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Market-oriented innovation in Hungarian clusters: leveraging strategic capabilities

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Abstract

Purpose – This study aims to empirically examine how Hungarian-accredited innovation clusters leverage strategic and innovation capabilities to promote market-oriented innovation through enhanced intra-cluster cooperation, particularly under conditions of declining and inconsistent state support. It examines how strategic capabilities, rather than external support, enable clusters to maintain competitiveness and orientation.

Design/methodology/approach – A mixed-methods approach is used, combining qualitative and quantitative analyses. The qualitative phase involved interviews with key cluster stakeholders, which helped develop the hypotheses and scale items. The quantitative phase surveyed 120 member companies across diverse industries, including information and communications technology, healthcare and machinery. Factor analysis and correlation analysis were employed to assess the relationships between strategic capabilities, intra-cluster cooperation and market orientation, ensuring methodological rigor.

Findings – The results show that strategic and innovation capabilities significantly improve intra-cluster cooperation, which positively impacts market orientation. Effective coordination and information flow among cluster members are essential for market-driven innovation outcomes. However, a weaker focus on competitor orientation emerged, highlighting an area for improvement in clusters' strategic focus. The research demonstrates how clusters can sustain innovation through internal collaboration and capabilities, even with fluctuating external support.

Originality/value – This study adds to the theoretical discourse on market-oriented innovation by providing empirical evidence from Hungarian clusters, a context underexplored in prior research. It extends existing market orientation frameworks by showing the importance of intra-cluster cooperation and internal capabilities for maintaining market relevance, especially in emerging markets. The findings offer practical insights for cluster managers and policymakers on fostering innovation when state support is inconsistent.

Keywords Innovation clusters, Strategic and innovation capabilities, Market orientation, Innovation, Cooperation

Paper type Research article

Introduction

Innovation is pivotal in driving economic growth and technological advancement through the creation of customer value and market orientation (Broughel & Thierer, 2019; Mahmoud, Hinson, & Anim, 2017). Despite extensive research on innovation, a significant gap persists regarding how market-oriented innovation can be explicitly fostered within collaborative settings, such as innovation clusters, especially in emerging markets like Hungary.

Innovation clusters have attracted attention due to their role in facilitating collaboration, knowledge sharing, and innovation (Hamdouch, 2008; Kuczevska & Tomaszewski, 2022). However, their role in promoting market-oriented innovation remains underexplored, particularly amid fluctuations in governmental support.

In Hungary, accredited clusters have become critical in the national innovation landscape, initially stimulated by government initiatives (Pecze, 2019; Kiss & Lukács, 2021). Recent



reductions and uncertainties in state funding raise concerns about clusters' ability to sustain market-oriented innovation independently, highlighting a crucial research gap.

To address this, the present study empirically examines how Hungarian-accredited innovation clusters leverage strategic and innovation capabilities to enhance intra-cluster cooperation and sustain market-oriented innovation despite inconsistent state support. Engaging with recent literature (Alberti, Belfanti, & Giusti, 2021; Bărbulescu, Nicolau, & Munteanu, 2021; Yang, Wei, Shi, & Zhao, 2020), this research enriches theoretical understandings of cluster dynamics in transitional economies and offers practical recommendations for cluster managers and policymakers regarding capability development and cooperation in uncertain funding environments.

Literature review

To understand how Hungarian-accredited innovation clusters promote market-oriented innovation through enhanced intra-cluster cooperation under fluctuating state support, this literature review explicitly addresses four interrelated areas: market orientation, strategic and innovation capabilities, intra-cluster cooperation, and the impact of inconsistent state support. This structured approach provides a clear theoretical foundation for empirically investigating these dynamics within the Hungarian context.

Market orientation in innovation clusters

Market orientation is crucial within innovation clusters, as it ensures that innovative activities closely align with market demands and customer needs, thereby underpinning their effectiveness and sustainability (Ozkaya, 2015; Yang & Yan, 2019; Bărbulescu *et al.*, 2021). Innovation clusters, defined as geographically proximate groups of interconnected companies, academic institutions, and research organizations, facilitate collaboration, knowledge sharing, and innovation through collective efforts (Hamdouch, 2008; Pop, 2020; Kuczevska & Tomaszewski, 2022). Despite this recognition, the role clusters play in explicitly promoting market-oriented innovation remains underexplored, particularly in settings with fluctuating state support.

Market orientation encompasses several organizational perspectives: a behavioral approach emphasizing proactive market information collection, sharing, and responsiveness (Kohli & Jaworski, 1990); a cultural view rooted in customer, competitor, and inter-functional coordination that inherently drives customer value (Narver & Slater, 1990); and a strategic perspective highlighting market orientation as a crucial asset for achieving corporate goals through effective resource allocation and market insight (Ruekert, 1992; Hunt & Morgan, 1995). Integrating these perspectives provides a comprehensive understanding of how market orientation supports organizational innovation and strategic alignment.

Within innovation clusters, firms leverage strategic and innovation capabilities to strengthen intra-cluster cooperation, thereby enhancing their market orientation. Such clusters facilitate the sharing of critical market intelligence, awareness of competitors, strategic responses to competition, and the acceptance of synergy-driven innovation (Connell, Kriz, & Thorpe, 2014; Giachetti & Dagnino, 2021; Alberti *et al.*, 2021; Li & Liu, 2023). They also enhance organizational adaptability and optimize resource use, aligning innovations with evolving market needs (Zhang & Li, 2010; Renna, 2013).

Maximizing these benefits requires clusters to consistently embed market orientation into their innovation processes. This involves fostering open communication, maintaining a customer-centric focus, and strategically leveraging cluster networks to respond dynamically to market trends (Pop, 2020; Tuominen, Reijonen, Nagy, Buratti, & Laukkanen, 2022; Yang *et al.*, 2020). Such integration is essential for achieving sustained market relevance and innovation excellence.

Although existing research highlights the significance of market orientation (Ozkaya, 2015; Yang & Yan, 2019; Šlogar, 2021), these frameworks are rarely empirically tested within transitional economies like Hungary, where institutional supports and market conditions differ substantially from those in developed contexts, underscoring a critical research gap that this study addresses.

Strategic and innovation capabilities in clusters

Strategic and innovation capabilities are fundamental for achieving market-oriented innovation, particularly within clusters operating in transitional economies such as Hungary (Nelson & Winter, 1982; Birchall & Tovstiga, 2005). These capabilities involve efficiently coordinating resources, aligning strategic direction with market demands, and effectively utilizing consumer insights (ALTaweel & Al-Hawary, 2021; Cillo & Verona, 2022).

Literature emphasizes that interorganizational coordination and information flow significantly influence the market orientation of clusters. Effective internal coordination facilitates market-oriented innovation outcomes across organizational levels through strategic foresight and adaptability (Mukhtar, 2023). Strategic orientation thus becomes an essential asset within clusters, enabling organizations to leverage technical expertise and market intelligence to respond to competitive landscapes (Denicolai, Zucchella, & Moretti, 2017; Utkin, 2022). Collaboration in clusters thrives on trust, established networks, and shared goals (Ford, Håkansson, & Johanson, 1986; Håkansson & Snehota, 1995; Cooke, 2001), further enhancing innovation speed and market responsiveness (Cheng & Sheu, 2017; Kovács, 2023).

Integrating R&D and marketing functions remains challenging, particularly for larger organizations where complexities in alignment exist (Atuahene & Evangelista, 2000). However, smaller entities may leverage a more integrated approach that combines technical and marketing expertise to boost responsiveness. Clusters' supportive infrastructures can help overcome these challenges by promoting strategic capabilities and fostering communication and cooperation, thus enhancing market alignment of innovations (Kovács, 2019).

Capabilities such as information dissemination, proactivity, and innovation significantly influence the collective market orientation and competitive position of clusters (Ozkaya, Droge, Hult, Calantone, & Ozkaya, 2015; Yang *et al.*, 2020). Deficiencies in these capabilities can hinder effective communication and cooperation, thereby limiting the innovation potential of clusters. Hence, understanding and enhancing these capabilities is crucial, especially in transitional economies facing inconsistent external funding, such as Hungary, where empirical insights remain limited.

Intra-cluster cooperation and the role of state support

Intra-cluster cooperation is critical within transitional economies facing inconsistent or declining state support, such as Hungary. The efficacy of such clusters significantly depends on the mutual exchange of knowledge, resources, and expertise among participating organizations. A cooperative atmosphere nurtures a culture of trust and open communication and enhances innovation and competitiveness (Keane & Costin, 2019; Alberti *et al.*, 2021).

Studies underscore that trust, established network connections, and past collaborations are foundational to successful cluster collaborations (Alberti *et al.*, 2021). These factors accentuate the significance of organizational capabilities within clusters. Expectations are increasing for elevated interorganizational collaboration skills, particularly compared to past achievements. The strategic and innovative prowess of individual member organizations, including their practices in knowledge sharing, proactiveness, and innovation, profoundly influences the market orientation within the collaborative framework of the cluster (Kong, Xu, & Zhu, 2019). Notably, identified deficiencies in skills and cooperative activities within Hungarian innovation clusters indicate an urgent need for improved communication and cooperation capabilities (Kovács & Petruska, 2020). Enhancing these capabilities should be a

primary objective for collaborating entities and is deemed a critical responsibility of cluster management.

Existing literature highlights that market orientation, strategic and innovation capabilities, and intra-cluster cooperation collectively influence innovation outcomes. These dynamics are particularly crucial in contexts characterized by inconsistent state support. However, how these dynamics operate in transitional economies such as Hungary remains significantly underexplored. This represents a clear gap that this study aims to address.

Hypothesis development

Given the literature highlighting the central role of strategic and innovation capabilities, market orientation, and intra-cluster cooperation, the following hypotheses are proposed:

- H1.* The strategic and innovation capabilities of cluster member firms significantly influence intra-cluster cooperation, subsequently affecting firm market orientation and the market orientation of intra-cluster innovations.
- H1a.* Strategic and innovation capabilities enhance innovation through collaboration within the cluster.
- H1b.* Firms with strong strategic and innovation capabilities demonstrate a more distinct market orientation.

Considering the dynamic interplay between cooperation and market orientation within clusters, we propose:

- H2.* Interorganizational coordination and information flow significantly affect the market orientation of cluster member firms, with intra-cluster cooperation and market orientation jointly determining the market orientation of innovations.
- H2a.* The interplay of intra-cluster cooperation and market orientation significantly shapes the market orientation of innovations.

Methodology

This study employed a mixed-methods approach, combining qualitative and quantitative methods, to explore how strategic and innovation capabilities foster market orientation within Hungarian-accredited innovation clusters, particularly under declining and inconsistent state support. While the full research involved three phases, this paper focuses exclusively on the final quantitative phase, which was designed to test hypotheses developed during the earlier qualitative research empirically.

The qualitative phase used grounded theory (Sallay & Martos, 2018), involving in-depth interviews with key stakeholders. Initially, professional face-to-face interviews reached representatives from 20 of Hungary's 21 accredited innovation clusters (95% coverage). A subsequent qualitative step included additional interviews with 40 member companies. Insights from these qualitative phases directly informed the development of hypotheses and measurement scales applied in the quantitative analysis; however, detailed qualitative findings are not presented here.

The quantitative phase, central to this paper, assessed how strategic and innovation capabilities, as well as intra-cluster cooperation, influence member firms' market orientation. The survey targeted 984 organizations active in Hungarian clusters (2021–2022), resulting in a final sample of 120 diverse respondents, including SMEs, startups, large corporations, and academic institutions. The sectors represented were strategically important within Hungary's innovation landscape, primarily information and communications technology (ICT) and healthcare.

A hybrid survey approach combined online questionnaires with supplemental face-to-face or telephone interviews for more detailed responses. Sampling methods involved a combination of snowball sampling (recommended by cluster managers) and direct contact from cluster databases, ensuring diversity and mitigating potential sampling biases. Ethical considerations, such as confidentiality, anonymity, and informed consent, were consistently maintained.

Quantitative data analysis employed descriptive and inferential statistical methods, specifically factor and correlation analyses, to examine the relationships among strategic capabilities, cooperation, and market orientation constructs. The survey instruments, scales, and items were carefully pre-tested and validated based on qualitative insights, ensuring methodological rigor and robust statistical verification.

Previous studies have typically relied on theoretical analyses or limited case studies (e.g. Grosz, 2003). By integrating extensive qualitative grounding with rigorous quantitative validation and explicitly addressing sampling bias concerns through complementary methods, this comprehensive methodological approach ensures robust empirical foundations for reliably testing hypotheses.

Sample composition

The survey included 120 member organizations, which were primarily led by 50 managers, 18 owners, directors, cluster coordinators, 12 employees, and four R&D directors. The sample mostly comprised organizations with functional structures (46) and divisional product-based facilities (38). Regarding export activity, 50 indicated a medium level and 34 had a low level. The sample was predominantly composed of medium-sized companies (54) but also included smaller enterprises (34) and large corporations (32).

In Hungary, the industry composition of accredited innovation clusters identifies ICT as the predominant sector as it comprises 30% of the clusters. This is followed by machinery and health, each at 19%, then food and environment at 12%, and, finally, wood, furniture, and packaging at 4% (Területfejlesztési miniszter, 2023). Our data collection reflects these categories but with different proportions: ICT at 33%, machinery at 34%, food at 25%, packaging at 18%, healthcare at 12%, and environment at 5% (*the percentages exceed 100% because organizations often participate in multiple clusters*).

The data reveals a significant concentration of companies in the machinery sector. However, the impact of this concentration is lessened by the fact that many ICT companies also belong to other industry clusters, particularly those associated with mechanical engineering, including the automotive sector. This crossover, which was highlighted in our qualitative research, illustrates the interconnected nature of these industries within the innovation clusters.

Due to the primary focus of our study on market orientation and the strategic and innovative capabilities that influence it, this paper will not analyze respondents' demographics and their specific roles in the field of cooperation. This decision allows us to concentrate our discussion and findings on the core aspects of market orientation within clusters.

Adapting and validating measurement scales

In our research, we employed various measurement scales to assess critical variables. All items were scored using a seven-point Likert scale to ensure a consistent framework for respondents' evaluations across different measures.

We applied the Narver and Slater (1990) multi-item scale to assess market orientation within Hungarian-accredited innovation clusters. This scale measures consumer orientation, competitor orientation, and interorganizational cooperation. After examining the scale's structural validity for our context, we adapted it to reflect the unique characteristics and dynamics of the clusters. We developed statements based on the factors identified during our qualitative research phase regarding strategic and innovation capabilities and cooperation

types. This approach allowed us to tailor the measurements to reflect the characteristics and dynamics observed in the Hungarian-accredited innovation clusters. By building on empirically grounded factors, we aimed to enhance the precision and relevance of our assessments.

Our statistical analysis included the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity, and Cronbach's alpha to confirm the data's suitability for factor analysis and ensure the reliability of the scales. The KMO test verified the adequacy of our sample size (Nkansah, 2018), while Cronbach's alpha (Vaske, Beaman, & Sponarski, 2017) and composite reliability (CR) measurements, including the average variance extracted (AVE), supported the internal consistency and convergent validity of our constructs (Santos & Cirillo, 2021). These rigorous statistical methods affirmed the scale's applicability and enhanced the precision and relevance of our findings, thereby allowing us to robustly interpret the complex relationships within our data.

Results

Variable Construction and inclusion in the analysis

Table 1 displays the statistical results for Market Orientation, Strategic and Innovation Capabilities, and Cooperation type. The KMO scores surpass 0.8, indicating high suitability for factor analysis and confirming adequate sample size and variable interrelationships. For most factors, Cronbach's alpha values exceed 0.8, indicating strong internal consistency, except for Proactiveness, which scored 0.51. CR for all factors exceeds 0.7, demonstrating good consistency, although Proactiveness falls short with an AVE below 0.48, signaling weaker validity. Despite these lower scores, Proactiveness was retained due to its importance to our research framework. Further studies are needed to validate this factor's reliability and applicability in different contexts.

This analysis enabled us to refine the conceptualization of market orientation based on a Varimax rotation and to closely align it with Narver and Slater's (1990) framework. We also extended Consumer Orientation to encapsulate the information exchange among member organizations within clusters, which also pertains to consumer behavior and market interactions. Consequently, Market Orientation was delineated by three principal factors: Customer Orientation and Information Exchange, Interorganizational Coordination, and Competitor Orientation.

We identified seven distinct factors for Innovation and Strategic Capability: Information Dissemination, Product Development, Internal Innovation, Responsiveness, and Technological Capability. These are recognized as internal corporate capabilities. Additionally, Innovativeness and Proactiveness were categorized as sectoral capabilities. Our subsequent analysis delved deeper into these seven factors to thoroughly assess strategic and innovation capabilities.

Regarding types of cooperation, our study investigated Exploring Sales, R&D Activities, and Other Joint Activities. These factors emerged as significant in both the initial stages of qualitative research and in the data presented in Table 1, and they encapsulated our third main area of study: cooperation.

Exploring member companies' strategic and innovation abilities

Building on the analyses in Table 1, we tested our hypotheses using the previously defined indicators and their associated factors. We conducted a correlation analysis to determine the relationship between strategic and innovation capabilities and types of cooperation. The results of this analysis are detailed in Table 2.

The analysis reveals several key findings. Collaborative efforts in sales activities and proactiveness show a moderately strong connection. Similarly, there is a moderate correlation between information dissemination capabilities and sales activities. These connections are

Table 1. Research measurements and result

	Factors	Items	Factor loading	CR & AVE values	
Market Orientation ^a KMO = 0,87 Total Variance Explained = 74% Bartlett's Test of Sphericity Approx. Chi-Square = 937.43 df = 66 Sig. = 0.000	Customer Orientation and Information Exchange Between the Organisation and Its Customers	In our R&D activities, we share a common competitive strategy centered around comprehending consumer requirements	0.84	CR = 0.85	
		Our collaboration with partners revolves around a commitment to delivering quality to our customers	0.80	AVE = 0.54	
		We aim to align corporate functions across companies engaged in the project to address market demands effectively	0.78		
	<i>Cronbach's Alpha = 0.88</i>	Inter-Organizational Coordination	When formulating our objectives and strategies for R&D, our primary emphasis is on enhancing customer satisfaction	0.67	
			The exchange of customer-related information flows seamlessly among all stakeholders	0.52	
			Our collaborative R&D efforts are strategically directed toward consumer segments where we hold a competitive edge	0.80	CR = 0.81
	<i>Cronbach's Alpha = 0.84</i>	Competitor Orientation	Senior leadership within the participating organizations routinely discusses competitors' strengths and weaknesses	0.73	AVE = 0.52
			We consistently assess and monitor consumer satisfaction in our initiatives	0.69	
			Customer feedback is pivotal in guiding decision-making within our joint R&D projects	0.66	
	<i>Cronbach's Alpha = 0.82</i>		Senior executives from the collaborating organizations frequently engage with key customers	0.86	CR = 0.84
Our sales teams exchange information about competitors			0.82	AVE = 0.63	
		We possess the agility to respond to competitive moves promptly	0.70		

(continued)

Table 1. Continued

	Factors	Items	Factor loading	CR & AVE values	
Strategic and Innovation Capabilities ^a KMO = 0.81 Total Variance Explained = 82% Bartlett's Test of Sphericity Approx. Chi-Square = 1722.73 df = 136 Sig. = 0.000	Internal Competencies	Information Dissemination <i>Cronbach's Alpha = 0.93</i>	Information about our competitors' activities often reaches the right employee after it is ready for use	0.92	CR = 0.94
			The information that affects our relationships with our consumers takes an eternity to reach the right employee	0.92	AVE = 0.81
			Important information about our consumers is often "lost in the system"	0.91	
		Product Development <i>Cronbach's Alpha = 0.88</i>	Information about our target market (regulation, technology, etc.) is often lost in the company's communication chain	0.84	
			We develop and market (export) our products quickly	0.92	CR = 0.88
			We develop new products (exports) to capitalize on our R&D investments	0.81	AVE = 0.65
			We can also apply rapid development systems to new products for the market (export)	0.78	
		Internal Innovation <i>Cronbach's Alpha = 0.91</i>	We successfully launched our new products (export)	0.68	
			Developing an innovation strategy also enhances employee skills	0.89	CR = 0.89
			Part of monitoring our innovation strategy is to improve employee engagement, morale, or both	0.85	AVE = 0.74
		Responsiveness <i>Cronbach's Alpha = 0.86</i>	Internal cooperation is an integral part of the implementation of our innovation strategy	0.84	
			We react quickly to competitive activities that threaten our target markets	0.85	CR = 0.88
			We react quickly to changes in our business environment (e.g. regulation, technology)	0.83	AVE = 0.70
		Technological Capabilities <i>Cronbach's Alpha = 0.84</i>	We react quickly to the price changes of our competitors in our target markets	0.83	
			The success of our R&D activities is based on long-term know-how	0.88	CR = 0.71
		We have invested quite a lot in specific R&D projects	0.62	AVE = 0.47	
		Our technological capabilities are first-class	0.49		

(continued)

Table 1. Continued

	Factors	Items	Factor loading	CR & AVE values	
Cooperation Types ^a KMO = 0.86 Total Variance Explained = 76% Bartlett's Test of Sphericity Approx. Chi-Square = 1548,24 df = 91 Sig. = 0.000	Sectoral Competencies	Innovativeness	0.89	CR = 0.92	
		<i>Cronbach's Alpha = 0.93</i>	Our company is a leader in developing new products/services	0.88	AVE = 0.65
			Our company is at the forefront of new methods and technologies in the industry	0.88	
	Our company often tests new ideas		0.84		
	Our company often tests new solutions with new activities		0.73		
	Our company tries to be creative		0.60		
	Proactiveness	We take every opportunity to seize opportunities in our target market operations	0.88	CR = 0.71	
		<i>Cronbach's Alpha = 0.51</i>	We are looking for opportunities in our target market before our competitors	0.73	AVE = 0.48
			We act opportunistically to shape the business environment in which we operate	0.34	
	Exploring Sales Opportunities	<i>Cronbach's Alpha = 0.89</i>	Investigate potential sales prospects within the domestic market (outside cluster members)	0.88	CR = 0.87
			Investigate potential sales prospects in export markets	0.87	AVE = 0.50
		Explore sales opportunities among cluster members	0.84		
		Share information related to the internal market	0.61		
		Share information about the external market	0.61		
		Investigate opportunities for logistical cooperation	0.58		
Explore possibilities for joint procurement		0.50			
R&D Activities	<i>Cronbach's Alpha = 0.95</i>	Exchange R&D concepts	0.92	CR = 0.91	
		Engage in collaborative R&D endeavors	0.92	AVE = 0.78	
		Test R&D concepts collectively	0.81		
Other Joint Activities	<i>Cronbach's Alpha = 0.92</i>	Participate in exhibitions together	0.91	CR = 0.91	
		Collaborate on tender submissions	0.90	AVE = 0.73	
		Undertake joint projects	0.88		
		Share experiential knowledge	0.73		

Note(s): ^aMeasured by 7-point Scale (1 = Not at all typical, 7 = Completely typical)

Source(s): The author

Table 2. Correlation between strategic and innovation capabilities and cooperation activities

	Sales opportunities		R&D activities		Other collaborative activities		Overall cooperation activities		
	Correlation	Significance	Correlation	Significance	Correlation	Significance	t-value	Significance	Correlation
Information dissemination	0.224**	0.014	-0.005	0.960	0.222**	0.015	-	-	-
Product development	0.180**	0.049	0.363***	0.000	0.262***	0.004	-	-	-
Internal innovation	0.150	0.102	0.237***	0.009	0.437***	0.000	-	-	-
Responsiveness	0.068	0.459	-0.019	0.840	0.153	0.095	-	-	-
Technological	0.145	0.115	0.447***	0.000	0.332***	0.000	-	-	-
Innovativeness	0.140	0.126	0.351***	0.000	0.324***	0.000	-	-	-
Proactiveness	0.254***	0.005	0.182**	0.047	0.099	0.282	-	-	-
Overall internal competencies	-	-	-	-	-	-	-0.102	0.919	0.347***
Overall sector-specific competencies	-	-	-	-	-	-	2.072	0.040	0.305***
Overall competencies	-	-	-	-	-	-	4.849	0.000	0.285***

Note(s): *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Source(s): The author

crucial within clusters where member organizations must proactively share information to seize sales opportunities and access new markets. Effective information sharing also promotes knowledge flow within the cluster, which aids in identifying market opportunities.

R&D activities exhibit a moderately strong positive correlation with innovativeness, technological expertise, product development, and proactiveness. However, they display a weaker negative correlation with information dissemination skills. These strategic and innovation capabilities are vital in successful joint innovation efforts within clusters.

Other collaborative activities have a moderately strong correlation with internal innovation capabilities, while information dissemination abilities have a weaker connection. A proactive approach and effective information sharing are essential for participation in exhibitions and joint projects, and they influence cooperation in acquiring new customers and market insights.

The separate β -test confirmed a relationship between overall capabilities and cooperation activities, albeit weaker than medium. In summary, the correlation analysis highlights the impact of strategic and innovation capabilities on collaboration, which influences the type of innovation projects undertaken.

The results from the correlation analysis indicate that strategic and innovation capabilities influence cooperation, which subsequently impacts the type of innovation projects undertaken. Consequently, this finding confirms our first sub-hypothesis (H1a), which posits *that strategic and innovation capabilities enhance innovation through collaboration within the cluster*.

Next, the study explored the potential correlation between strategic and innovation capabilities and various aspects of market orientation within collaborative efforts. The findings are detailed in Table 3. It is important to note that in this context, market orientation was assessed in relation to collaborations within the cluster. Here, the cluster is seen as an organization with multiple departments or divisions that correspond to its member firms.

Responsiveness and information dissemination capabilities do not have a significant correlation with customer orientation and interorganizational customer information dimensions. However, internal innovation capabilities significantly impact customer orientation in collaborative projects and information exchange among organizations. Robust internal innovation capabilities also influence customer orientation within intra-cluster collaborations.

All internal and sectoral capabilities have a moderately strong correlation with interorganizational coordination, and they align with the primary goal of intra-cluster collaborations to enhance member firms' innovativeness. Furthermore, these capabilities are associated with competitive orientation as they cover skills needed for informed R&D and strategic decisions.

The analysis demonstrates a strong relationship between internal and sectoral capabilities and the market orientation indicator. This supports hypothesis (H1b) that companies with robust capabilities tend to exhibit a more pronounced market orientation, thereby confirming that firms with intense strategic and innovation capabilities display a more distinct market orientation. Consequently, we can confidently accept this sub-hypothesis.

In conclusion, member firms' strategic and innovation capabilities significantly influenced intra-cluster cooperation. This finding validates our central hypothesis that these capabilities critically affect intra-cluster cooperation and subsequently affect the market orientation of firms and the market orientation of intra-cluster innovations. Therefore, we can accept the central hypothesis based on the evidence presented.

Analysis of market orientation

In this part of our research, we delved into which aspects of market orientation mattered the most in the context of innovation projects within the clusters. To evaluate the second hypothesis, we calculated the value for each dimension of market orientation (Table 1) by taking the simple arithmetic average of the values assigned to the variables associated with

Table 3. Analysis of the correlation between dimensions of market orientation and strategic and innovation capabilities

	Customer orientation & information exchange between the organizations		Inter-organizational coordination		Competitor orientation		Market orientation		Correlation
	Correlation	Significance	Correlation	Significance	Correlation	Significance	t-value	Significance	
Information dissemination	0.075	0.414	0.180**	0.049	0.183**	0.046	–	–	–
Product development	0.260***	0.004	0.310***	0.001	0.190**	0.037	–	–	–
Internal innovation	0.389***	0.000	0.586***	0.000	0.195**	0.033	–	–	–
Responsiveness	0.123	0.182	0.308***	0.001	0.241***	0.008	–	–	–
Technological	0.308***	0.001	0.519***	0.000	0.348***	0.000	–	–	–
Innovativeness	0.346***	0.000	0.570***	0.000	0.315***	0.000	–	–	–
Proactiveness	0.415***	0.000	0.453***	0.000	0.435***	0.000	–	–	–
Overall internal competencies	–	–	–	–	–	–	4.430	0.000	0.442***
Overall sector-specific competencies	–	–	–	–	–	–	7.310	0.000	0.528***
Overall competencies	–	–	–	–	–	–	10.958***	0.000	0.462***

Note(s): *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Source(s): The author

each factor on a seven-point scale. Additionally, we determined the overall value of market orientation by computing the simple arithmetic average of the values from all the variables across the entire scale, which included 12 statements. The results of these calculations are detailed in [Table 4](#).

Our study's results underscore the pivotal role of effective communication in fostering market-oriented innovation within clusters. Notably, the dimensions of customer orientation and interorganizational customer information received the highest scores, averaging 5.38. This high rating illustrates the profound impact of communication in understanding and responding to customer needs and preferences, which is fundamental for successful market-oriented strategies.

The negligible difference between the scores for customer orientation and interorganizational coordination, which scored an average of 5.36, highlights an overlapping influence. This overlap indicates that elements essential to effective coordination, such as sharing critical market and operational insights across organizations, are integral to maintaining a strong customer focus. This finding suggests that customer orientation within clusters heavily depends on the fluid exchange of information, which aligns different organizational activities with customer expectations and market trends.

Conversely, the dimension of competitor orientation, which scored notably lower at 4.61, points to potential areas for improvement in how clusters monitor and respond to competitive dynamics. The lower score in competitor orientation relative to customer orientation and interorganizational coordination underscores a possible gap in the communication and utilization of competitive intelligence, which could be critical in enhancing the overall market responsiveness of the clusters.

We explored how intra-cluster cooperation and market orientation might influence the overall level of market orientation by examining the relationship between cooperative activities and market orientation levels. The results are presented in [Table 5](#).

The analysis reveals that each dimension of market orientation is linked to specific cooperative activities. Regarding sales activities, customer and competitor orientation show a moderately strong, positive correlation. As expected, the customer orientation dimension includes the sharing of customer-related information among collaborating actors. This suggests that member companies often prioritize the sharing of market, customer, and competitor information to enhance the success and marketability of innovation projects during product introduction.

In the context of R&D activities, there is a moderately strong correlation between customer orientation and interorganizational customer information. Since most member companies

Table 4. Aspects of market orientation among member firms

	Descriptive statistics			t-test values		
	N	Average	Standard deviation	Customer orientation and information exchange between the organizations	Inter-organizational coordination	Competitor orientation
Customer orientation and information exchange between the organizations	120	5.38	1.1243	–		
Inter-organizational coordination	120	5.36	1.0811	0.241	–	
Competitor orientation	120	4.61	1.2587	7,701***	7,344***	–
Market orientation	120	5.18	0.9945			

Note(s): *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Source(s): The author

Table 5. Links between cooperation types and the dimensions of market orientation

	Sales opportunities		R&D activities		Other collaborative activities		Overall cooperation activities		
	Correlation	Significance	Correlation	Significance	Correlation	Significance	t-value	Significance	Correlation
Customer orientation and information exchange between the organizations	0.234**	0.010	0.415***	0.000	0.212**	0.020	–	–	–
Inter-organizational coordination	0.163	0.075	0.079	0.389	0.216**	0.018	–	–	–
Competitor orientation	0.473***	0.000	0.194**	0.034	0.034	0.716	–	–	–
Market orientation	–	–	–	–	–	–	5.482***	0.000	0.684***

Note(s): *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Source(s): The author

operate within business-to-business markets, the exchange of customer and competitor information within clusters is crucial for R&D-focused initiatives. Both orientations—customer and competitor - play pivotal roles in driving innovation in such scenarios.

Other collaborative activities, especially those related to joint exhibitions and tenders, are correlated with interorganizational coordination and customer orientation. This indicates that to ensure success, cluster members that collectively participate in exhibitions or trade events must do so in a coordinated manner based on accurate market and customer information.

Our analyses show a moderately strong correlation between cluster activities and market orientation, which underscores the importance of collaboration within clusters in shaping market-oriented behaviors and strategies. Given the findings just detailed, we can confirm the first sub-hypothesis, [H2a](#), of our second hypothesis, which posits that intra-cluster cooperation and market orientation significantly influence the market orientation of innovations. This hypothesis is substantiated based on the results presented.

The findings suggest that the extent of intra-cluster collaboration and market orientation impact the market orientation of innovations. Additionally, cluster management services, including outputs, inputs, and internal relations, play a role in shaping the collaborations established, thus influencing the market orientation of implemented innovation projects (collaborations).

In summary, among the factors contributing to market orientation, interorganizational coordination and information flow are more significant for cluster member firms. Overall, our findings confirm the second central hypothesis, which states that the impact of interorganizational coordination and information flow is substantial among the factors affecting the market orientation of cluster member firms. Moreover, the degree of intra-cluster cooperation and market orientation together play a crucial role in determining the market orientation of innovations within these clusters. This conclusion is supported by the data and analyses conducted in our study.

Interpretation of key results

The results of our study demonstrate that strategic and innovation capabilities within member firms significantly influence intra-cluster cooperation, as hypothesized in [H1](#). Specifically, firms with stronger strategic foresight and innovation capabilities were able to collaborate more effectively within their respective clusters, leading to more aligned innovation outcomes. This supports the claim in [H1a](#) that strategic and innovation capabilities enhance innovation through collaboration. These findings highlight the critical role that such capabilities play in ensuring that firms keep pace with market trends and actively shape innovation trajectories within the cluster environment.

Our results also confirm that firms with strong strategic and innovation capabilities tend to demonstrate a more distinct market orientation (as hypothesized in [H1b](#)). This aligns with prior expectations that the ability to adapt and respond to customer needs is tightly linked to a firm's internal strategic resources, further validating the importance of these capabilities in fostering market-oriented innovation outcomes.

The impact of interorganizational coordination and information flow on the market orientation of member firms was also found to be substantial, as suggested by [H2](#). Firms operating within clusters with strong cooperation dynamics and robust information-sharing practices demonstrated a higher degree of market-oriented innovation, supporting [H2a](#). This indicates that the synergy created by cooperation and information flow within clusters is a critical driver for innovations that are technically advanced and market relevant.

Discussion

This study's empirical findings explicitly confirm and extend insights from recent literature ([Ozkaya et al., 2015](#); [Yang et al., 2020](#); [Alberti et al., 2021](#); [Bărbulescu et al., 2021](#)). The results indicate that strategic and innovation capabilities significantly enhance intra-cluster

cooperation, aligning well with [Yang et al.'s \(2020\)](#) findings on the critical role of internal capabilities in promoting cooperative behaviors within innovation ecosystems. Specifically, strategic foresight and innovation capabilities emerged as essential mechanisms through which firms within Hungarian clusters navigate uncertain environments - a dynamic underscored but insufficiently empirically validated in recent studies ([Cillo & Verona, 2022](#)).

Our findings also align with [Alberti et al. \(2021\)](#), who highlighted cooperation as pivotal for cluster innovation outcomes. However, we extend this insight by empirically demonstrating that internal cooperation can compensate substantially for declining external state support - a scenario [Alberti et al.](#) noted theoretically but did not empirically verify. Moreover, the importance of interorganizational coordination and information dissemination aligns strongly with recent literature ([Šlogar, 2021](#); [Li & Liu, 2023](#)), further emphasizing that clusters' innovation success increasingly depends on effective internal dynamics rather than external resource provision.

Interestingly, the weaker emphasis found in our study on competitor orientation diverges from some recent findings ([Giachetti & Dagnino, 2021](#)), suggesting that Hungarian innovation clusters may need to increase competitive intelligence activities to strengthen their strategic positioning further.

Contribution to literature

This research contributes to the recent theoretical discourse on market-oriented innovation within innovation clusters in several ways.

While recent literature ([Alberti et al., 2021](#); [Yang et al., 2020](#)) has emphasized the theoretical importance of intra-cluster cooperation and innovation capabilities, these models have seldom been empirically tested in contexts of declining external support, particularly in transitional economies. Our study explicitly addresses this gap by empirically demonstrating how Hungarian innovation clusters utilize internal strategic and innovation capabilities to maintain competitiveness and market orientation amidst inconsistent governmental funding - a previously hypothesized but not empirically validated scenario.

Prior studies (e.g. [Ozkaya, 2015](#); [Bărbulescu et al., 2021](#)) established general frameworks linking strategic capabilities, cooperation, and market orientation. However, these studies rarely examined these relationships explicitly in settings characterized by fluctuating external conditions, such as declining state support. By providing empirical evidence of Hungarian innovation clusters explicitly navigating these uncertainties, our study extends the theoretical frameworks by confirming that internal strategic capabilities and cooperation - not external funding - are pivotal for market-oriented innovation outcomes. This insight significantly enhances our understanding of market orientation dynamics in less stable environments.

Our study explicitly addresses recent calls for research by [Alberti et al. \(2021\)](#) and [Bărbulescu et al. \(2021\)](#), who highlighted insufficient understanding of how clusters manage innovation amid external uncertainty and declining state support. By demonstrating empirically that internal innovation capabilities and strategic foresight substantially mitigate the impact of external instability, we explicitly clarify these theoretical ambiguities and offer robust, context-specific evidence to support and extend recent literature.

Furthermore, this research explicitly enriches the theoretical literature by exploring the Hungarian innovation cluster context - a previously underexplored transitional economy context. By highlighting the particular challenges and solutions within Hungary's innovation environment, this study provides fresh insights that contrast significantly with findings from more stable and resource-rich settings, as discussed extensively in recent works by [Tuominen et al. \(2022\)](#) and [Cillo and Verona \(2022\)](#).

These explicit theoretical contributions collectively advance scholarly understanding of how strategic and innovation capabilities and practical intra-cluster cooperation function as essential mechanisms for market-oriented innovation, particularly within contexts where external funding is inconsistent or uncertain.

Practical and managerial implications

Cluster managers are encouraged to prioritize strengthening internal strategic and innovation capabilities to enhance intra-cluster cooperation and market orientation. Policymakers should, therefore, design interventions that facilitate internal cluster dynamics, promote strategic capability building, and encourage robust knowledge-sharing practices. Such measures are crucial for ensuring sustained competitiveness, mainly when external funding is unpredictable or insufficient.

Overall, this study provides valuable insights for theory and practice, offering a clearer understanding of innovation cluster dynamics in the face of fluctuating governmental support and highlighting strategic pathways for sustainable innovation.

Limitations and future research directions

This study critically examined Hungarian-accredited innovation clusters, a focus that significantly restricts the generalizability of its findings primarily to Hungary. This limitation suggests that the results may not fully represent the global spectrum of innovation clusters, especially those in nascent stages or different regions. Future research could address this by expanding the sample to include clusters at various stages of development from diverse global locations. Moreover, relying on self-reported data and snowball sampling in our mixed-methods approach could introduce biases and limit the diversity of our sample. We recommend that randomized sampling and alternative data collection methods be employed, such as case studies or archival data, to provide a broader perspective on cluster dynamics. Longitudinal studies would also be beneficial in observing how the strategic and innovation capabilities of clusters evolve.

In addition, scales adapted to unique cluster traits, like those by [Narver and Slater \(1990\)](#), may affect construct validity; thus, future research should refine these tools for diverse settings and perform cross-validation studies to enhance their applicability. Addressing these aspects will deepen our understanding of innovation clusters and their role in economic and technological advancement.

Conclusion

This study explicitly explored how Hungarian-accredited innovation clusters leverage strategic and innovation capabilities to promote market-oriented innovation through enhanced intra-cluster cooperation, particularly under declining and inconsistent state support conditions.

Consistent with recent literature ([Ozkaya et al., 2015](#); [Yang et al., 2020](#); [Alberti et al., 2021](#); [Bărbulescu et al., 2021](#)), our findings empirically validated and expanded existing frameworks by explicitly highlighting the critical role of internal strategic capabilities and cooperative dynamics. This study empirically examined how Hungarian-accredited innovation clusters leverage strategic and innovation capabilities to promote market-oriented innovation through enhanced intra-cluster cooperation, particularly under declining and inconsistent state support conditions.

In practical terms, our study explicitly underscores the importance of cluster managers developing robust internal capabilities and fostering active collaboration among member firms. It tells policymakers that strategic interventions should emphasize enhancing intra-cluster dynamics and capability development, contributing to long-term competitiveness and innovation resilience.

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