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The Relationship Between Organizational Innovation and Innovation Capacity in Geothermal Companies

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THE RELATIONSHIP BETWEEN ORGANIZATIONAL INNOVATION AND INNOVATION CAPACITY IN GEOTHERMAL COMPANIES

Celaleddin SERINKAN[1]
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Abstract

Abstract The primary aim of this study is to investigate the impact of the sub-dimensions of organizational innovation—namely creativity, organizational openness, proactivity, risk-taking, and future orientation—on innovation capacity, and to analyze how these dimensions differ according to various demographic and organizational characteristics of the participants.
Data were collected through a survey instrument adapted from established studies in the literature, designed to measure both organizational innovation and innovation capacity. The first section of the survey gathered demographic information, including participants' gender, age, education level, and professional position. The second section contained items related to organizational innovation and innovation capacity.
The data were analyzed using the IBM SPSS statistical package. Prior to the main analyses, normality and reliability tests were conducted to assess the suitability of the dataset. Results revealed that the reliability coefficients of all scale dimensions exceeded the threshold value of .70, and the data were normally distributed.
The findings indicate that organizational innovation is positively and significantly associated with innovation capacity at the general level. Moreover, the results demonstrate significant differences across some innovation dimensions with respect to variables such as age, education level, job title, number of company branches, and tenure. Notably, creativity and organizational openness scores tended to increase with age.
Keywords: Geothermal Companies; Organizational Innovation; Innovation Capacity; Managers

1. INTRODUCTION

Certain terms, when translated into Turkish, do not fully capture the conceptual nuance they convey in international discourse. Before addressing the Turkish Language Association's (TDK) definition of innovation, it is necessary to contextualize the term. TDK briefly defines innovation as "yenileşim" (renewal) (Türk Dil Kurumu, 2025). However, in practice—particularly in corporate and academic settings—the English term innovation is used far more frequently than its Turkish equivalent.
In essence, when something is created for the first time, it is considered an invention or discovery. Yet, innovation is more than mere invention; it encompasses processes of renewal, improvement, enhancement, and the addition of new perspectives. Importantly, innovation is fundamentally driven by "need."

Innovation is often intertwined with related concepts such as novelty, creativity, entrepreneurship, and design, yet it is not synonymous with them. Each of these concepts overlaps with and influences innovation, while also being shaped by it. Therefore, innovation should be evaluated distinctly, rather than being conflated with these adjacent terms (Demirci et al., 2012).

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Innovation is not only associated with novelty but also represents a dimension of broader change (Akyürek, 2020). It entails the introduction of unprecedented and creative ideas that materialize into applicable and commercially viable processes. For a novelty to be considered an innovation, it must create added value—economically and socially—beyond mere originality.

Organizational innovation refers to the introduction of new or significantly improved methods within a firm's organizational structure, managerial processes, business practices, external relations, or strategies (OECD/Eurostat, 2018). This definition encompasses not only large-scale structural changes but also incremental improvements in workflows, decision-making, human resource practices, and knowledge-sharing mechanisms (Damanpour, 1991). Successful organizational innovation requires managerial support, incentive systems, and the conscious promotion of innovative approaches throughout the firm. Even when technical infrastructure is sufficient, resistance to innovative thinking within management may hinder progress, highlighting the importance of interdepartmental communication and collaboration (Kasımoğlu & Akkaya, 2012).

Innovation capacity, on the other hand, can be defined as an organization's systematic ability to generate, acquire, absorb, transform, and apply new knowledge and ideas at the firm, sectoral, regional, or national level (Bakıcı & Doğan, 2017). This capacity enables the development of improved products, services, processes, and business models, as well as their successful commercialization (Çevik & Sezen, 2012). It also reflects a firm's adaptability, continuous learning, and resilience in the face of change—ultimately contributing to sustainable growth and competitive advantage (Gümüşlüoğlu et al., 2013).

This study examines the relationship between organizational innovation and innovation capacity, with a particular focus on geothermal enterprises. The geothermal sector was selected due to the strategic importance of innovation in enhancing efficiency, competitiveness, and sustainability within this industry.

2. CONCEPTUAL FRAMEWORK

2.1.Innovation

Innovation can be most accurately defined as the fundamental driver that supports business ideas and propels them toward the achievement of strategic objectives. Marketing, often regarded as the most critical function of a firm, is closely tied to innovation, as business success increasingly relies on the introduction of creative and novel ideas into the market. Products and services must be launched with innovative business concepts—ideas that are unprecedented, sometimes radical, and capable of achieving set performance targets (Örücü et al., 2011).

Innovation should not be perceived as limited to a particular function within a company. Rather, it encompasses the entire process—from the initial conceptualization of a product, through development and market introduction, to post-sale activities. Importantly, the true significance of innovation lies not only in originality but in its capacity to generate commercial value. An idea that fails to deliver economic or social benefits cannot be classified as an innovation.

The term novelty is often used interchangeably with innovation, yet novelty alone does not adequately capture the economic and social dimensions that define innovation. A new idea, product, or process becomes an innovation only when it creates tangible value—such as competitive advantage, financial gain, or societal impact. In this sense, innovation requires collaboration among multiple stakeholders, including individuals, firms, society, and the state (Uzkurt, 2010).

Internationally, one of the most widely accepted definitions of innovation is provided by the Oslo Manual, jointly published by OECD and Eurostat. According to this manual, innovation involves the implementation of newly developed or significantly improved products, processes, marketing methods, or organizational practices within firms. This definition emphasizes that innovation extends beyond technology, encompassing marketing, managerial systems, and organizational structures (Çağla, 2010).

2.2.Organizational Innovation

While innovation was initially perceived as primarily technological in nature, organizational innovation has emerged as an equally important dimension in today's knowledge-based economy. For small and medium-sized enterprises (SMEs), which often lack extensive resources for R&D, organizational innovation represents a more feasible and impactful strategy. It does not require heavy financial investment, yet can significantly enhance competitiveness when effectively applied (Telli et al., 2010).

Organizational innovation refers to new or substantially improved methods in managerial practices, business processes, organizational structures, workplace arrangements, or external relations. It delivers several strategic advantages for firms, including:

-Enhanced Efficiency and Effectiveness: Streamlined workflows and improved processes optimize resource use and boost organizational performance (Drucker, 1999).

-Cost Reduction: Innovative management practices eliminate inefficiencies, thereby strengthening competitiveness (Porter, 1985).

-Adaptability to Change: Flexible, learning-oriented structures enable firms to adapt rapidly to evolving markets and technological shifts (Senge, 1990).

-Competitive Advantage: Unique organizational practices that are difficult to replicate create sustainable differentiation in the market (Barney, 1991).

-Capacity for Further Innovation: A culture of organizational innovation fosters the successful development and implementation of other types of innovation, including product, process, and marketing innovations (Tidd et al., 2005).

The success of organizational innovation depends on several internal and external factors (Kanter, 1988):

-Organizational Culture: A culture that promotes risk-taking, collaboration, and openness to learning.

-Leadership: Visionary and supportive leaders who drive change and innovation.

-Communication and Knowledge Sharing: Effective mechanisms for collaboration and information flow.

-Learning Capability: The ability to learn from past experiences and continuously improve.

These elements collectively form the foundation for fostering organizational innovation within firms.

2.3.Innovation Capacity

Schumpeter (1934) conceptualized innovation as the key driver of economic development, highlighting the creation of new products, processes, markets, resources, and organizational forms. Later scholars, such as Drucker (1985, 2001), emphasized that innovation is not confined to technological advancements but also encompasses organizational and managerial changes.

Innovation capacity refers to an organization's ability to integrate, reconfigure, and transform its internal and external resources in response to shifting market and technological conditions. From this perspective, innovation capacity is not a static attribute but a dynamic

capability that evolves over time (Zahra & George, 2002). At the national level, innovation capacity is shaped by the interplay among firms, universities, research institutions, government bodies, and other stakeholders, ultimately influencing economic competitiveness and social welfare (Lundvall, 1992).

Innovation capacity is thus multidimensional, involving strategic orientation, innovative behaviors, and organizational processes. It reflects not only the ability to generate new ideas but also to coordinate and sustain innovative activities effectively (Wang & Ahmed, 2004). Firms can strengthen their innovation capacity through continuous investment in R&D, enhancing technological competencies, fostering internal creativity, establishing collaborations, and promoting knowledge sharing.

2.4.The Relationship Between Organizational Innovation and Innovation Capacity

Innovation capacity serves as a prerequisite for organizational innovation. Firms with higher levels of innovation capacity are better equipped to generate, evaluate, develop, and implement new ideas (Lawson & Samson, 2001).

At the same time, organizational innovation strengthens innovation capacity by enriching the firm's knowledge base, developing new capabilities, and refining innovation processes. Innovation thus becomes both an outcome and a catalyst of organizational learning (Teece et al., 1997).

Sustained innovation requires strong innovation capacity, enabling firms to embed innovation into their organizational DNA rather than treating it as a one-time effort (Nonaka & Takeuchi, 1995). Organizational factors such as culture, leadership, structure, processes, and human resource management directly shape innovation capacity. Supportive cultures and visionary leadership, in particular, are strongly associated with higher innovation capacity (Amabile, 1988).

3.METHODOLOGY

3.1.Research Objective

Türkiye ranks seventh worldwide in terms of geothermal energy potential, and fifth in non-electric applications of geothermal energy. The use of geothermal resources for greenhouse and residential heating has been expanding rapidly. Across the country, there are approximately 1,000 thermal and mineral water sources, with 95% of identified geothermal fields suitable for thermal applications. A total of 170 geothermal sites with temperatures above 30°C are distributed nationwide, though primarily concentrated in Western, Northwestern, and Central Anatolia. For medical purposes, 20°C is considered the threshold temperature, and with over 600 source groups, Türkiye holds the leading position in Europe for geothermal potential (Köse et al., 2004). In recent years, the use of thermal springs for health-related purposes has also significantly increased.

Within this context, the primary objective of the present study is to examine the effects of organizational innovation on innovation capacity in geothermal companies. The study adopts a quantitative research design, specifically the relational survey model, which is employed to determine the direction and degree of relationships between variables. Accordingly, the research explores the associations between the sub-dimensions of organizational innovation—creativity, organizational openness, proactivity, risk-taking, and future orientation—and innovation capacity.

3.2.Sample and Research Design

The study sample consisted of managers working in geothermal enterprises located in the Alaşehir region of Manisa, Türkiye. Data were collected from a total of 39 participants using convenience sampling. All company and participant information was kept strictly confidential. Ethical approval for the study was obtained from the Pamukkale University Social and Human Sciences Research and Publication Ethics Committee (Decision No. 24-9, Meeting Date: 27/12/2024).

3.3.Data Collection Instrument

The data collection tool was a structured questionnaire adapted from validated scales in the literature, designed to measure organizational innovation and innovation capacity. Items were rated on a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Organizational Innovation Scale: Originally developed by Ruvio et al. (2014) and later adapted into Turkish by Kömeç (2023), the scale consists of five sub-dimensions: creativity, organizational openness, proactivity, risk-taking and future orientation. It includes a total of 18 items (Kömeç, 2023: 134).

Innovation Capacity Scale: First employed by Johnson (2020) and adapted into Turkish by Kömeç (2023), this scale consists of 6 items measuring an organization's ability to develop and implement innovations (Kömeç, 2023: 135).

The first part of the questionnaire collected demographic information (e.g., gender, age, education level, and job position), while the second part focused on organizational innovation and innovation capacity. The present study reports the initial findings of an ongoing research project.

3.4.Data Analysis

The data were analyzed using IBM SPSS Statistics. To assess the suitability of the dataset for parametric analyses, normality and reliability tests were conducted. The results of skewness and kurtosis analyses showed that values were within the acceptable range of –2 to +2 (Şencan, 2005), indicating normal distribution. In addition, the Kolmogorov-Smirnov test confirmed the normality of the data ($p < 0.05$).

Reliability analyses revealed that all scales achieved Cronbach's alpha coefficients above the recommended threshold of .70, demonstrating internal consistency. Given the normal distribution, parametric tests were used in the analyses.

Specifically: Independent samples t-tests were conducted to examine group differences across categorical variables such as gender. One-way ANOVA tests were applied to compare differences across age groups, education levels, and job titles. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were also calculated for socio-demographic characteristics of the participants.

Table 1. Reliability and Normality Test Data of Scales

	N	Mean	Std. Deviation	Skewness	Kurtosis	Cronbach's Alpha
Organizational Innovation	39	67,4103	16,22979	-1,149	1,160	0,97
Innovation Capacity	39	19,9487	4,85012	-1,316	1,973	0,81

4.FINDINGS

This section presents the results of the statistical analyses conducted on the data collected from 39 participants. First, descriptive statistics regarding participants' demographic characteristics are provided, followed by the results of t-tests and one-way ANOVA conducted across the scale dimensions. Finally, correlation analyses are reported to assess the relationship between organizational innovation and innovation capacity.

4.1.Descriptive Characteristics of Participants

Among the 39 respondents, 82.1% were male and 17.9% were female. A majority (56.4%) fell within the 31–40 age group, followed by 15.4% aged 21–30, and 12.8% aged 41–50. Regarding educational attainment, 53.8% held a bachelor's degree, while 20.5% had completed a master's or doctoral degree.

In terms of professional roles, 48.7% were managers, 25.6% engineers, and 12.8% technicians. Additionally, 61.5% worked in headquarters or corporate offices, while 41% reported having more than 10 years of experience in the geothermal sector.

4.2.Correlation Analysis

A Pearson correlation analysis was conducted to examine the relationship between organizational innovation and innovation capacity. The results revealed a positive and significant correlation between the two variables ($r = .610$, $p < .001$). This finding suggests that higher levels of organizational innovation are associated with greater innovation capacity. The correlation coefficient of .61 indicates a moderately strong relationship, confirming that the adoption of innovative practices, processes, and systems directly supports organizations' capacity to generate and implement new ideas.

Table 2. Relationship Between Organizational Innovation and Innovation Capacity

		Organizational Innovation	Innovation Capacity
Organizational Innovation	Pearson Correlation	1	,610**
	Sig. (2-tailed)		,000
	N	39	39
Innovation Capacity	Pearson Correlation	,610**	1
	Sig. (2-tailed)	,000	
	N	39	39
**. Correlation is significant at the 0.01 level (2-tailed).			

4.3.Gender Differences

Independent samples t-tests were conducted to evaluate differences between male and female participants. The results showed **no statistically significant differences** in organizational innovation or innovation capacity scores across gender groups ($p > .05$). Although male participants reported slightly higher mean scores, the differences were not significant. This finding implies that gender is not a determining factor in innovation-related processes within geothermal firms.

Table 3. Gender Differences in Scale Score

	Gender	n	Mean	SD	t	p
Organizational Innovation	Female	7	61,1429	20,0369	-1,132	0,265
	Male	32	68,7813	15,3091		
Innovation Capacity	Female	7	19,2857	5,7652	-0,395	0,695
	Male	32	20,0938	4,7203		

4.4.Age Differences

One-way ANOVA tests were performed to examine differences across age groups. The results indicated significant differences in several sub-dimensions:

-Creativity (F = 3.049, p = .030): Younger participants (<20 years) scored significantly lower than older participants (>50 years).

-Organizational Openness (F = 3.386, p = .020): Participants under 20 years of age scored significantly lower than those aged 31–40 and over 50.

-Risk-Taking (F = 3.026, p = .031): Participants under 20 years scored significantly lower than those aged 31–40.

No significant differences were observed for proactivity, future orientation, overall organizational innovation, or innovation capacity across age groups.

Table 4. Data on Differences Between Participants' Ages and Innovation Values

	Age	n	Mean	SD	F	p
Creativity	Less than 20	3	13,3333	5,5076	3,049	**0,030**
	21-30	6	20,6667	3,6697		
	31-40	22	19,9091	3,6241		
	41-50	5	19,8000	3,4205		
Future Orientation	More than 51	3	23,3333	2,8868		
Organizational Openness	Less than 20	3	9,3333	4,9329	3,386	**0,020**
	21-30	6	15,5000	3,5637		
	31-40	22	15,9545	3,0625		
	41-50	5	14,2000	4,2661		
	More than 51	3	18,6667	2,3094		
Risk Taking	Less than 20	3	8,6667	4,6188	3,026	**0,031**
	21-30	6	15,3333	2,1602		
	31-40	22	15,2727	3,5615		
	41-50	5	13,2000	2,5884		
	More than 51	3	15,0000	1,0000		
	21-30	6	20,6667	3,3862		
	31-40	22	21,0909	4,5556		
	41-50	5	16,0000	5,3385		
	More than 51	3	21,3333	1,1547		

4.5.Education Differences

Analysis of variance across educational levels revealed significant differences in:

-Creativity (F = 3.507, p = .025): High school graduates scored significantly lower than participants with a master's or doctoral degree.

-Organizational Openness (F = 3.881, p = .017): High school graduates also scored significantly lower than those with postgraduate education.

-Risk-Taking (F = 2.854, p = .050) and Organizational Innovation (overall) (F = 2.795, p = .045): Both dimensions showed marginally significant differences across education levels.

No significant differences were observed in proactivity, future orientation, or innovation capacity. These results suggest that higher education levels are associated with stronger innovative tendencies, particularly in creativity and openness.

Table 5. Differences Between Participants' Educational Status and Innovation Values

	Education	n	Mean	SD	F	p
Creativity	High School	4	16,0000	6,9761	3,507	**0,025**
	Associate Degree	6	20,5000	3,6742		
	Bachelor's Degree	21	19,0952	3,5058		
	Master's Degree/Doctorate	8	22,8750	2,0310		
Organizational Openness	High School	4	12,0000	6,6833	3,881	**0,017**
	Associate Degree	6	15,1667	4,3089		
	Bachelor's Degree	21	14,8095	2,8569		
	Master's Degree/Doctorate	8	18,6250	1,7678		
Risk Taking	High School	4	10,5000	5,2599	2,854	**0,050**
	Associate Degree	6	14,6667	2,9439		
	Bachelor's Degree	21	14,4286	3,4867		
	Master's Degree/Doctorate	8	16,5000	1,8516		
Organizational Innovation	High School	4	56,2500	26,6630	2,795	**0,045**
	Associate Degree	6	60,5000	19,8368		
	Bachelor's Degree	21	66,9524	13,2570		
	Master's Degree/Doctorate	8	79,3750	8,1053		
	Master's Degree/Doctorate	8	19,8750	4,3569		

4.6.Differences by Job Title

ANOVA results demonstrated significant differences across job titles:

-Creativity (F = 3.761, p = .012): The highest mean scores were observed among technicians, while the lowest were among accountants. Managers also scored significantly higher than accountants.

-Innovation Capacity (F = 2.792, p = .042): Again, technicians reported the highest scores, while accountants had the lowest.

For other dimensions—including organizational openness, proactivity, risk-taking, future orientation, and overall organizational innovation—no significant differences were found across job titles. These results indicate that innovation-related capabilities may vary by role, with technicians and managers demonstrating greater involvement in innovative practices compared to support positions such as accounting.

Table 6. Data on Differences Between Participants' Titles and Innovation Values

	Title	n	Mean	SD	F	p
Creativity	Manager	19	20,2632	3,9978	3,761	**0,012**
	Engineer	10	19,7000	2,9078		
	Technician	5	22,6000	1,9494		
	Accountant	2	11,5000	6,3640		
	Operator	3	17,6667	3,2146		
Innovation Capacity	Manager	19	20,3158	4,3596	2,792	**0,042**
	Engineer	10	19,7000	3,8020		
	Technician	5	24,0000	3,3912		
	Accountant	2	13,0000	8,4853		
	Operator	3	16,3333	6,4291		

5.CONCLUSION

The primary objective of this study was to examine the effects of the sub-dimensions of organizational innovation—creativity, organizational openness, proactivity, risk-taking, and future orientation—on innovation capacity, and to analyse how these dimensions vary across demographic and organizational characteristics.

The findings indicate that organizational innovation is positively and significantly associated with innovation capacity. This supports the view in the literature that innovative organizational structures and processes enhance firms' competitive strength and their ability to generate and implement new ideas. In particular, organizational innovation contributes not only to operational effectiveness but also to the long-term sustainability of innovation activities.

The study further revealed that certain demographic and organizational factors significantly influence innovation dimensions:

Age: Creativity, openness, and risk-taking scores increased with age, suggesting that life experience contributes positively to innovative thinking.

Education: Higher education levels were linked to stronger creativity and openness, highlighting the role of advanced knowledge in fostering innovation.

Job Title: Managers and technicians reported higher levels of creativity and innovation capacity compared to other groups, suggesting that individuals directly engaged in decision-making or implementation processes are more actively involved in innovation.

Gender: No significant differences were observed, implying that gender does not play a decisive role in innovation-related competencies in this sector.

These findings demonstrate that organizational innovation is not a one-dimensional construct but is influenced by both personal characteristics (such as age and education) and professional roles. Furthermore, the results highlight that the development of innovation capacity requires a supportive organizational culture, visionary leadership, and the integration of innovative practices across all levels of the firm.

Limitations and Future Research: The study has certain limitations. First, the sample size was relatively small (n = 39), which restricts the generalizability of the results. In addition, some subgroups (e.g., certain job titles) included only a few participants, which may have limited the statistical power of the analyses. Therefore, these findings should be considered preliminary.

Future research should employ larger and more diverse samples to validate and expand upon these results. Comparative studies across different sectors may also provide valuable insights into the broader relationship between organizational innovation and innovation capacity. Furthermore, qualitative research methods such as interviews and case studies could enrich the understanding of the mechanisms underlying this relationship.

Practical Implications: The results suggest several practical implications for geothermal companies and similar industries:

Promoting Innovative Culture: Organizations should foster a culture that values creativity, openness, and risk-taking.

Encouraging Lifelong Learning: Training programs and continuous education initiatives can enhance innovation-related skills, particularly among younger employees.

Leveraging Roles: Firms should recognize the importance of both decision-makers (managers) and implementers (technicians) in driving innovation, ensuring that support positions are also integrated into innovation processes.

Strategic Investment: Organizational innovation should be prioritized alongside technological innovation to sustain competitiveness in dynamic markets.

In sum, this study underscores the importance of organizational innovation as a driver of innovation capacity. By aligning organizational practices with innovative thinking and by

considering the demographic and professional attributes of employees, geothermal companies—and firms in general—can enhance their innovation capacity, strengthen competitiveness, and ensure sustainable growth.

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