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Innovation Pathways: Value Capture through Collaboration in Norway

Henry Efe Onomakpo*

Faculty of Economics and Business, University of Gadjah Mada, Yogyakarta, Indonesia

***Corresponding Author**
Henry Efe Onomakpo, Faculty of Economics and Business, University of Gadjah Mada, Yogyakarta, Indonesia.

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Abstract

This study investigates the dynamics of collaborative innovation among Norwegian firms, focusing on the configurations of innovation activities, collaborative relationships, and technology investments that drive value capture. Addressing the challenges and opportunities within Norway's unique economic context, the research examines how different types of collaborative partnerships impact firm innovation performance. Utilizing data from the Innovation Norway Business Survey (2018-2022), a mixed-methods approach combining descriptive statistics and fuzzy-set Qualitative Comparative Analysis (fsQCA) was employed. The descriptive analysis revealed significant variance in innovation adoption among firms, while fsQCA identified key configurations associated with high value capture. Results indicate that selective collaboration, particularly when coupled with process innovation and strategic technology investments, outperforms pure strategies. The study highlights the importance of aligning collaborative initiatives with digital capabilities and adapting to specific regional conditions. These findings offer actionable insights for Norwegian firms and policymakers seeking to foster a resilient innovation ecosystem. They contribute to a more nuanced understanding of effective collaborative innovation strategies, emphasizing the context-specific nature of successful value capture in the digital age. They extend previous understanding by showing the importance of innovation, technology and relationships.

Keywords: Collaborative Innovation, Value Capture, Norwegian Firms, Fuzzy-Set QCA, Technology Investment and Regional-Ecosystem

Abbreviations

R&D : Research and Development
SME : Small and Medium-sized Enterprise
fsQCA : fuzzy-set Qualitative Comparative Analysis
CIS : Community Innovation Survey (Specify the year range if appropriate, e.g., CIS 2018-2022)
NOK : Norwegian Kroner
PdI18_20 : Product Innovation (2018-2020)
PdI20_22 : Product Innovation (2020-2022)
BPcI18_20 : Business Process Innovation (2018-2020)
BPcI20_22 : Business Process Innovation (2020-2022)
CoorpI18_20 : Cooperation in R&D Innovation (2018-2020)
CoorpI20_22 : Cooperation in R&D Innovation (2020-2022)
TIExp18 : Total Innovation Expenditure (2018)
TIExp20 : Total Innovation Expenditure (2020)

1. Introduction

Understanding the drivers of innovation and firm performance has become a central theme in business and regional economics research [1]. While early studies often treated innovation as a firm-internal process, contemporary perspectives emphasize the critical role of collaborative relationships and the broader ecosystem in fostering successful innovation outcomes [2]. A key point of contention in the existing literature is the importance of strategic focus against the implementation of an interconnected business practice. This relates to strategic decisions when looking at all of the available factors. There has been research that supports focusing on a single area while others have found that working with different sectors is best [2,3]. These highlight what must be considered while innovating.

However, gaps persist in fully understanding how these elements interact and how regional contexts might moderate their effects, so this paper poses the following questions.

1. What are the key factors for the modern-day Norwegian business that wishes to operate with a high degree of innovation?
2. With the different types of business collaborations to take into consideration, which ones yield a higher economic output for Norwegian companies to make use of in business?
3. What can the current business achieve by maximizing the best output from all the available factors in their local region?

In response to these gaps, the purpose of this study is to examine the specific opportunities and challenges for Norwegian firms in leveraging collaborative innovation, the impact of various collaborative relationships on innovation performance, and effective value capture strategies. It has not been known what effects innovation performance can have with different regional settings, to improve company results. The overarching purpose will then be to fill these gaps in the discussion.

Therefore, the aims of this study are threefold: (1) to identify the specific challenges and opportunities for Norwegian firms in leveraging collaborative innovation, (2) to determine how different types of collaborative relationships impact the innovation performance of Norwegian firms, and (3) to uncover how Norwegian firms can effectively capture value from collaborative innovation. This study uses descriptive statistics and fuzzy-set Qualitative Comparative Analysis (fsQCA) to analyze data from the Community Innovation Survey (CIS) of Norwegian firms, to be able to uncover non-linear relations between key items and economic results for companies.

2. Materials & Methods

This study employed a mixed-methods approach, combining descriptive statistics and fuzzy-set Qualitative Comparative Analysis (fsQCA) to investigate the configurations of factors influencing value capture in collaborative innovation among Norwegian firms. The study utilized data from a comprehensive survey of Norwegian businesses conducted by Innovation Norway, covering the period 2018-2022.

2.1 Data Collection and Sample

The primary data source was the Innovation Norway Business Survey, a nationally representative survey of Norwegian firms across various industries. The survey collects detailed information on firms' innovation activities, collaborative relationships, technology investments, and financial performance. The community innovation survey dataset used for this study included responses from firms that provided complete data for the variables of interest. This sample was selected to ensure representativeness across industry sectors and firm sizes within the Norwegian economy.

2.2 Variable Measurement

The study included several key variables related to innovation activities, collaborative relationships, technology investments, and financial performance. These variables were measured as follows. Innovation Activities was measured using indicators of different types of innovation, including product innovation (PdI18_20, PdI20_22), business process innovation (BPcI18_20, BPcI20_22), and total innovation expenditure (TIExp18, TIExp20). These variables were measured in Norwegian Kroner (NOK) and reflected firms' investments in these activities.

Subsequently, the "Collaborative Relationships" variables were measured using an indicator of cooperation in R&D innovation (CoorpI18_20, CoorpI20_22), reflecting the extent to which firms engaged in collaborative R&D activities. Meanwhile, "Technology Investments" was measured using firms' total innovation expenditure (TIExp18, TIExp20) as a proxy for investments in new technologies. Value capture was determined by turnover attributable to product innovation (Turnover_ProductInnovatio2018), reflecting the ability of an organization to harvest a competitive advantage [4]. The data were collected over two periods of 2018-2020 and 2020-2022, to capture changes in innovation activities and collaborative relationships over time. All monetary values were adjusted for inflation to 2022 NOK.

2.3 Descriptive Statistics

Descriptive statistics were calculated to provide an overview of the distribution of each variable in the dataset. These statistics included means, standard deviations, minimum values, and maximum values. The descriptive statistics were used to characterize the overall innovation landscape in Norway and to identify potential patterns and trends in firms' innovation activities and collaborative relationships.

2.4 Fuzzy-Set Qualitative Comparative Analysis (fsQCA)

fsQCA was used to identify the configurations of factors that are associated with high levels of value capture. fsQCA is a set-theoretic method that allows for the analysis of complex causal relationships by identifying necessary and sufficient conditions for an outcome. The fsQCA analysis was conducted using the fsQCA 4.1 software [5]. The variables were calibrated into fuzzy sets using direct calibration with three qualitative anchors: full membership (1), cross-over point (0.5), and full non-membership (0). The calibration thresholds were determined based on theoretical considerations and the distribution of the data.

The fsQCA analysis involved these steps. The "Construction of a Truth Table" through calibrated fuzzy sets combined to create a truth table, which lists all possible configurations of the causal conditions and their corresponding outcome. Subsequently, the necessity analysis was conducted to identify conditions that are necessary for the outcome. A condition is considered necessary if its consistency score is above a threshold of 0.9. Subsequently, the sufficiency analysis was conducted to identify the configurations of conditions that are sufficient for the outcome. The Quine-McCluskey algorithm was used to minimize the truth table and identify the prime implicants. The solutions were simplified using a consistency cutoff of 0.8 and a frequency cutoff of 1, which is consistent with prior research in the field. The consistency and

coverage scores were used to evaluate the strength of the causal relationships identified by the fsQCA analysis [6]. Consistency measures the extent to which a configuration is a subset of the outcome, while coverage measures the proportion of the outcome that is covered by the configuration.

3. Results

This section presents findings derived from the Community Innovation Survey (CIS) data of Norwegian firms. A key advantage of this dataset is its recent inclusion of measures for co-creation with users, addressing whether customers actively participate in the conceptualization, design, and development of new products or services (CIS 2018 and 2020). This advancement overcomes a prior limitation in innovation surveys. The data, accessible at https://www.ssb.no/en/teknologi-og-innovasjon/forskning-og-innovasjon-i-naeringslivet/statistikk/innovasjon-i-naeringslivet, allows for a comprehensive examination of co-creation's impact. This study synthesizes insights from the literature and fuzzy-set Qualitative Comparative Analysis (fsQCA) to reveal the nuanced relationships between co-creation, innovation types, and firm performance across industries. The research aims to identify the specific contexts and mechanisms through which co-creation enhances innovation and long-term performance in service firms, accounting for the role of dynamic capabilities and digital transformation in moderating these relationships [7,8]. While some advocate for focusing resources on a single area, others support working with different sectors [2,3]. This can offer a clear solution as to which approach is the most suitable for specific regional contexts.

3.1 Literature Review

This literature review explores how Norwegian firms innovate through collaboration, encompassing research and development (R&D) and other collaborative activities, to create, distribute, and capture value. Given the limited direct focus on Norwegian firms within the provided list of publications, this review will synthesize relevant theoretical frameworks and empirical findings from related areas, extrapolating potential implications for Norwegian firms. Where applicable, data related to Norway in broader international studies will be emphasized.

3.1.1 The Importance of Collaboration for Innovation

According to Schumpeter (1934), innovation is the development and use of new goods, procedures, or services [9]. It is essential for business competitiveness and economic expansion. But as innovation becomes more intricate and knowledge-intensive, businesses must have access to a variety of resources and expertise [10]. For businesses to overcome resource limitations, gain access to complementary knowledge, and share the risks involved in innovative endeavors, collaboration is a crucial tool.

3.1.2 Theoretical Frameworks: Open Innovation

Several theoretical frameworks inform the understanding of innovation through collaboration. The Open Innovation framework coined by Chesbrough (2003) posits that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology [10]. This framework emphasizes the importance of knowledge inflows (e.g., through R&D collaborations) and outflows (e.g., through licensing) in driving innovation. Potential Implication for Norwegian Firms: Norwegian firms, particularly SMEs, can benefit from open innovation by actively seeking external knowledge and partners, especially given their limited internal resources.

Cohen and Levinthal (1990) introduced the concept of absorptive capacity, defined as the ability of a firm to recognize the value of new external information, assimilate it, and apply it to commercial ends [11]. Absorptive capacity is crucial for firms to effectively leverage collaborative relationships and benefit from external knowledge. Potential Implication for Norwegian Firms: Investments in internal R&D and employee training are essential for Norwegian firms to build absorptive capacity and effectively utilize knowledge gained through collaboration.

Teece et al. (1997) highlight the importance of dynamic capabilities, which are the abilities of a firm to integrate, build, and reconfigure internal and external competences to address rapidly changing environments [7]. Dynamic capabilities are crucial for firms to adapt to new technological developments and market opportunities created through collaborative innovation. Potential Implication for Norwegian Firms: Given the dynamic nature of industries like oil and gas and maritime, Norwegian firms must cultivate dynamic capabilities to adapt and innovate effectively in response to technological disruptions and changing market demands.

Furthermore, Etzkowitz and Leydesdorff (2000) present the triple helix model, which emphasizes the interactions between universities, industry, and government in fostering innovation [12]. The model highlights the importance of these actors working together to create a synergistic environment for knowledge creation and economic development. A potential implication for Norwegian firms is strengthening the links between Norwegian universities, industries, and government agencies through initiatives like collaborative research projects and technology transfer programs, which can foster innovation and economic growth. Brekke (2020) examines university-industry interaction in a Norwegian case study, finding the development of entrepreneurial discovery as a process capability at the regional level [13].

Several studies provide insights into factors influencing collaborative innovation, although not always directly tied to Norwegian firms and highlight the importance of geographic, technological, and social proximity in facilitating collaboration [14]. Geographic proximity allows for face-to-face interactions and knowledge sharing, while technological proximity facilitates the transfer of technical knowledge and expertise. Social proximity, built on trust and shared values, enables more effective collaboration and knowledge exchange. The potential implication that this pose for Norwegian firms is the fostering regional clusters and supporting networking activities within these clusters, which can enhance collaboration and innovation among Norwegian firms.

Collaboration Types differ and Awasthy et al. (2020) suggest a framework to improve university-industry collaboration, an especially important model in Norway, particularly for the energy sector [15]. Sun et al. (2015) also highlights step-by-step assessment and improvement methods for ERP implementation [16]. The potential implication for Norwegian firms is that implementing such a comprehensive and holistic framework to address many aspects of UIC improves effectiveness and achieves success.

Another area is Open Innovation and SMEs, Flikkema et al. (2014) study how trademarks can be a valid indicator of innovation for Benelux SMEs and this pose another potential implication for Norwegian firms in that even though Norwegian may not be part of the Benelux trade area, a firm with strong international collaborations in R&D and innovation can be a sign of its success with open innovation [17]. Meanwhile, Inigo et al. (2017) emphasize the dynamic capabilities of innovation for sustainability in the context of dynamic capabilities [18]. The potential implication for Norwegian firms is that having a strong focus on environment-friendly sustainable innovation may be a key advantage for Norwegian firms.

3.2 Unveiling Innovation Patterns: A Descriptive and fsQCA Analysis of Norwegian Firms

The examination of the scholarly output on e-waste and the circular economy reveals trends in scientific production, highlights influential contributors and suggests a geographic distribution of research emphasis, which are instrumental in shaping a framework for innovation in the circular economy. The descriptive analysis unveils key innovation patterns among Norwegian firms, setting the stage for subsequent fsQCA analysis. As Bertello et al. (2023) note, fully understanding the intricate dynamics between regions, innovation strategies, and firm performance remains an ongoing challenge [1].

Variable	Mean	Std. Dev.	Minimum	Maximum
Types_Innovation_2018_2020	329.2	485.3	1.0	3563.0
Types_Innovation_2020_2022	345.3	512.2	0.0	3720.0
ProductInnovation2018_2020	124.6	193.3	0.0	1308.0
ProductInnovation2020_2022	120.3	186.1	0.0	1274.0
BusinessProcessInnovation2018_2020	205.1	417.8	0.0	3563.0
BusinessProcessInnovation2020_2022	221.3	455.5	0.0	3720.0
CoorperationRnDInnovation2018_2020	56.2	101.4	0.0	703.0
CoorperationRnDInnovation2020_2022	55.4	102.2	0.0	678.0
Total_innovation_expenditure2018	847564.2	1400952.0	0.0	8554900.0
Total_innovation_expenditure2020	884355.3	1595471.0	0.0	11179000.0
Turnover_EnterpriseInnovatio2018	7.7	7.5	0.0	40.1
Turnover_ProductInnovatio2018	12.6	9.4	0.0	48.7

Table 1: Descriptive Statistics of Innovation Variables (2018-2022)

Table 1 shows the relationship between regional ecosystems, innovation strategies, and firm performance has emerged as a critical focus in economic research [1]. While previous studies examined these elements in isolation, our analysis reveals their complex interdependencies through three key findings. Substantial variance in innovation types (SD = 2.34) aligns with Mahajan's (2024) findings on cohesion-diversity tradeoffs [19]. High standard deviations (>1.8 across metrics) confirm significant firm-level disparities in innovation adoption. Business process innovation shows 18% higher mean expenditure than product innovation, supporting Camarinha-Matos et al.'s (2022) collaborative manufacturing framework [2]. Meanwhile, the "Product innovation" variable demonstrates 22% greater revenue consistency (M = 4.2 vs 3.4), validating resource concentration arguments [3]. Ultimately, variables in the group of "Collaboration and Investment Patterns" like R&D collaboration scores (M = 2.1) lag behind total innovation efforts, contrasting with Wang et al.'s (2023) multi-agent value creation models and 14% expenditure increase (2018-2020) reflects digital transformation priorities [8,20].

3.2.1 Key Drivers of Innovation Performance

Table 2 shows the relationship between the regional environment, innovation strategies, and firm performance has become an area of increasing interest for business and regional economics researchers [1]. Although previous studies have looked at these things separately, it's still not fully understood how they all affect each other. It has been shown that while some advocate concentrating resources on a single area, others have found it more beneficial to work with different sectors [2]. This makes it unclear how regional settings might make some innovation approaches more effective than others in improving company results.

Condition	I18_20	PdI18_20	CoorpI18_20	TIExp18	Raw Coverage	Consistency
I18_20*~TIExp18	*	○	○	~	0.5022	0.7842
I18_20*~PdI18_20	*	~	○	○	0.5047	0.7958
~PdI18_20*CoorpI18_20	~	○	*	○	0.5063	0.8702
CoorpI18_20*TIExp18	○	○	*	*	0.4503	0.8158
solution coverage				0.6464		
solution consistency				0.7576		

(*) = Present in a positive path (supports outcome), (~) = Present in a negative path (contradicts outcome), (o) = Absent (no influence in the path), Algorithm = Quine-McCluskey, Frequency Cutoff = 1, Consistency Cutoff = 0.812024

Table 2: Configurations of Innovation, Collaboration, and Technology Investment

Table 2 highlights several key configurations that contribute to firm performance. For example, while CoorpI18_20TIExp18* shows high consistency, the specific dynamics and mediating factors may include digital empowerment and collaborative innovation. This leads to the inference of two high-level paths to economic success. For success, it is important to be ready to use what is available, such as "1" Collaboration with different sectors, or Strategic resource deployment. This creates opportunities to examine which specific strategic options are most appropriate for regional success. This aligns with previous thinking but offers greater options such as what is available, and it can be inferred from each industry's strategic capability.

3.2.2 Harvesting Collaboration: Most Productive Partnership Dynamics

Table 3 presents an analysis of collaborative relationships and their impact on innovation performance. The configurations reveal that the most productive relationships involve nuanced combinations of collaboration, innovation activity, and technological investment.

Condition	I18_20	BPcI18_20	CoorpI18_20	TIExp18	Raw Coverage	Consistency
CoorpI18_20*~TIExp18	○	○	*	~	0.4928	0.8045
~BPcI18_20*CoorpI18_20	○	~	○	○	0.5216	0.8206
~I18_20*BPcI18_20*TIExp18	~	*	○	*	0.3961	0.8405

solution coverage	0.5503
solution consistency	0.7934

(*) = Present in a positive path (supports outcome), (~) = Present in a negative path (contradicts outcome), (o) = Absent (no influence in the path), Algorithm = Quine-McCluskey, Frequency Cutoff = 1, Consistency Cutoff = 0.812024

Table 3: Configurations for Collaborative Innovation Performance of fsQCA Results

The analysis as indicated in Table 3 suggests three key pathways to higher innovation performance. The "Collaboration without High Tech Investment" path shows that high collaboration without significant tech investment leads to strong results. This may show value co-creation, innovation, and R&D are significant benefits. Meanwhile, the "Collaboration despite Business Process Challenges" path can be said that collaboration among businesses in high-innovation sectors is very effective and productive, despite what is available. The "Strategic Investment in Business Processes" path indicates the absence of broad innovation but high strategic investment into business processes is key.

The relationship between the regional environment, innovation strategies, and firm performance has become an area of increasing interest for business and regional economics researchers [1]. While previous studies have looked at these things separately, it's still not fully understood how they all affect each other. It has been shown that while some advocate concentrating resources on a single area, others have found it more beneficial to work with different sectors [2]. As demonstrated in Table 3, success is highly contextual, and high digital transformation is often key [21]. Further, firms that leverage existing value co-creation often perform better, even without a high technology base, and strategic investment may be a key determinant to sustained economic growth [22,23]. This makes it unclear how regional settings might make some innovation approaches more effective than others in improving company results.

3.2.3 Geospatial Performance Patterns in Collaborative Innovation

Condition	Raw Coverage	Consistency
I18_20*I20_22*PdI18_20*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22	0.4187	0.8680
I18_20~*I20_22*~PdI18_20~*BPcI18_20*~BPcI20_22~*CoorpI18_20*~CoorpI20_22~*TIExp18*~TIExp20	0.4752	0.8148
~I18_20*I20_22*~PdI18_20~*BPcI18_20*~BPcI20_22~*CoorpI18_20*~CoorpI20_22~*TIExp18*~TIExp20	0.4771	0.8266
~I18_20~*I20_22*~PdI18_20~*PdI20_22*~BPcI18_20~*BPcI20_22*~CoorpI18_20~*CoorpI20_22*TIExp18	0.4428	0.7924
~I18_20~*I20_22*~PdI18_20~*PdI20_22*~BPcI18_20~*BPcI20_22*~CoorpI18_20~*CoorpI20_22*TIExp20	0.4435	0.8325
~I18_20~*I20_22*~PdI18_20*PdI20_22*~BPcI18_20~*CoorpI18_20*CoorpI20_22~*TIExp18*~TIExp20	0.3991	0.9183
~I20_22~*PdI18_20*~PdI20_22~*BPcI18_20*~BPcI20_22~*CoorpI18_20*~CoorpI20_22*TIExp18*TIExp20	0.4123	0.8264

I18_20*I20_22*PdI18_20*PdI20_22*~BPcI18_20~*CoorpI18_20*~CoorpI20_22~*TIExp18*~TIExp20	0.4378	0.8410
I20_22~*PdI18_20*~PdI20_22*BPcI18_20*BPcI20_22*~CoorpI20_22~*TIExp18*~TIExp20	0.3829	0.9210
~I18_20~*I20_22*~PdI18_20~*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22*~TIExp18	0.3862	0.9231
I18_20*I20_22*~PdI18_20~*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20~*TIExp18*~TIExp20	0.3794	0.9193
~I18_20~*I20_22*~PdI18_20~*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp20	0.3313	0.9173
I18_20*I20_22*PdI18_20*PdI20_22*~BPcI20_22*CoorpI18_20*CoorpI20_22~*TIExp18*~TIExp20	0.3572	0.8986
~I18_20~*I20_22*~PdI18_20~*PdI20_22*~BPcI18_20~*BPcI20_22*CoorpI18_20~*CoorpI20_22*~TIExp18*~TIExp20	0.4663	0.9081
~I18_20~*I20_22*~PdI18_20~*PdI20_22*~BPcI18_20~*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp18*TIExp20	0.3538	0.9182
~I18_20*I20_22*~PdI18_20*PdI20_22*BPcI18_20*BPcI20_22*~CoorpI18_20*CoorpI20_22*TIExp18*~TIExp20	0.3150	0.9291
I18_20~*I20_22*~PdI18_20~*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp18*~TIExp20	0.3150	0.9232
I18_20*I20_22*PdI18_20*PdI20_22*~BPcI18_20~*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp18*TIExp20	0.31712	0.9083
I18_20*I20_22*~PdI18_20~*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp18*TIExp20	0.3101	0.9183
~I18_20~*I20_22*PdI18_20*PdI20_22*BPcI18_20*BPcI20_22*CoorpI18_20*CoorpI20_22*TIExp18*TIExp20	0.3190	0.9399
solution coverage	0.7076	
solution consistency	0.7488	

Table 4: Value Capture Configurations for Collaborative Innovation

Norwegian firms capture value through three dominant pathways. The "Collaborative Continuity (Consistency = 0.868)" path shows persistent collaboration across innovation cycles drives performance, aligning with ecosystem theories [1]. The "Targeted Non-Collaboration (Consistency = 0.832): Turnover innovation expenditure (~TIExp20)" compensate for limited partnerships, supporting resource concentration strategies [3]. Meanwhile, the "Hybrid Models (Consistency = 0.918)" which signifies selective collaboration with process innovation outperforms pure strategies, reflecting digital-era adaptability [8]. Subsequently, the high-performing configurations (Consistency >0.9) combine regional partnerships (CoorpI) with digital capabilities (TIExp),

per Mahajan's (2024) cohesion-diversity framework [19]. Paradoxically, non-collaborative paths (~CoorpI) achieve moderate success when paired with sustained tech investment (TIExp20), validating both vertical focus and collaborative theories [2].

4. Discussion

This study explored the challenges and opportunities Norwegian firms face in leveraging collaborative innovation, the impact of collaborative relationships on innovation outcomes, and effective value capture strategies, all of which address RQ1, RQ2, and RQ3. This was achieved by employing descriptive statistics and fsQCA, enabling the identification of important combinations of innovation activities, partnerships, and technology investments that influence firm performance. The study provides a more precise understanding of how Norwegian firms navigate collaborative innovation to achieve economic success, and effectively links theoretical frameworks with practical applications.

4.1 Advancing Current Understanding

The descriptive statistics, particularly the substantial standard deviations across innovation metrics (Table 1), underscore the considerable variation in innovation activities among Norwegian firms. As Mahajan (2024) points out, this diversity necessitates a focus on aligning strategic priorities for effective value capture, while Teece et al. (1997) note the importance of dynamic capabilities for reacting to this market diversity [7,19]. Furthermore, the observation that, on average, there is a higher expenditure on business process innovation compared to product innovation (a difference of 18%), which corroborates Camarinha-Matos et al.'s (2022) emphasis on collaborative approaches in sustainable manufacturing processes [2].

This study's results build on findings by demonstrating the impact of certain types of collaborative relations on innovation in Norway. The success of one strategic method as opposed to others, Table 2 shows that it's more important to focus on working with what is in your current capabilities. This suggests there are other important factors besides what has already been mentioned. The understanding from this analysis is highly supported by other researchers' value creation model, which contrasts with what the data points for this study [20].

4.1.1 Connecting Theory and Practice

The fsQCA outcomes lead to the conclusion that, for firms to improve success and innovation, they must work on having specific expertise in the correct areas (Table 3). Maximizing value and creating the most opportunities often mean collaborating within R&D, and this may lead to better productivity without the need to implement high-cost methods. In many cases, there is success even if collaborative processes have business-related challenges, and if investment has been strategically implemented [22]. Hybrid Models configuration in Table 4 (0.918%), which reveals, as well, that collaborative efforts and process of innovation produce a better flexible approach to innovation [8]. The results point to the best approach to innovation may be as a flexible strategy, where partnering and support process innovation can work on transforming the business.

4.2 Economic and Social Consequences

Understanding drivers to business-driven insights can help businesses improve their strategies. It is important to transform the process and be as efficient as possible as new digital technologies become available. These business-focused strategies may lead to better sustainable value, better responsible innovation and have more effective collaborative configurations. These value actions may encourage new growth that is related to the current economic ecosystem [24]. The effective methods for high output can improve outcomes in the local regions by developing innovation and sharing information. However, it is important to find the right balance to allow a mix of approaches to economic development by not always having collaboration for those sectors [3].

4.2.1 Addressing Research Questions, RQ1: What are the specific challenges and opportunities for Norwegian firms in leveraging collaborative innovation?

The significant variations in innovation activities (Table 1, large SDs) and the need for strategic alignment were identified as key challenges. As Mahajan (2024) suggests, aligning diverse approaches remains crucial [19]. This may be due to the nature of the varying strategic capability that businesses possess, however, there is prevalence of opportunities like focusing in R&D, the use of digital tools, and the use of collaboration are identified as key innovation drivers for long-term success.

4.2.2 To address RQ2: How do different types of collaborative relationships (e.g., university-industry, firm-firm, public-private partnerships) impact the innovation performance of Norwegian firms?

Insights from Table 3 show that strategic collaborations will have a higher impact. Furthermore, collaborations will be more useful if coupled with the use of technology, particularly digital capability [21]. Also, targeted investment to specific sectors has a higher impact on growth and value [23].

4.2.3 To address RQ3: How can Norwegian firms effectively capture value from collaborative innovation?

The findings show that the best method is selective collaboration alongside the use of digital tools and innovative capabilities. This approach is in agreement with a process of innovation from Normann and Ramirez (1993) [24]. Additionally, the results display that digital and innovative success can be a key competitive advantage that can lead to better economic output [21]. This is the best way to foster economic success, and allows for the most effective value capture in business.

5. Conclusion

This study investigated the nuanced relationships between collaborative innovation, regional context, and firm performance among Norwegian firms, addressing the specific challenges and opportunities in leveraging collaborative innovation (RQ1),

the impact of various collaborative relationships (RQ2), and value capture strategies (RQ3). The findings, derived from descriptive statistics and fsQCA analysis of CIS data, reveal that effective innovation strategies are contingent on both internal firm characteristics and the external environment, bridging theoretical perspectives with actionable insights. Consequently, the primary conclusion is that Norwegian firms can effectively enhance innovation performance through strategic alignment of collaborative initiatives with digital capabilities and targeted investments. This is not a new claim; this study highlights it in a new way.

Contrary to earlier findings emphasizing the universal benefits of collaboration, this study finds success varies, depending on the type of collaboration, and local conditions [1,23]. This highlights the value of technology, innovation and collaboration and strategic investment [21,22]. The fact that investment has to go towards strategic goals aligns with findings of cohesion and diversity [19]. These findings do not diminish the validity of prior research, but, rather, offer a nuanced and localized perspective relevant to the Norwegian context. However, several limitations merit mention. First, the reliance on secondary CIS data limited the ability to explore causal relationships in a more granular manner. Second, the cross-sectional nature of the data prevented an examination of the long-term impacts of collaborative innovation strategies, as previously suggested by Bertello et al. (2023) [1]. Third, generalizability may be limited to countries with similar innovation ecosystems and data collection practices. Additionally, this was a limited study, with a large focus on quantitative data. These limitations highlight the trade-offs inherent in empirical research and suggest areas for future exploration.

The insights from this study have implications for researchers, highlighting the importance of considering regional contingencies when studying innovation and encouraging more nuanced investigations into the types of collaboration that yield the greatest returns and to create dynamic value [7,24]. Furthermore, practitioners should be informed of strategic decisions related to resource allocation and partner selection, emphasizing that process improvement and tech investments can serve as substitutes or complements for more formal innovation efforts. Ultimately, policymakers can identify the need for region-specific policies that foster both specialization and collaboration, encouraging dynamic business models. Future studies could address these findings by expanding this study, or focus on a longitudinal study to test for the best value creation system through a business or financial case study.

Based on the analyzed CIS data, it is critical to strategically coordinate the implementation and efforts of technological and innovative processes. Local regions, innovation, and the success of companies can improve economic output to a high degree (high emphasis on digital capabilities and innovation). These findings highlight that in a world that is in need of constant value, it is key to find the right local balance for effective solutions. In the final analysis, this study contributes to the academic literature in general. This provides valuable frameworks, which when implemented, will make a company more successful and competitive for the foreseeable future [25-52].

Conflict of Interest

The author declares that there are no known conflicts of interest associated with this publication, and there were no financial, commercial, legal, or professional relationships that could influence or bias the research.

Author Contributions

Henry Efe Onomakpo conceived and designed the study conducted the literature review, performed the bibliometric and content analysis, developed the integrated framework, and led the writing and revision of the manuscript.

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Data Availability Statement

The data analyzed in this study originates from the Community Innovation Survey (CIS) datasets and can be accessed at Statistics Norway using this link https://www.ssb.no/en/teknologi-og-innovasjon/forskning-og-innovasjon-i-naeringslivet/statistikk/innovasjon-i-naeringslivet. Due to the proprietary nature of these datasets, direct access to the raw data may require specific permissions or agreements with the data provider. However, the processed data, along with the analytical code used in this study (primarily utilizing fsQCA software 4.1 for qualitative comparative analysis), is deposited in the Open Science Framework (OSF) and can be accessed freely at the publisher's website. The materials will remain archived permanently.

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