putting more effort into digitization than incumbents. As a result, energy service providers are working toward adopting such business models with highly complex value creation and delivery structures.

The core motivation of this paper rest on the context of the current energy transition, where the digital ecosystem becomes more complex due to the increasing number of prosumers and distributed energy resources (DERs). Also, platform owners and marketplace operators must manage and govern their platforms ecosystems carefully [7]. Also, platform owners seek to attract entire ecosystem actors to their platform, which is capable of serving a complex value chain. In line with SDG (Sustainable Development Goal) seven [8], increased cooperation and the sharing of best practices are accelerating the transformation of the world's energy systems, which has already begun. These factors include technological advancements, rapid cost reductions, strategic shifts in policies, regulatory frameworks, investments, new business models, and strategic shifts in business models. A resilient ecosystem of digital platforms is necessary for this shift.

Another core motivation is The tactics energy companies use to succeed in markets with quickly evolving technological, social, and market settings while others fail is another fundamental driving force. The utilization of dynamic capabilities will help explain this phenomenon per the proposed research directions in our previously published work Idries et al. [7].

This section has attempted to provide a brief introduction of the topic and introduced the motivation for this study and what this study intends to do. The remainder of this paper is structured as follows: the "Background" section introduces the main definitions related to this paper. The "Research Design and Method" section presents the methodology adopted for this paper, "Case Background" presents the company background and the digitalization nature within the firm, the "Dynamic Capabilities in Energy Digitalization" section presents the findings of this paper and presents the practices associated with each dynamic capability and their activities, the "Discussion" section provides a discussion of the findings and how they're related to the main research questions (RQ's), and finally, the

"Conclusion" section concludes the findings of this study and its shortcomings. The section below describes the relevant background, and main terminologies used in this paper and highlights the proposed research questions.

2. Background

2.1. Transition Toward Service Platforms Model in Electrical Energy Services

Constantinides et al. [9], and Ardolino et al. [10] defined digital platforms as a collection of digital assets, such as services and contents, that allow for the generation of value and interactivity between prosumers and consumers on the outside. Additionally, digital platforms could be described as an extendable code base that allows for the addition of complementary third-party modules [9,11,12].

The main goal behind any service platform is combining all services and products together, which generates improved efficiency and cost reduction. Additionally, this can help the service become more concrete and understandable. From Ardolino et al. [10], Using modular elements and components that are used to create a variety of various types of services is what is meant by the term "service platform", which refers to a method of reducing complexity. Most service platforms use a multi-sided approach, in which the platform acts as an intermediary to bring various players and actors to the platform and encourage them to contribute by providing their services and goods, which provide value to the service provider. Also, service platforms support the continuous liberalization of the market regulations (deregulation) [13]. According to Xu et al. [13], service platforms in the electrical energy field has four main archetypes, which are: Load balancing services, centralized utility model, and distinguished retailer model (flexibility).

Decentralization in market and service platforms is made possible by disruptive technologies like ML (Machine Learning), IoT (Internet of Things), and AI by eliminating conflicts of interest and delivering information parity to all platform users, which results in affordable transactions. All of the aforementioned technologies are necessary for decentralization to be accomplished. Another unique characteristic of platforms that emphasizes this is that they heavily rely on digitization; specifically, they collect, transmit, and sell data through internet connectivity. Thus, a software engine is a foundation of many profitable platform-based and digital business models [14].

The properties of electrical energy digitization have been extensively discussed by authors. According to Richter et al. [15], energy service is smart, for instance, if the power management mechanism and energy device management employ a particular algorithm and if there is a communication protocol or method between grids and devices. Consumers are now more likely to accept electricity contracts through microgrids because of recent changes to EU energy legislation. A development like this offers service platforms a great chance to expand. The disconnect between technology and the level of consumer or customer interaction necessary, however, is another barrier. Various factors, including the significant movement in the electrical energy sector toward decarbonization and digitization, have made service innovation and service platforms a "game-changer" for the stakeholders along the electrical energy value chain [16].

According to Adil and Ko [17], there are three different ways that energy decentralization can be implemented: distributed generation, micro-grids, and smart micro-grids. Additionally, Thomas et al. [18] cited the energy system as a group of many networks, sources, and accountable parties, as well as the related physical and information, flows. With more information available and programmable components present, it is predicted that the complexity of energy networks will rise. This will result in the construction of new information interfaces coupled with decentralization of responsibilities, or it will need current interfaces to handle more information [18].

In the domain of energy, platformization's main purpose is to facilitate information interchange between physical facilities and all other market participants and stakeholders [19–21]. The problem is the absence of an accessible, inter-operable data exchange interface that satisfies the needs of all system stakeholders. These stakeholders include

aggregators, microgrid operators, and system operators in the electrical energy industry. The integration of energy distribution systems, smart metering technologies, real-time monitoring technologies, and adaptive controlling mechanisms is what Wang et al. [21] termed as the energy internet. Energy internet facilitates access to distributed energy storage systems and large-scale distributed generation. While the smart grid is managed by a regional system, the energy internet focuses primarily on various distributed energy resource types (mostly renewable and environmentally favorable resources). Wang et al. [21] compared the energy internet and the smart grid in terms of architecture, centralization, and communication methods. As a result, the decentralization process is facilitated by the energy internet.

Yuan et al. [22] conducted preliminary research on energy trading platforms by examining the function of big data in an AI- and machine learning-based power trading platform. The authors suggested a platform that would distribute goods and services using microservices and Blockchain technology. They talked about how big data controls stakeholders in terms of their profiles and relationships as well as how it does demand and supply forecasts on electricity trading platforms. These are platform-specific historical, behavioral, and categorization data. Data serve many other important purposes besides those that were just listed. In order to fully comprehend the relationships between the parties, it also examines power trading processes. Furthermore, the literature on energy informatics and information systems must take into account the real-world practices associated with the platformization and digitalization of the electrical energy services industry.

2.2. Dynamic Capabilities in Information Systems and Strategic Management

Research on dynamic capacities has become a key area of study in the literature on information systems (IS) and strategic management.

In contrast to digitalization, which uses digital technologies to alter current business processes to increase productivity and add value, digitization is the act of converting analog data into digital format [23].

According to Witschel et al. [24], the ability of a company to integrate, develop, and reconfigure internal and external competencies to address quickly changing surroundings is known as dynamic capabilities. In light of path dependencies and market positioning, dynamic skills thus reflect an organization's capacity to develop novel and creative kinds of competitive advantage. Firms need a dynamic system of capabilities to manage resources and adapt their business models. It serves as a bridge between business models and strategies. The constant and balanced availability of thousands of loosely-coupled actors who provide access to thousands of readily-accessible small resource sets is necessary for value co-creation on digital platforms [11]. Digital transforming capabilities are microfoundations that relate to (1) traversing innovative ecosystems, (2) redesigning internal structures, and (3) enhancing digital maturity in the context of digitalization and digital transformation [25].

The company's technical capabilities must meet high demands as it transitions to platform-based business models. Established businesses are required to develop capabilities, repurpose existing capabilities, and effectively deploy them since digital business models call for specific and novel knowledge of digital technologies and IT skills for the majority of enterprises [24].

The required abilities can differ significantly depending on the architecture of the business model and the underlying technologies. For instance, a digital and platform-based model requires different abilities than a traditional business model. Previous studies have outlined a variety of best practices that businesses can use to respond with the right actions. This makes a few technological activities very pertinent. Therefore, it's crucial to ensure data protection compliance, IT security, and the creation of a user-friendly interface. In order to achieve high expandability and scalability, it is also crucial to create platform-based business models [24].

According to Warner and Wäger [25], three interrelated capabilities of customer agility (e.g., co-creating user experiences), partnering agility (e.g., orchestrating an ecosystem of external partners), and operational agility (e.g., achieving speed, accuracy, and cost efficiency) should be developed by businesses using information technology (IT) infrastructures in order to improve financial performance. Because of this, established businesses in the present energy transition are required to create or join a digital ecosystem in order to collaborate with new partners on "co-creation" and "coopetition" activities that help redefine the speed of collaborative behaviors and develop new business models.

Dynamic capabilities are structured into three main capabilities, namely: Sensing, Seizing opportunities and managing threats (transforming). According to Teece [26], sensing capability evolves activities related to getting insights about current research and development activities in the market, firm capabilities to learn, filter, and calibrate opportunities. Seizing indicates the capability of seizing new business opportunities. Sensing opportunities involves maintaining and improving technological abilities and assets and investing in that (Ex.startups) to achieve market acceptance [26,27]. In addition, in the context of digitalization and technological disruption, it is clear that investing in new technologies and startups requires multidisciplinary skills. According to Teece [26], seizing activities evolves enterprise restructuring and end users' involvement in different activities such as products testing and implementing strategies to capture and create values. The third main capability is transforming and managing market and industry threats. Teece [26] defines the transformation capability as the capability to reconfigure the resource base. In addition, transformation evolves and involves activities related to organizational alignment, governance, and strategy-related activities (Ex. sustainable development of competence and practices). Moreover, dynamic capabilities are influenced by many drivers. For example, the sensing capability is more driven by an entrepreneurial mindset, while seizing and transforming are driven by a managerial mindset [24,26], and this appears more in the type of activities conducted and performed under each capability.

Dynamic capabilities, which include competencies to (1) sense and evaluate opportunities and threats; (2) seize opportunities, mitigate threats, and capture value from doing so; and (3) transform and reconfigure a firm's tangible and intangible assets to remain competitive, govern how a firm's ordinary capabilities (e.g., effective marketing tactics, efficient manufacturing processes) are developed, augmented, and combined [28]. Therefore, in the context of electrical energy services, dynamic capabilities can help energy service providers remain competitive in an era of digitalization and rising ecosystem innovation.

In our previously published work, Idries et al. [7], the authors have discussed the digitalization and platformization challenges in context of electrical energy services. Since this knowledge is largely dispersed, systematizing the difficulties can help direct digitalization in this context.

According to Teece [29], Figure 1 presents the structure and explanation of the dynamic capabilities. In light of the current energy transition driven by digitalization, this study examines an industry that is traditionally monopolized and controlled by incumbents. Firms need certain dynamic capacities (DC) to be able to successfully respond to changing market conditions with organizational and strategic measures in such a dynamic business and transition where disruptive technology leaps have become prevalent. The DCV (dynamic capabilities view), which refers to the idea of sustainable competitiveness, asserts that the existence of DCs has a significant impact on how successfully particular enterprises can adjust in dynamic times [29]. From this vantage point, the DC offers an explanation for the disparate success of businesses in the digital [30,31].

Overall, this research draws on, integrates into, and extends digitalization research on electrical energy services. We specifically study the digitalization and platformization of renewable electrical energy services using dynamic capabilities as a theoretical lens. To answer the research question

RQ1: How the electrical energy firms build capabilities in context of transition toward digital and platform-based business models?

RQ2: What are the capabilities required for electrical energy firms in the context of digitalization?

Given the practical and scholarly relevance of this topic, this study investigates how service providers and organizations develop and implement digital business models from a dynamic capabilities theoretical lens and how these digital business models and digital platforms ecosystems need to evolve to survive.

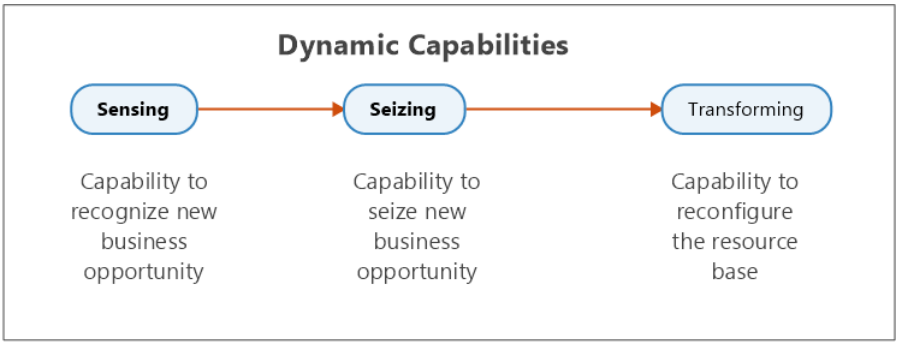

Figure 1. The structure of dynamic capabilities.

3. Research Design and Methodology

3.1. Research Design

Positioned at the intersection between digital platforms ecosystems literature, dynamic capabilities, and energy informatics (see Figure 2). We identified research priorities in this emerging domain in our previous work, Idries et al. [7], from which contributions to existing IS literature can emerge. Capabilities for electrical energy digital platform is poorly understood? in the context of IS and energy informatics. As a result, we use an exploratory case study research design guided and informed by Mathiassen et al. [32], Blaschke et al. [11], Teece. [29], West et al. [33] and Lahiri et al. [2] to study electrical energy services platforms in a real-life situation through in-depth data collection.

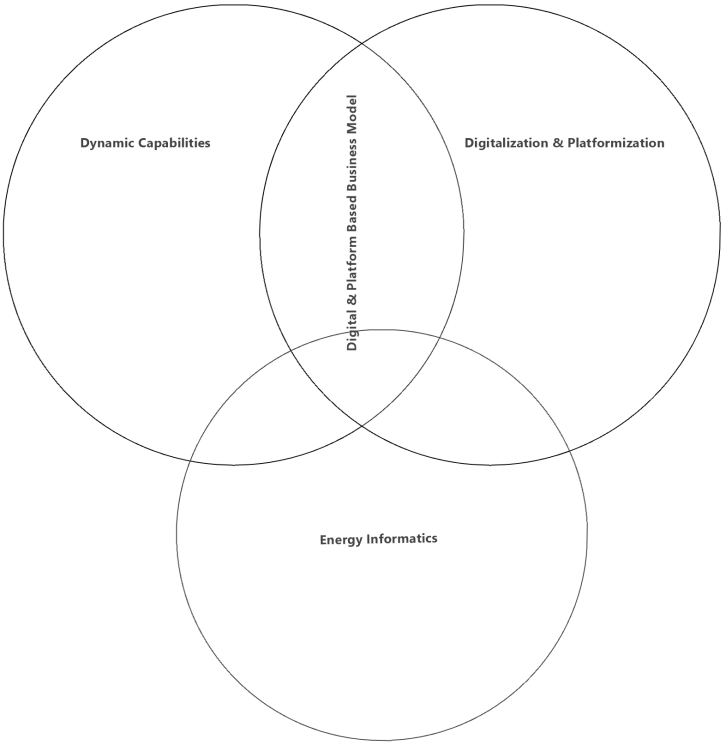

Figure 2. Research Position.

The research design addresses the pressing problem of transition into a digital platform model within the context of electrical energy service providers. Dynamic capabilities are essential to the sustainability and well-being of the platform ecosystem in the context of electrical energy service. this is ongoing research on assessing and theorizing the sustainability of electrical energy service platforms.

There is a need for electrical energy services providers and policy practitioners to understand how the digital ecosystem design affect their business efficiency. One can use SD-L (Service Dominant Logic) and DC (Dynamic capabilities) theories to understand the ecosystems. However, dynamic capabilities are poorly understood in context of energy services platformization and decentralization [2]. Furthermore, because of the varied and current nature of the area of platforms ecosystems studies [11,12], and particularly in the context of the electrical energy transition, building a theoretical framework and proposing assumptions upfront is difficult. As a result, we choose an exploratory case study research approach to investigate an energy service platform in its real-world setting using recursive, iterative data gathering and analysis to yield exploratory insights.

Informed by Yin [34] and Winter and Szulanski [35], we focused on sample selection based on (a) Norwegian context of renewable energy and established firms in Norway, (b) across the electrical energy value chain context, and (c) successful adoption of new digital business models, where a digital business model is defined as "a business model that uses digital technologies and data to create, deliver, and capture value" [36].

Because of the subject's novelty, industry dynamism, and business criticality, as well as the tiny underlying population, we originally picked several stakeholders (N = 3) from the Norwegian electrical energy value chain and ecosystem that met the required selection criteria. After prioritizing based on the adequacy of their implemented business model, the firm's reputation, and the level of maturity in terms of digitization and innovation, one was recognized as appropriate for this study, and one company (N = 1) participated in the study. Also, to understand the nature of digitalization and business model in the electrical energy context, we interviewed an expert from the national TSO (Transmission Service Operator), which has an incumbent nature. Table 1, presents details about the company in the case study. The chosen company has effectively built a new digital business model and is today regarded as one of the country's most creative renewable energy enterprises. Since the firm was founded a long time ago, it has a lengthy history of stability as well as versatility and adaptation to changing market demands.

Table 1. Business Model Characteristics.

Company Name	Employees	Revenue (Euros M)	Industry/Role in Value Chain	Type of Business Model Change	Strategic Intention	Business Model Description
TrønderEnergi	400	150	Renewable Energy Producer, Grid Operator and Distribution Systems Operator	Innovation and Adaptation	Better managing of uncertainty can lead to better bids and increased trading autonomy. Multiple renewable resources should be combined, and appropriate trading techniques should be devised, to achieve the final aim of maximizing profit and stability. Predictive maintenance for wind farms and hydroelectric plants using transfer learning and hybrid AI.	Digital Business model includes an AI-driven platform. Digital Capabilities driven by AI capabilities

3.2. Data Source and Process of Data Collection

We performed five semi-structured interviews with domain experts, executives, and senior managers from the organization as the major data source. We interviewed those involved in strategy, technology, and business development to gather credibility and varied perspectives (i.e., business and technical perspectives). Obtaining insights from specialists with complementary roles and duties not only avoids information bias but also allows

for distinguishing details from many viewpoints and mapping the whole development process [34]. Getting and obtaining information and insights from influential experts allowed us to get views and details from different perspectives managerial, technologically, and strategically [37]. Also, we gathered technical and relevant documents from the industry about the digitalization of renewable energy (N = 5).

The interview guideline was informed by Yin [34] to ensure the results' credibility and reliability. The introduction part addressed background issues such as the expert's work history, organizational information, a description of the current employment position and duties, and the relationship between the present role and digitalization. The second part deals with the organizational characteristics and how the organization benefits from such transformation/transition. The third part of the interview deals with platformization characteristics and the process of business model change from a dynamic-capability view. Informed by the Teece [29] framework, questions concerning the dimensions of sensing, seizing, and transforming were framed while also addressing the transformation development process. Sensing examines the search and identification process, seizing examines the development process and converting addresses the digital transformation of the business model and organizational rejuvenation. Furthermore, the debate is primarily focused on the essential critical competencies and underlying activities and mechanisms, as well as related influencing variables and problems associated with digitalization and platformization in this context. Table 2 summarizes the sources and use of data. Figure 3 summarizes our data collection process.

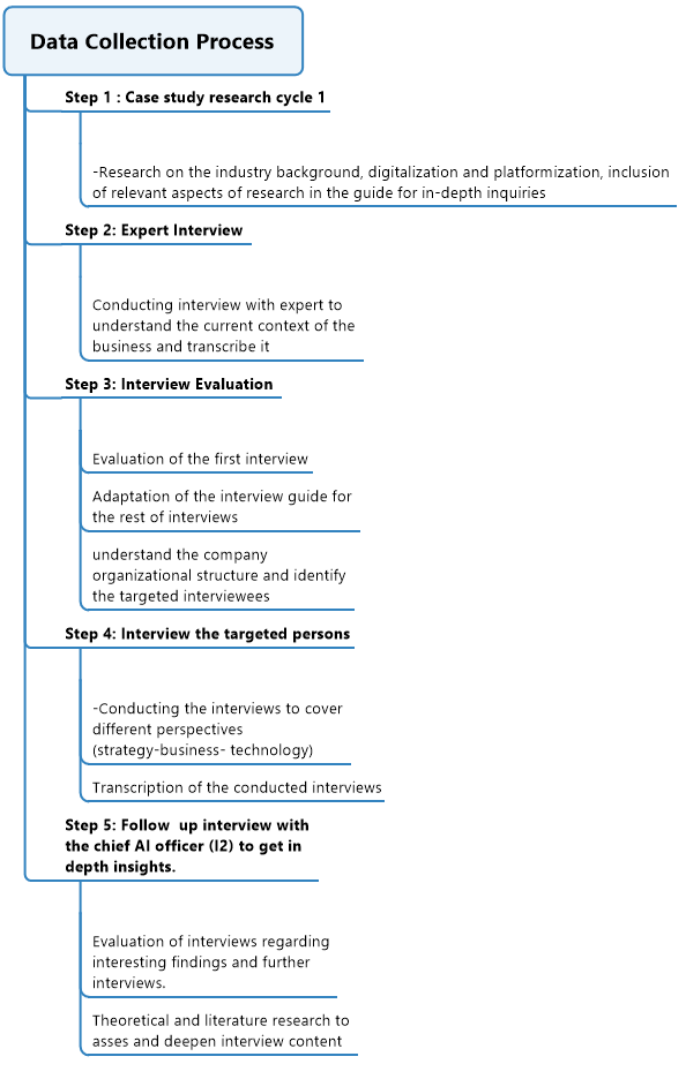

Figure 3. Data Collection Process.

Table 2. Data Source.

Interviewee	Position	Experience (Years)	Interview Length (Minutes)	Secondary Data Source	Comments
I1	Expert, Senior Adviser System operation and Market development	15	replied through email	Internal reports (N = 7)	
I2	Chief AI Officer	15	92		2 follow up interviews
I3	Chief Digitalization Officer/ Head of Digitalization and IT	22	50		
I4	Head of Energy Markets and Services	16	40		

We also collected secondary data in the form of industrial data, such as annual reports, released news articles, websites, and presentations from expert interviews, to gain a more thorough and deep knowledge of industry-specific elements and firm-specific characteristics. Finally, we triangulated our data with public data, such as media stories, press articles, websites, and management literature, to better understand the industry and firm-specific dynamism.

3.3. Data Analysis

The interpretation of qualitative data is generally required. This suggests that the evidence necessitates many interpretations [38]. This is due to the fact that large volumes of qualitative evidence are frequently gathered. Informed and directed by Ven [39] and Oates [40], we used the theme analysis technique [41,42]. Thematic Analysis is thought to be the best choice for any study that attempts to uncover via interpretations. It adds a methodical component to data analysis. It enables the researcher to correlate a frequency analysis of a topic with the entire text. This will increase the research's accuracy, complexity, and overall meaning. Understanding and collecting varied features and data are required for qualitative research. Thematic Analysis allows you to comprehend better the possibilities of any situation [38].

Thus, against the backdrop of limited prior knowledge in the field of digitalization and platformization research from the dynamic capability lens in general, and in search of new insights related to distinct capabilities activities and contingencies relevant in the renewable energy and digitalization context, we found a reason to justify the use of thematic analysis in our work. We followed their four-step data analysis procedure:

1. Preparation:
   In the preparation step, we derived the themes based on the original conceptual DC framework by Teece [29] and Witschel et al. [24]. We clustered the themes/categories based on the identified DC's by Teece [29,43]; these main DC's were: sensing, seizing, and transforming. In addition, we imported the transcribed video interviews and additional documents into NVIVO, a computer-aided software for qualitative data analysis.
2. Extraction and Analysis:
   We analyzed the data material of the interviews one by one. We discussed the emerging findings and how the organizations interact with the transition. From the interviews, we identified the activities related to dynamic capabilities. Also, we used the activities (sensing, seizing, and transforming) as main units of analysis Figure 1.

We were able to establish our final theoretical construct as a consequence of the within-case study, which demonstrated the mapping between dynamic capacities, digitalization, and other aspects such as the ecosystem and organizational environment. A summary of the main finding is provided in the case analysis section.

4. Case Description

A local player from the Norwegian ecosystem with goals for the Nordic next-generation energy management is TrønderEnergi. They produce renewable energy and offer cutting-edge renewable energy solutions and services, relying on 70 years of hydro-power industry expertise. The business is attempting to take the lead in Norway's energy transformation. Power trading and renewable energy innovation are also handled by TrønderEnergi. The company positions itself to take advantage of opportunities in new renewable technologies, new business models, and new market models for the power industry through market activities.

Additionally, it pushes toward the downstream sector and is assuming a role in the ongoing electrification through partner-based growth in energy services through three sister firms in the retail, vehicle charging, and construction sectors, along with a future venture in the farming sector. TrønderEnergi, however, has a level of digitization maturity that covers many stages.

The key driving force behind TrønderEnergi comes from the strong and effective organizational and executive support, which is one of the different digitalization enablers, along with technology, organization, and process. The company's digitalization efforts have focused on a number of important areas, ranging from the upstream forecasting, planning, trading, and maintenance of hydropower and wind power production, through the middle stream of power transmission with grid loss estimation, to the downstream power consumption and flexibility. Additionally, the primary digitization initiatives seek to change trade activities and predictive maintenance from forecast to autonomous by the year 2022 [1]. The major dynamic capacities that are affecting this change and how they are reshaping an industry that is monopolized and controlled by incumbents will be introduced in this article.

5. Case Study Analysis: Dynamic Capabilities for Electrical Energy Services Digitalization

This section presents the analysis of the case study. In the following pages, I will present an analysis of the interview findings; these findings are viewed and discussed from the perspectives of the dynamic capabilities theoretical lens.

5.1. Sensing Threats and Opportunities

Psara et al. [16], and Idries et al. [7] identifies different barriers related to digitalization and innovative energy services; barriers were in sociotechnical, organizational, and regulatory domains. To date, little evidence has been found associating dynamic capabilities with digitalization and innovative energy services. All these barriers indicate that the energy market has a dynamic nature. As a result, before transitioning toward a platform-based and digital business model, it is important to identify and recognize the activities and required sensed capabilities for this transition. Informed by Witschel et al. [24] and Teece [29], we identified the capabilities and activities related to the sensing stage. These activities were related to (1) early identification of market trends and dynamics, (2) customer involvement in creating ideas, (3) value-capturing mechanisms, and (4) partners and suppliers integration into ideas creation.

5.1.1. Market Trends and Dynamics

In volatile and dynamic industries, it is typically essential to spot market dynamics and trends early on, as failing to do so might result in missed opportunities to innovate or adjust the business model.

According to Kovalenko et al. [44], the trend linked with digitization and the use of digital technology in the industry has a significant impact on the electrical energy sector as well. Digital technologies are already being actively used by electrical energy service providers to automate every process across the value chain. According to Witschel et al. [27], and Karami et al. [45], it is necessary to comprehend the needs of stakeholders and actors

as well as the growth of services, markets, and competition in order to identify market trends and business possibilities.

> "It will enable the company actually to go into this markets that would've been impossible earlier without this digitalization initiative" (I2).

The conducted interviews in TrønderEnergi, show that early recognition of market dynamics and trends is a required capability in the electrical energy market since the transition toward decentralization will remove the monopolization of the market from incumbents and will allow new players to join the market.TrønderEnergi supports this capability using various methods and techniques, including organizational structure mapping to handle the tasks necessary for this stage and introducing new departments to track and manage market dynamics and trends.

> "That's mainly done by the part of the organization that is primarily tasked with business development. So, the driving force is there. But, its tightly connected with the top management for how to prioritize different initiatives and get financing. So, the business development department does all groundwork and analyzes and suggests initiatives to the top management who does all the prioritization on how to choose different initiatives and also at the same time financing them" (I3).

Participating in investments related to the energy transition and sustainability can also lead to a better grasp of the market. This not only enables a deeper comprehension of the market and client needs, but it also serves as a helpful instrument for proactive market impact and triggers before specific customers are aware of new technology prospects or tenders are announced.

> "We're also a shareholder in (. . .) funds that are specialized on the energy transition and digital. So you get sort of direct insights through these kind of investments" (I4).

Prior to the market being mature, the actions mentioned above emphasize shaping and recognizing trends and dynamics as well as learning processes through investments and best practices from market participants. Finding the best choice from the many chances available in the electrical energy sector is one of the biggest obstacles.

> "evaluate the potential and the risks for becoming a flexibility provider, one must also understand relatively complex concepts such as grid balancing, security of supply, ancillary services, and market requirements. The complexity of these technical and commercial concepts represents a barrier to new players, as establishing a sufficient understanding requires significant amounts of research" (Doc 1, I1).

5.1.2. Integration of Customers into Ideas Creation

In order to estimate and manage the delivered services to the network operators through bilateral agreements or the market, service providers are reportedly required to have access to the data of their customers, either as a single party or as an aggregated entity through other actors and stakeholders. Therefore, it is necessary for service providers to offer cutting-edge solutions and services, which calls for a high level of user and consumer involvement in the development of ideas and services. Additionally, building new services necessitates empowering customers by providing them with the knowledge and resources they need to evaluate their energy usage and control their bills [16].

> "if we have new ideas or new initiatives or even on the existing one. We always try it out with proof of concept. So, we select few customers and try out their ideas and then the actual solutions before we get them to the market. So, proof of concept is the thing that we always do" (I3).

In the context of dynamic capabilities, the transition toward a digital platform-based business model requires a deep understanding of the customer needs and requirements [43]. This is relevant to the context of the digitalization of electrical energy services, as involving

customers in testing the new services is a critical capability to understand their needs. In the presented case, our interviews indicated that this transition changed the way that the company is developing products at the organizational and business levels. Hence, the company has applied an iterative approach to designing services, which allows for more feedback and involvement from the end user.

> "We always try it out with proof of concept. So, we select a few customers and try out their ideas and then the actual solutions before we get them to the market. So, proof of concept is the thing that we always do" (I3).

At TrønderEnergi, customers are involved in different ways to identify their problems and needs. According to the requirements of design thinking, user testing, and usability testing, scrum and the design approach are organized.

> "I think that's part of the maturing that we have been doing over the last year; since that we are recognizing the importance of working closely with the customer for insights and basically utilizing methodologies like design thinking in order to create services that the customers are requesting. I think we're also in the sort of the early stages on this side. I think that's a Working with the customers and working with design as a discipline That way we will probably have to strengthen going forward." (I4)

An important component of this activity is the utilization of feedback loops and design thinking exercises to increase consumer involvement, offer useful input to the business that is simple to understand and provide creative products and services.

> "it's basically a partly the same answer, but you need to have feedback loops where you can test things in the market, get direct insights and then sort of do the circle again. So having an iterative approach is what we're trying to do in order to do that." (I4)

Idries et al. [7] and Psara et al. [16] highlighted organizational barriers and challenges related to customers' and stakeholders' inclusion in the services; the above practices and approaches can help in offering them innovative services in a user-friendly manner.

5.1.3. Partners Involvement in Pilots

The digitalization in the electrical energy context opens a huge arena for open innovation and service innovation. As a result, the need for identifying new business lines and opportunities has increased [46,47]. A benefit in terms of sensing capabilities is the integration of external partners (such as solution providers and stakeholders) outside the company and their placement of them in a specific form. In addition, in the context of digitalization and decentralization of electrical energy, internal resources and knowledge are not sufficient for business model transition toward digitalization [24]. Access to new markets and risk distribution are the primary justifications for open and service innovation in the context of digitization and the energy transition. In our previous work Idries et al. [7], we highlighted several challenges in service innovation in the context of electrical energy services while transitioning toward platform and digital business models. This includes the design of cooperation agreements, stakeholder management, and business model design.

> "we're part in +cityxchange https://cityxchange.eu/ (accessed on 23 December 2021) and we're working with other partners Volue and ABB and we developed this platform and it was for testing purposes. What we talking about here, the decentralized energy system is not there yet. So, it in the future, but then we know how to operate it" (I2).

The case study demonstrates that TrønderEnergi engaged in various types of collaboration with other parties. This encompasses forms of cooperation with universities and municipalities in city projects (Ex. +CityXchange project), strategic investments, industry network (Volue and ABB), and establishing new business lines which allow more interaction with partners in testing ideas and ideas creation process, which also seems to be an

effective practice within the digitization context in order to develop new business models. In general, the level of cooperation differs from one company to another; in the context of digitalization, DSO's are highly engaged in cooperating and investing in start-ups and establishing dedicated services for certain domains (Ex. EV charging, retail, farming, and construction) which seems to be a cross-industry trend.

> "If you look at the partner level, we are working closely with a few larger corporations like Microsoft and Volue, . . . on the European side, (. . .). I think that's the sort of the major players that we deal with. On the more downstream business where we are; now more niche segments and then (Ease) is an example of a charge box provider that we work closely with both on the hardware and software side , and the end users can range from our in house operators or in house trader to a user of a charging service in a condominium, basically it's a large stretch" (I4).

According to Teece [29], a crucial success factor for the platform and digital business models is the timely establishment of a sizable network of key partners; in the case of TrønderEnergi, this was achieved.

5.1.4. Value Proposition Modeling and Value Capturing Mechanism

According to Pressmair et al. [48], electrical energy may be thought of from the standpoint of a product that end-users can use to operate electric equipment. Organizations and service providers must be able to develop their value proposition and revenue models in accordance with the operators' shift to digital and platform-based business models, which are increasingly user/customer-centric as a result of ongoing digitalization. However, these skills are crucial to prevent failing to provide sustained revenue [29,43].

In the context of the digitalization of electrical energy services, the ability to understand the end-user problems and translate this into the value proposition and entire business model design is important and critical.

> "So we have business developers that identify opportunities, and then they in sort of open markets where we see opportunities in some direction either as an energy provider or yeah that we can sort of get a larger part of the what we expect to become the new market and then the way we build up startup companies that tries to capture this market and then part of this at digitalization is, part of the solution, which means that we have to provide some services to their customer user interfaces and sort of this is the way the service is provided either a selling it partially digitally and then reporting digitally but also we use AI system to optimize through energy uses for instance, or forecasting, but we are involved. There are departments involved and very late stage of when we are not in the early stages; there are some ideas where we can provide value. And when we have a sort of a setup here and we've started getting customers then we can build solutions, but as you know, sort of in this sort of digitalization Pyramids that there is, there's AI you have to collect data, You have to visualize data many steps before you can sort of do or autonomy or make decisions or automatically, Maybe we have to forecast first. But all these lower steps have to be done before we usually are involved. Sometimes we actually help in the slower parts as well with collecting data but mostly that is a part of what that the products are." (I2).

The business model in the context of digitalization must maintain featuring multiple revenue streams due to the market dynamics and, to some extent, must be able to use flexible service (ex peer to peer and pay as you charge) as part of their pricing policy and strategy and the new business streams were mentioned in the previous subsection. The interviews show us how TrønderEnergi used digital technologies to model the value and capture it. Also, it shows us how the company built its AI on top of the digitalization process, which helps in creating customer journeys.

> "In terms of benefits, we are dealing with energy markets that are that are operating quicker and quicker. The time frames allowed for taking stations are just

> shrinking. So in order to be competitive, we need to digitize.so that's one aspect. In order to get the best out of our assets, we need to digitize, we need to get into Preventive maintenance and all these kind of things in order to know how our assets are doing, to get list out of them ; and then the third parties we talked about earlier are there, is it B2B modern market or end customer side of it in order to be competitive in order to create services that are customers will enjoy, we need to manage the digital components in them" (I4).

5.2. Capabilities for Seizing Opportunities

The previous section outlines the necessary skills for seeing opportunities in the context of the switch to a platform business model for electrical energy. Energy service providers also need to concentrate on how to respond and actively identify these possibilities in the context of the energy transition. The following subsections try to determine what resources are needed and what competencies the organization employed to take advantage of possibilities because the energy market is so volatile.

5.2.1. Organizational Development and Competence

> "It affect the organization heavily, with different competence, different people, different organization, and knocked all like the old organization were focusing on hydro and wind production" (I3).

Since the energy transition is driven by 5D's, which was mentioned earlier in the introduction section, digitalization is one of these 5D's. such transition requires certain competencies and organizational alignment. In addition, the such transition brings to the surface the demand for interdisciplinary knowledge, especially in the digitalization domain [49]. In the context of electrical energy digitalization, enterprise architects, AI experts, and market experts are highly needed.

> "Around the last one and half year we've hired around 70++ people which come from different areas and markets to build this downstream goal/initiative." (I3)

The interviews indicate the cross-organizational cooperation as an additional effective tool that supports open and service innovation [29,47].

> "It's knowledge, rearranging from domain expertise to deep expertise on key sort of key systems To support the development, project management design as I mentioned, it's structured basically in two main teams where we have the centralized team that are working both upstream and downstream and supporting them in different aspects of the sort of the total digital landscape. And then we have an additional team that is only focused on the downstream and developing this B2B services" (I4).

Additionally, because it has not historically been the fundamental competency of IT to enable service and open innovation for the end users and construct an AI-driven platform, the internal digital capabilities of established firms are sometimes insufficient (in case of TrønderEnergi) (I2;I3).

5.2.2. Agile and Lean Mode for Developing Business Model

According to Kovalenko et al. [44], New businesses may offer personalized goods and services at cheaper costs than established businesses because of digitalization. As a result, iterative and design thinking approaches are becoming increasingly important for a transition toward digital and platform business models, which are also essential activities of seizing [50]. In conjunction with Teece [51], there are overlapping and similarities between seizing and sensing capabilities.

> "I think that that's part of the maturing that we have been doing over the last year; since that we are recognizing the importance of working closely with the

> customer for insights and basically utilizing methodologies like design thinking in order to create services that the customers are requesting" (I4).

In addition, to establish such practices in certain organizations, there is a need for organizational flexibility and executive support from the top management. Our interviews show how the organizational setting affects and supports the agile mode of working. However, the presented case shows that cross-departmental collaboration affects the agility of work and acts as additional value to it (I2;I3;I4).

> "The management is very much on top of and very much involved to grow.so, they're actively seeking the opportunity to grow. We've been growing a lot now as we've been discussing, we will see also other areas yet to come. The company is highly motivated to grow and its not necessarily clear in what areas, but of course we see opportunities in other areas of production. For instance, wind and solar. And in downstream markets we have lots of ideas that are not tested out yet. So, its continuous process and the main goal is how to into new market" (I3).

> "Very much cross collaboration, my department for instance is having the responsibility for lots of this things which are organized within energy management division today. But, now we re-organizing it.so, we are setting new division called 'technology and development' which tasked with supporting the rest of organization with both technology and development resources" (I3)

Citing Dellermann et al. [52], it can be said that digitalization fosters cross-border organizational learning as well as innovation that builds on novel combinations of previously untapped knowledge from various technical and application sectors.

5.2.3. Customer Integration into Development and Testing

The digitalization in electrical energy opens the window for many products and services to arise. Therefore, there must be certain activities to be conducted in order to make sure these solutions and services have met the end user's requirements [24]. Solutions are initially offered as MVPs (Minimum Viable Products) in keeping with the open and service innovation idea and the new trend of digitalization in electrical energy so that the minimally functional iteration of the business model is cyclically improved and extended based on customer feedback [24,43]. Our case shows how the company is working toward integrating customer and end users in the testing and pilot phases. Early risk detection and the creation of services and solutions that satisfy end-user needs are the major objectives of such activity.

> "To large degree they we provide services to them and we sell in services to them and which means that we have we need to involve them in our product development so that we are sure that Our systems fit their need and this is for the company in general, but for the AI team we have a very similar approach, when we develop an AI solution we have domain experts that could tell us basically what they need and how everything works and what's important for the systems that we are going to build and then we develop them accordingly and we show our results with them and we discussed whether we are able to capture the their needs and whether this works" (I2).

However, integration of customers in certain processes can be difficult. therefore, TrønderEnergi views this skill as a problem because improving end-user engagement is difficult when creating new business models and services.

> "I think if you see in the customer side, I think the main issue for us now is the customer interaction via the customer portal. So, to develop the customer portal is necessary to have the functions that are asked for. So, that's the key for us to get better customer interaction and that in both downstream and upstream" (I3).

5.2.4. IT Key Activities Implementation

The current development of digital and platform business models among the electrical energy providers raised the demand for the digital and technical capabilities of the providers. Since this shift is moving toward open and service innovation, such innovations are also opening up a completely new market and business opportunities leading to another set of processes, activities, and IT abilities that work on the intersection of energy, IS, and ICT industry [53]. In addition, the transition toward new business models, especially digital and platform-based models as one of the digitalization critical outcomes, can well explain how the use of digital technologies allows different outcomes and impacts on the organizational level, thereby creating the need for efficient deployment of key IT activities [54]. Additionally, the results of our interviews demonstrate the significance of creating platform-based business models and the contribution of these models to the energy transition.

> "I'm starting new initiative to come to the whole field with future strategy for the platform and IT solutions combined. We're moving into new era, and the platform and software support has to be different from what it is today" (I3).

The company has to be able to scale up or down on business model innovations that might improve current client wants and requirements as well as respond to market changes and dynamics, according to Warner and Wäger [25]. The TrønderEnergi AI team plays a key role in creating a scalable platform architecture through SAAS cloud hosting and the platform's adaptable and modular design.

> "We of course have some resources, such as power plants and ohmia chain. And we have software platform SaaS, we have workshop machine software. We have domain experts in different areas to make us have the best practice. Also we have collaborative approach to achieve all this" (I2).

As a result of the transition toward a new business model, this requires the organization to be a part of a multi actors ecosystem and take a part in a platform that has another player, actors, and stakeholders, and so it requires a certain setting [55]. This shows us how TrønderEnergi dealt with such scenario.

> "We joined Nordpool (another ecosystem), we provided them with a protocol and must adhere to this protocol. So we defined certain processes and they provide us with API and we connected this with several platforms provided by Volue. We don't want to do this by our self.its sort of boring job" (I2).

Capabilities for Transforming

Furthermore, in the context of electrical energy digitalization, organizations need to have and maintain certain transformation capabilities, which are presented by the organization's ability to adapt and deal with market and industry dynamics. In performing so, organizations have the choice to implement and build these capabilities internally or externally. In the following sections, we discuss the required capabilities in the context of transformation.

5.2.5. Organizational Design and Transformation

> "For instance, at our organization, we changed the organization to reflect this. So, we have the energy management unit that am part of it, it contains the IT services, the trading, AI organization and the operating center. We have changed the organization in order to meet this market changes. It has been sort of cognizant move in order for us to meet the market changes and in a best way we changed our organization to reflect this , so we can coordinate in house in a better fashion and also the fact that you have an AI department, so you have someone using the product of digitalization and in this way you have someone internally get the

> organization moving when it comes to digitalization because the organization need the fruit of digitalization process" (I2).

According to Santa-Maria et al. [47], long-term organizational settings and capabilities are critical success factors for digitalization and business model transition. However, the move toward digital business models and platform-based business models is a difficult process for electrical energy service providers, notably DSOs and renewables suppliers, who must build up specific structures and practices over decades [7]. Our interviews show that the organization has performed many activities in this domain, such as restructuring the organizational structure around this digitalization initiative as the process of integrating the new business model into the organizational structure (I3;I4). Additionally, our research shows that the company has acquired startups to support particular business lines. Strategic acquisitions are crucial in industries where the competitor has an advantage in terms of expertise and experience while also providing access to new markets and customers.

> "but on top of those initiatives we have built it and bought it ourselves and in one location we have bought a company with software platform. Also, we are considering other initiatives for farming areas. Companies are ohmia charging, ohmia retail and ohmia construction , the fourth one is ohmia energy, selling energy to other companies and third party markets" (I3).

According to Witschel et al. [24], Some businesses prioritize data analytics, creating their own teams or even centers of excellence on top of their digitization efforts (I2). To this end, the ability of the organization restructures and consider it as a continuous process is a key dynamic capability for digitalization [43]. In order to deeply embed the necessary capabilities in the context of AI within the company, TrønderEnergi designed a new organizational structure.

5.2.6. Sustainability of Developing of Key Competence

The energy transition opens the arena for the digitalization of electrical energy services; their services require a high level of decentralization and digitalization in order to achieve a level of inclusion for the user and a large degree of democratization. As a result, the digitalization of electrical energy services requires many skills and competencies from the human capital, and also it requires certain human capital that can maintain the sustainability of services and business continuity.

> "That a key question for us, because we come from place where the maintenance and development of platform was the main task actually, and that has evolved that we need more capacity and knowledge about the solutions, we need capacity to both buy and selling to production new system and build new system, and we've been hiring lots of people in that areas in the last years and we will continue to find the needed competence .so, it's been kind of evolving from platform development and maintenance to more about full modular where we aiming at digitalized platform for every considerable need. So, now we're recruiting and developing new competence through the existing employees" (I3).

In the presented case, the company aligned the needed competencies with the current stage of digitalization. Our interviews reveal that the competencies and skills are required in the domains of solutions development, sales, data analytics, and machine learning. Also, the transition toward a digital business model and platform model in the context of electrical energy requires more skills related to market knowledge which intersects technology and business [55]. Therefore, electrical energy service providers must be capable of developing certain competencies over time and maintain the sustainability of these competencies and capabilities [53].

In addition, the case study shows how TrønderEnergi is working toward enhancing the sustainability of needed competencies for energy transition and how the company developed an internal platform for learning and development activities. This internal

platform covers a wide range of training opportunities, from technical training on data analytics to using administrative solutions for human resources.

> "we have an internal platform where you can go through lots of different courses on many different topics from how to register travel expenses to sort of IT security and lots of other topics, maybe sustainability and how it's achieved in a company like this, and then you can go through this courses and learn sort of quick bites, we also have opportunity to take courses at university or at where Coursera or similar courses where we can develop needed skills in parts of the organization" (I2).

In addition, the case of TrønderEnergi shows how the restructuring in the context of digitalization promotes interdisciplinary IT skills through recruiting new skills and learning from project benchmarks. However, there will still be a challenge in B2C (Business to Consumer) oriented operations since it requires new and multiple competences in areas related to digitalization and product development.

> "In AI department, at least we have internal Projects that we only have for learning where we do, we have do things together and for instance, now we're focusing on time series and we're making a benchmark for many different algorithms, and we are putting this benchmark up in a four way and the goal is to publish this and then the whole department is involved in this effort. So we this is one way of learning and to build the competency in the team and of course we go to conferences as well. So there are many different ways that we learn and change." (I2).

5.2.7. Customer Support and Interaction

The market for electrical energy has become more volatile due to the shift to a platform-based, digital business model. Success in the electrical energy market depends on having the flexibility to adapt and adjust the business model over time. The capacity to communicate with current clients in particular is crucial and crucial. However, the emergence of cutting-edge services in the electrical energy transition (such as flexibility and peer to peer trading) has increased the need for extensive client engagement and assistance. As a result, it's critical for retaining customers, and on the other hand, consumer input is essential for a product's ongoing improvement, as noted in Witschel et al. [24], Gong and Ribiere [54] and Verma et al. [53].

> "to develop the customer portal is necessary to have the functions that are asked for. So, that's the key for us to get better customer interaction and that in both downstream and upstream" (I3).

The interviews show continuous development for customer interaction on different business lines offered by TrønderEnergi. Also, in the current context of digitalization, it is important and crucial to providing customer support in downstream operations since new services are delivered to certain customers, such as car charging, retail, and farms. However, intensive customer support and interaction remain a challenge in electrical energy digitalization since it requires in-depth understanding of customers' needs in order to shift electricity from just a commodity to an experience.

> "But, all this is planned to go on new initiative we have with new customer portal, so, everything is going to be modernized and digitalized, and that's also on production side, we have lots of customers who owns power plants, where we today give them a report once a month, but, from next year we will have customer portal to both get al.l the information and send the information back. So, we're digitalizing all the customer experience we have" (I3).

In conclusion, the previously covered actions serve as best practices for ensuring and guaranteeing long-term client loyalty and commitment, as well as laying the groundwork for actively taking part in the ongoing evolution of business models through customer engagement and interaction.

5.2.8. Rising the Business Model through Partnership

scaling up and raising the business model through partnerships is an important capability since it helps a lot in acquiring new skills from external resources and integrating them into the organization [24]. In this context, TrønderEnergi is involved in acquiring new companies to deliver services to new market segments and new customers. Also, the company created partnerships with other industry partners (Ex. ABB and Volue) and other actors in the ecosystem. In addition, such activities are important for transitioning toward digital and platform-based business models in the electrical energy industry; further, long-term involvement in partnerships with partners who have competencies and skillful resources is a success factor [49,50]. TrønderEnergi's case demonstrates how important is the flexibility and openness of the business model for integrating new players and partners to the ecosystem (I2).

> "We have some of the initiatives we started from the ground up. So, we started with more or less nothing and build up the organization ourselves that's around charging area and construction area, but in the retail one we bought three small companies" (I3).

Citing Witschel et al. [24], it is clear that the business model needs to be adjusted, particularly in light of shifting consumer expectations, shorter product lifecycles, and the rapid pace of innovation in the market.

> "We provide services, we bid on prices. so the companies are focusing partnerships rather than providing services" (I2)

6. Discussion

Based on the results of our study and considering the outcomes of our study (See Figure 4), in this section, we discuss the key findings and our reflections in relation to the research questions.

Digital platforms have rapidly become an important phenomenon among electrical energy service providers. The capacity of a company to integrate, develop, and reconfigure internal and external competencies to handle a quickly changing environment is referred to as dynamic capabilities [3]. Hence, dynamic capabilities play a role in the such a transition toward delivering decentralized electrical energy services [2]. Digitalization is grounded in lowering the operating costs of firms.

As mentioned in the introduction, this study was motivated and informed by Witschel et al. [24] aspects required for energy digitalization. Separated or combined, these outcomes are consistent with the conceptual findings of Teece [29,51].

This study's primary research question (RQ) seeks to ascertain how electrical energy firms build capabilities in the context of the transition toward digital and platform-based business models and what dynamic capabilities are required for electrical energy firms in response to digitalization. Since the main objective of this study is to investigate the digitalization practices in electrical energy firms from a dynamic capability perspective, the second research question identifies the activities related to these capabilities.

As the practices of digitalization in the electrical energy industry is not yet fully understood and conceptualized for practitioners, academia, managers and policymakers, a complete investigation of digitalization practices is required in order to map it with future needs. However, there is little discussion in the literature about the technical, managerial, and strategic aspects of digitalization practices and strategies in the electrical energy sector. Therefore, this paper presents the current situation of one industry player and presents current practices from the dynamic capabilities view. Consequently, an intriguing discovery is that new utility company positions are being created due to service innovation in electrical energy services, e.g., the emergence of a Chief Digital Officer, Chief. Transformation Officer and Chief AI Officer are associated with the findings of Idries et al. [7] and Witschel et al. [24].

The interviews show how TrønderEnergi builds the capabilities which help in building and transforming toward a digital business model and innovative services. Since digitalization is a new phenomenon in the electrical energy industry and it opens the door for services innovation, this pushes the electrical energy providers to compete and creates more dynamic markets. The case shows how leadership and organizational support affect dynamic capabilities' effectiveness. In addition, in transitioning toward new business and operational models, dynamic capabilities (DC) are highly needed and must be continuously adopted. In our previous work Idries et al. [7], we highlighted challenges related to digitalization in the context of the electrical energy industry. So, in order to overcome these challenges, leadership and organization must have managerial and business capabilities for sensing (Ex. market forecasting) and dynamic capabilities for seizing opportunities and transforming toward new business and operational models (Figure 4).

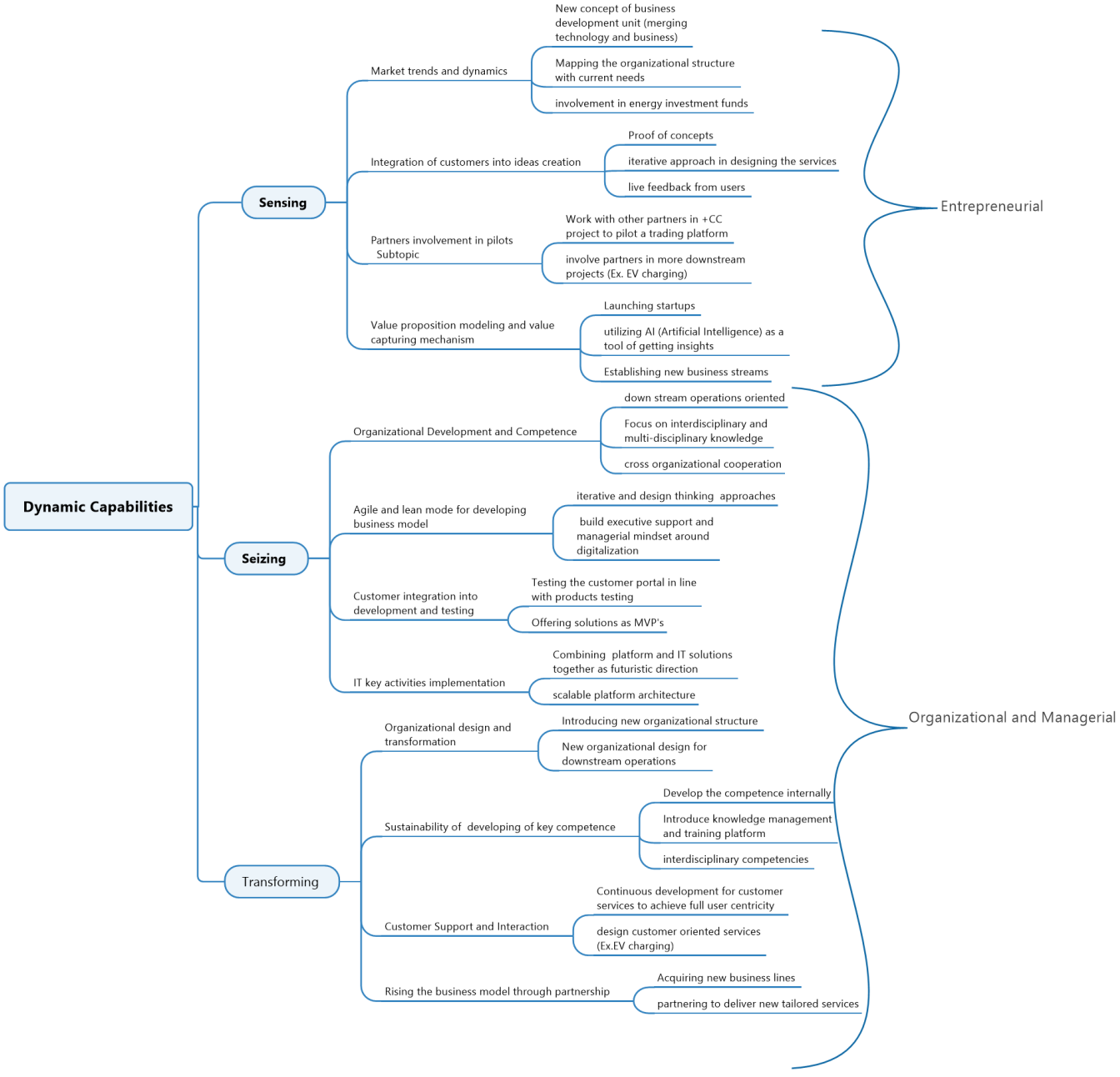

Figure 4. Dynamic capabilities activities overview.

Our study focuses on the digitalization of electrical energy providers in Norway. Therefore, our interviews targeted mainly the employees who are concerned with this task technically, strategically, and operationally. In addition, digitalization is a new phenomenon in the electrical energy industry, and it is affected by many contextual factors (Ex. market dynamics, regulations, strategy, and organizational design). Therefore, our results managed to identify several activities under each capability. Our findings, however, indicate that each and every aspect of dynamic capabilities is critical and significant. In addition, our results show some overlapping between activities, especially in activities related to customers and end-users involvement in the creation and testing of ideas and solutions, which indicates the existence of a challenge in achieving user centrality in the digitalization of electrical energy services. However, this overlapping is still limited. In summary, dynamic capabilities are crucial enablers for digitalization since it helps firms create and capture values [51]. The interviews show how digitalization is a core part of the company strategy, where the transition toward a digital and platform business model is the response to market dynamics and energy transition.

Our research also demonstrates that design thinking and iterative methods are helpful tools and skills in transitioning to a new business model since they have the capacity to give this assistance in terms of principles, process models, and procedures [56]. Such a strategy will aid in comprehending how to include customers in platform operations and allow them to take part in the creation of novel offerings and innovative services [7] and this is consistent with Teece [51] of the suitability of such approached for business model transformation.

RQ 2, Attempted to identify dynamic capabilities required for electrical energy firms in the context of digitalization and the activities required to achieve a certain level of digitalization. The findings show how the capabilities are driven by two mindsets, namely: managerial and entrepreneurial, For example, sensing capability (Ex.monitoring market trends and dynamics) is more driven by an entrepreneurial mindset while seizing and transforming (Ex. Organizational design and development)are driven by managerial mindset, and this appears more in the type of activities conducted and performed under each capability, and this was consistent with findings of Witschel et al. [24] and Teece [26].

Moreover, the findings reveal that people from diversified disciplines are involved in the processes of transformation and transition toward new business models. In the context of the electrical energy business and with the current energy transition, the development of such a business model requires multiple IT skills and multi-disciplinary knowledge, this result is in line with Peñarroya-Farel et al. [49] and Witschel et al. [27]. To conclude, the interviews show that the industrial context, organizational support, and executive mindsets strongly influence the transition toward digital and platform business models in the context of the electrical energy industry.

The findings of this paper are a prerequisite for understanding the digitalization practices in the electrical energy industry, especially in cases of transitioning toward digital and platform-based business models from information systems and managerial perspectives. Therefore, this paper contributes to the research area of dynamic capabilities theoretical lens. thus, our contribution can be an empirical extension of the studies by Witschel et al. [24,27]. Moreover, the recent papers by Peñarroya-Farel et al. [49], Witschel et al. [24], and Teece [29] said that in order to develop and capture value, adapt to market dynamics, and mitigate threats, dynamic capabilities are often required for business model transition. Another key finding which contributes to the energy informatics and energy markets domains in scopes of business model and service innovation, service providers must have these dynamics in order to develop new resources and build new business and operational models (Ex. Platform based business model).

7. Conclusions and Limitations

The purpose of this study was to provide a contribution to practice and initial work to theorize digitalization practices in the electrical energy industry. Also, the presented

case demonstrates how digitalization can play a role in the current energy transition by presenting a set of practices in the transition toward a digital business model. However, our study is constrained by certain limitations. Due to the narrow scope of the case, we cannot guarantee the applicability of the results to other actors in the electrical energy value chain (Ex. TSO). Also, the activities highlighted in the findings might defer from one actor to another in the ecosystem, and these activities are limited by contextual factors, including geographical locations. The selected case was restricted to an established electrical energy company in Norway. Therefore it would be interesting to explore how the electrical energy firms in another context build their dynamic capabilities, especially for their platforms (in the case of platform-based models). Since the electrical energy business is known as a monopolized business and is now it's moving toward de-monopolization, a further study could investigate how incumbents interact with these digitalization trends and how they build their dynamic capabilities. Our study demonstrates how the business interacts with external partners, including customers, vendors, tech partners, academic institutions, and stakeholders.

the results of conducted interviews and the highlighted activities can act as a managerial guide for building and designing dynamic capabilities for electrical energy service providers that are moving toward digitalization. In addition, our interviews and findings show that there is required for dynamic capabilities to be integrated into the strategic and organizational body. However, the choice and selection of any capability vary from one actor to another (Ex. it might be different in TSO's) and is also affected by different contextual factors. Also, in the interviews, we reveal that partnerships with technology providers and academia, as well as end users oriented involvement are crucial for improving the company's dynamic capabilities. Also, it is recommended to focus more on design thinking practices in digitalization since the processes need to be aligned with a new scenario of digitalization. To sum up, for electrical energy service providers (Ex. DSO, TSO and EV charging), the digitalization process need the existence of a new contextual setting.

Because the transition is primarily toward platform-based business models (for example, flexibility and peer-to-peer energy trading), platforms and their ecosystems may become the next competitive factors determining a business model's success or failure. We must investigate the dynamic capabilities required for building and sustaining digital platforms. Another limitation is the number of interviewees; due to the narrow scope of the study, we targeted those who were concerned with strategy, technology, and digitalization, and since the company is still moving toward a fully digitalized model, the number of interviewees was limited. Therefore, further study should discuss the dynamic capabilities from the perspective of other business units within the organization. Furthermore, a more in-depth research is needed to contribute to a better knowledge of how electrical energy providers establish dynamic capacities in order to sustain their digitalization practices, as well as the constraints connected with these processes. Another shortcoming, the study doesn't investigate the company platform from a dynamic capabilities perspective. Therefore, this paper managed to identify the required dynamic capabilities to transform toward digital and platform business models as the first stage of ongoing research.

Furthermore, because digitalization is new in the electrical energy industry, a longitudinal case study method might aid in understanding how dynamic capabilities contribute to platform value generation (for example, EV charging platforms) and how platform owners manage developing challenges. Furthermore, the study does not consider the effects of digitalization on the other participants in the electrical energy value chain. Therefore, further research should carry out an investigation of how platforms are changing the ownership model in DSOs and other value chain actors.

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Abbreviations

The following abbreviations are used in this manuscript:

DV	Dynamic Capabilities
DCV	Dynamic Capabilities View
IS	Information Systems
DRR	Distributed Renewable Resources
IT	Information Technology
OT	Operational Technology
CPS	cyber-physical system
AI	Artificial Intelligence
IoT	Internet of Things
DER	Distributed Energy Resources
SDG	Sustainable Development Goal
SDL	Service Dominant Logic
TSO	Transmission Service Operator
B2B	Business to Business
MVP	Minimum Viable Products
ICT	Information and Communication Technology
DSO	Distribution Service Operator
B2C	Business to Concsumer
EV	Electrical Vehicle
SAAS	Software As A Service

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