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From The Editors

Dear colleagues,

Bringing the each issues on to your screen is both very tiring and exiting period and it requires allot of joint effort from all sides. Now we are so happy to bring our new issues to you and we hope you will enjoy reading our issue.

We are thankful for those who supporting us either by sending their research results. Despite receiving number of article, we could only finalize two of them to be ready for the issue. Although the number of the publish article is law, the spent effort is more and quality of the paper is very good. We congratulate all the authors and the reviewers who help us to improve the quality of the papers. Without their support it would not be possible to bring the Journal to this level.

In this new issue, we have different well-addressed two research papers about innovation analytics which is introduced the literature recently. The second paper is about how to increase the level of entrepreneurship of countries in GEM reports by using artificial intelligence techniques.

We hope this issue will also provide useful information both researchers, professionals as well as it will also provide useful information for policy makers.

Finally, I like to remind you that you can access all our past and current issues with no charge. I strongly recommend you to read our publications and I believe this will be helpful for your current research and professional business.

Best Regards

Cevahir UZKURT
Editor in Chief

İçindekiler / Content

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The Impact of Perceived Entrepreneurial Ability on Entrepreneurial Intentions: A Long-Term Analysis from a Global Perspective

Nurdan Gürkan*

ABSTRACT

Purpose: While perceived entrepreneurial ability (PEA) has long been acknowledged as a core predictor of entrepreneurial intentions (EI), its role across diverse cultural and temporal settings remains underexplored. Drawing on the Theory of Planned Behavior, Social Learning Theory, Expectancy Theory, and Social Cognitive Career Theory, this study re-examines this relationship through a global and longitudinal lens.

Methodology: Utilizing panel data from the Global Entrepreneurship Monitor (GEM), the study analyzes entrepreneurship trends across 22 countries over a five-year period (2017–2022). By applying panel regression models, the analysis captures both temporal consistency and cross-national variations in the PEA–EI linkage.

Findings: The results consistently demonstrate a strong and positive association between individuals' perceived entrepreneurial ability and their entrepreneurial intentions. This effect holds across countries and over time, suggesting the robustness of PEA as a motivational driver regardless of contextual differences.

Practical Implications: For educators and policymakers aiming to stimulate entrepreneurial activity, these findings offer a clear message: interventions that enhance individuals' sense of entrepreneurial capability may be effective across varied institutional environments. Educational programs and policy tools grounded in skill-building and self-efficacy development may thus yield widespread benefits.

Originality: By integrating theoretical perspectives and adopting a longitudinal, multi-country dataset, this study adds empirical depth to the growing literature on entrepreneurial cognition. In doing so, it moves beyond context-specific insights and sheds light on the enduring impact of perceived ability on entrepreneurial behavior globally.

Keywords: Entrepreneurship, Entrepreneurship Intention, Perceived Entrepreneurial Ability

JEI Codes: M13, M10

Algılanan Girişimcilik Yeteneğinin Girişimcilik Niyeti Üzerindeki Etkisi: Küresel Perspektiften Uzun

ÖZ

Amaç: Algılanan girişimcilik yetisinin (PEA), girişimcilik niyetlerinin (EI) temel belirleyicilerinden biri olduğu uzun süredir kabul görmektedir. Ancak bu ilişkinin farklı kültürel ve zamansal bağlamlardaki rolü yeterince araştırılmamıştır. Bu çalışma, Planlı Davranış Teorisi, Sosyal Öğrenme Teorisi, Beklenti Teorisi ve Sosyal Bilişsel Kariyer Teorisi'ne dayanarak söz konusu ilişkiyi küresel ve uzunlamasına bir bakış açısıyla yeniden ele almaktadır.

Yöntem: Araştırmada, Küresel Girişimcilik Monitörü (GEM) tarafından sağlanan panel veriler kullanılarak, 22 ülkede girişimcilik eğilimleri beş yıllık bir dönemde (2017–2022) analiz edilmiştir. Panel regresyon modelleri aracılığıyla yürütülen analiz, PEA–EI ilişkisini hem zaman içinde tutarlılığı hem de ülkeler arası farklılıkları dikkate alarak incelemektedir.

Bulgular: Elde edilen bulgular, bireylerin algıladıkları girişimcilik yetisi ile girişimcilik niyetleri arasında güçlü ve pozitif bir ilişki olduğunu tutarlı biçimde ortaya koymaktadır. Bu etkinin hem zaman hem de ülke farklılıklarına rağmen geçerliliğini koruması, PEA'nın evrensel bir motivasyon kaynağı olarak işlev gördüğünü göstermektedir.

Sonuç ve Öneriler: Girişimcilik faaliyetlerini teşvik etmeyi amaçlayan eğitimciler ve politika yapıcılar için bu bulgular açık bir mesaj sunmaktadır: Bireylerin girişimcilik yetkinliği algısını güçlendirmeye yönelik müdahaleler, farklı kurumsal bağlamlarda dahi etkili olabilir. Bu nedenle beceri geliştirmeye ve öz-yeterlik inşasına dayalı eğitim programları ve politika araçları geniş kapsamlı faydalar sağlayabilir.

Özgün Değer: Kuramsal perspektifleri bütünleştirerek ve çok ülkeli uzunlamasına bir veri seti kullanarak bu çalışma, girişimcilik bilişine ilişkin literatüre ampirik bir derinlik katmaktadır. Böylece bağlama özgü gözlemlerin ötesine geçerek, algılanan yetinin girişimcilik davranışı üzerindeki kalıcı etkilerine dair küresel bir bakış sunmaktadır.

Anahtar Kelimeler: Girişimcilik, Girişimcilik Niyeti, Algılanan Girişimcilik Yeteneği

JEL Sınıflandırması: M13, M10

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1. Introduction

Entrepreneurship continues to attract scholarly interest as a deeply layered phenomenon that spans individual initiative and broader societal transformation. While often defined in terms of launching new ventures, the entrepreneurial process extends far beyond business creation—it involves a blend of creativity, confidence, persistence, and the willingness to embrace uncertainty (Gelderen et al., 2008). At its core, entrepreneurship encompasses the recognition of opportunity, innovative problem-solving, and the courage to act under risk—traits closely tied to economic development and the diffusion of knowledge within and across industries.

The complexity of entrepreneurial behavior has led researchers to draw on various theoretical lenses to unpack its underlying mechanisms. One widely used framework is the Theory of Planned Behavior (Ajzen, 1991), which emphasizes the role of perceived behavioral control—an idea closely aligned with entrepreneurial self-efficacy. Numerous studies have confirmed the relevance of perceived capabilities in shaping entrepreneurial intentions (Kautonen, Gelderen & Fink, 2015; Amini Sedeh, Abootorabi & Zhang, 2021). Building on this perspective, prior research has examined how both internal traits and external influences shape one's intention to pursue entrepreneurial activity (Maes, Leroy & Sels, 2014; Adekiya & Ibrahim, 2016; Henley et al., 2017; Kazmi et al., 2019).

Entrepreneurial intention (EI) has come to be recognized as one of the most reliable predictors of future entrepreneurial behavior. Yet, despite its centrality, the question of what truly motivates individuals to form such intentions remains unsettled. Earlier studies have often presented fragmented theoretical approaches, offering a wide array of explanatory variables without converging on consistent predictors (Gartner, 1988; Zhao, Seibert & Hills, 2005). This lack of coherence has led scholars to call for more targeted investigations into personal cognitive variables that may underlie entrepreneurial motivation.

Among such variables, perceived entrepreneurial ability (PEA)—which reflects one's belief in their capacity to successfully perform entrepreneurial tasks—has gained increasing attention (Naktiyok, Karabey & Gulluce, 2010; Dölarslan, Koçak & Walsh, 2020). As an individual-level construct, PEA may play a particularly vital role in intentional decision-making. When individuals believe in their entrepreneurial competence, they are more likely to translate ideas into action. This study builds on that insight by focusing specifically on the direct relationship between PEA and EI.

In doing so, the study responds to recent calls for empirical research that clarifies the foundational psychological mechanisms that precede entrepreneurial behavior (Thompson, Verduijn & Gartner, 2020). While previous works have examined entrepreneurial intention in conjunction with both personal and social factors, this research isolates perceived entrepreneurial ability to assess its long-term influence on entrepreneurial intentions across national contexts.

Research Question: How does perceived entrepreneurial ability (PEA) influence entrepreneurial intentions (EI) over time and across national contexts?

Beyond theoretical exploration, the findings of this study have important practical implications. A better understanding of how individuals perceive their entrepreneurial competence can inform the design of educational programs, entrepreneurship training, and policy interventions that foster entrepreneurial mindsets. By targeting self-efficacy and cognitive readiness, such efforts can help activate latent entrepreneurial potential within populations. Moreover, strengthening perceived ability may contribute to the development of more resilient entrepreneurial ecosystems, especially in environments characterized by uncertainty or institutional weakness.

This study also offers a methodological contribution. By utilizing a longitudinal dataset covering 22 countries over a five-year period (2017–2022), it captures both temporal trends and cross-national differences in the PEA–EI relationship. This global lens enables a deeper understanding of whether and how perceived entrepreneurial ability consistently drives intention formation across varying socioeconomic environments. In this way, the research aims to enrich entrepreneurship theory and contribute robust evidence to a domain that remains theoretically rich but empirically fragmented.

2. Theoretical Framework

Entrepreneurial intention (EI) remains one of the most widely studied constructs in the field of entrepreneurship, serving as a crucial proxy for understanding how individuals move from ideation to action. Conceptually, EI refers to a person's conscious and deliberate plan to start a business, reflecting both motivational forces and a perceived readiness to engage in entrepreneurial activity. Over the past two decades, numerous studies have attempted to explain what drives individuals to form such intentions. However, the field has often been characterized by a fragmented theoretical landscape. Many studies have explored isolated variables without embedding them in coherent conceptual frameworks, leading to a proliferation of possible antecedents but little agreement on which ones matter most (Gartner, 1988; Zhao, Seibert & Hills, 2005; Kazmi et al., 2019). As scholars increasingly seek to ground their investigations in theory, several frameworks have emerged to explain how intentions are formed and translated into entrepreneurial behavior. Among these, the Theory of Planned Behavior (TPB) has been especially influential in organizing our understanding of the psychological mechanisms underlying EI.

2.1. Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (Ajzen, 1991) offers a structured lens through which to examine how individual beliefs shape entrepreneurial intention. It posits that intention, as the most immediate antecedent of behavior, is influenced by three primary cognitive factors: personal attitudes toward the behavior, perceived social pressure (subjective norms), and perceived behavioral control. In entrepreneurial contexts, these elements map onto the desirability of entrepreneurship, social expectations around starting a business, and one's perceived ability to engage in entrepreneurial activity.

Within this framework, perceived behavioral control is particularly relevant—it closely mirrors what the literature describes as perceived entrepreneurial ability. Scholars such as Krueger and Brazeal (1994) and Shapero and Sokol (1982) have emphasized that both the perceived desirability and feasibility of entrepreneurial action play critical roles in forming intention. PEA aligns directly with feasibility, representing an individual's self-assessed capability to succeed in entrepreneurial tasks. When individuals believe they have the necessary skills and resources, their intention to pursue entrepreneurial ventures becomes significantly more likely.

Recent empirical work supports the theoretical significance of PEA. For example, Amini Sedeh, Abootorabi, and Zhang (2021) examined the relationship between PEA and EI using data from over 95,000 individuals across 33 countries. Their findings confirmed that higher levels of PEA were consistently associated with stronger entrepreneurial intentions. Importantly, this study incorporated national-level social capital as a contextual moderator, illustrating how perceived ability interacts with broader institutional conditions to shape intention formation. The authors employed hierarchical linear modeling to isolate the effects of individual perceptions from national characteristics, providing a robust test of TPB's applicability in diverse settings.

Complementary insights are offered by Afiat et al. (2023), who further elaborated the psychological underpinnings of EI by integrating attitudes, subjective norms, and perceived behavioral control into a conceptual model rooted in TPB. Their work highlights the complex interplay between individual cognition and social influence, reinforcing the theory's relevance in entrepreneurship studies. Attitudes reflect how individuals evaluate entrepreneurship; subjective norms capture perceived societal expectations; and perceived control reflects one's confidence in navigating entrepreneurial challenges.

Taken together, these studies underscore the explanatory power of TPB in entrepreneurship research. They demonstrate that EI is not simply the result of isolated traits or external pressures, but emerges through a structured cognitive process in which perceived ability—captured by PEA—plays a central role. This perspective is especially valuable in global research contexts, where variations in institutional support, cultural norms, and opportunity structures may shape how individual-level cognitions translate into entrepreneurial action.

2.2. Social Learning Theory (SLT)

Bandura (1986) introduced the concept of self-efficacy within the Social Learning Theory framework, emphasizing it as a crucial construct for defining beliefs about one's competencies. Accordingly, entrepreneurial self-efficacy, which is the belief in one's ability to successfully execute entrepreneurial activities, is detailed by Rosique-Blasco, Madrid-Guijarro and García-Pérez-de-Lema (2017, p. 1031). PEA, or entrepreneurial self-efficacy, can thus be defined as an individual's perception of their capacity to undertake entrepreneurship, fulfill related roles and tasks, and perform various entrepreneurial activities (Chen, Greene and Crick 1998; Rosique-Blasco, Madrid-Guijarro and García-Pérez-de-Lema, 2017; Boyd and Vozikis, 1994; Luthans and Ibrayeva, 2006; Forbes, 2005; Dölarslan, Koçak and Walsh, 2020). This concept has been widely adopted to explain the formation of EI as a significant determinant of the intention to start a business (Naktiyok, Karabey and Gulluce, 2010; Walker, Jeger and Kopecki, 2013; Noguera, Alvarez and Urbano, 2013) and to assess perceived competencies, risk inclination, and opportunity recognition in EI (Zhao, Seibert and Hills, 2005). Deliana (2023) delves into the exploration of entrepreneurial intent as impacted by an individual's self-efficacy, drawing upon the theoretical framework advanced by Bandura. The investigation reveals a direct correlation: enhanced self-efficacy significantly elevates the probability of making informed decisions regarding the realization of their aspirations.

Research on entrepreneurship emphasizes the significance of perceived ability and self-efficacy. Kazmi et al. (2019) illustrate how PEA, the mental assessment of one's capacity to mobilize necessary resources, engage in entrepreneurial activities, and sustain motivation, profoundly influences behavioral preferences. Individuals are drawn to situations where they anticipate having more personal control and steer clear of circumstances where control appears limited. Thus, the perception of one's capabilities significantly directs career decisions and EI, guiding individuals toward roles in which they feel competent (Naktiyok, Karabey and Gulluce, 2010, p. 420).

In their scholarly contributions, Duong (2023) and Lin et al. (2023) delve into the Social Learning Theory (SLT) to demonstrate that components such as attitudinal disposition towards behavior, personal expectations, perceived authority, and entrepreneurial mindset are integral determinants influencing EI. These elements, within the framework of SLT, underscore the complex interaction between an individual's psychological beliefs and the external social environment in shaping their propensity towards entrepreneurial endeavors. Attitudinal disposition towards behavior encapsulates an individual's evaluative stance on entrepreneurship; subjective norms address perceived external pressures or expectations; perceived behavioral control pertains to the individual's self-assessment of their capability to undertake entrepreneurial activities; and entrepreneurial self-efficacy reflects the conviction in one's entrepreneurial competencies. Collectively, these facets provide a nuanced understanding of the motivational underpinnings of entrepreneurial intent within the purview of SLT.

2.3. Expectancy Theory

PEA is similarly juxtaposed against Expectancy Theory, a cognitive framework predicated on two forms of anticipation: the probability that effort will culminate in a designated performance level, and the probability that such performance will engender a specific outcome. In contrast, PEA focuses on the execution of an action influenced by internal factors, including coping skills under stress and motivational state, suggesting that low PEA might hinder an individual's ability to perform desired behaviors due to insufficient cognitive and emotional resources (Chen, Greene and Crick, 1998, p. 299). PEA, essentially an individual's belief in their capability to execute entrepreneurial tasks successfully, is akin to the concept of self-efficacy in Expectancy Theory. Self-efficacy, defined as the conviction in one's capacity to accomplish a goal, is a pivotal element that impacts motivation and, subsequently, action (Renko et al. 2012).

In the entrepreneurial journey, starting a business or launching a venture is often seen as a deliberate choice influenced by an individual's PEA, which is argued to significantly impact entrepreneurial preferences and behaviors (Boyd and Vozikis, 1994; Chen, Greene and Crick, 1998, p. 297).

This study explores the influence of PEA on the intention to start and manage a business, focusing on EI and PEA as key variables.

The relationship between PEA and EI has gained increasing attention in recent literature, largely due to the compelling role PEA plays in shaping how individuals evaluate their entrepreneurial potential. Scholars such as Amini Sedeh, Abootorabi, and Zhang (2021) have highlighted that individuals who perceive themselves as capable are more inclined to consider entrepreneurship as a viable path. This self-assessment acts as a psychological filter: individuals are naturally drawn to environments where they believe their skills will be effective, and conversely, they are more likely to avoid contexts where they feel ill-equipped or uncertain about their performance.

Expectations about success or failure are central to this evaluative process. As Brockhaus (1980) noted, individuals with higher PEA tend to interpret challenging situations as opportunities for achievement, whereas those with lower perceived ability are more prone to anticipate negative outcomes. These forward-looking beliefs do not merely influence whether someone intends to become an entrepreneur—they also shape how individuals cognitively engage with the risks, opportunities, and demands associated with entrepreneurial activity. In this sense, PEA not only predicts entrepreneurial intentions but also informs the subjective interpretation of one's entrepreneurial environment, influencing both motivation and behavioral response.

2.4. Social Cognitive Career Theory (SCCT)

Social Cognitive Career Theory, originally developed by Lent, Brown, and Hackett (1994), offers a compelling framework for understanding how individuals form career-related intentions, including those related to entrepreneurship. Rooted in Bandura's broader social cognitive theory, SCCT emphasizes the interplay between self-efficacy beliefs, outcome expectations, and personal goals in shaping career trajectories. These elements jointly influence how individuals perceive their capacity to act, what they expect from their efforts, and the kinds of paths they pursue as a result.

When applied to entrepreneurship, SCCT provides a valuable lens for examining how perceived entrepreneurial ability—closely aligned with entrepreneurial self-efficacy—affects entrepreneurial intentions. According to this perspective, individuals who believe they can successfully organize and perform entrepreneurial tasks are more likely to develop intentions to launch and sustain a business (Pham et al., 2024). This confidence in one's capabilities not only boosts motivation but also reinforces persistence when facing uncertainty or failure, making it a key driver of entrepreneurial behavior.

A growing body of empirical research supports the relevance of SCCT in explaining EI. For instance, Zhao, Seibert, and Hills (2005) found that self-efficacy was a significant predictor of entrepreneurial intention, with individuals possessing higher self-belief more inclined to consider entrepreneurship as a career choice. Similarly, Chen, Greene, and Crick (1998) emphasized that both self-efficacy and expected outcomes play a crucial role in determining whether individuals choose to engage in entrepreneurial activity. These findings underline the dual influence of internal confidence and anticipated rewards in shaping one's decision to pursue entrepreneurship.

More recent studies continue to expand on SCCT's utility in entrepreneurship research. Licznerska and Ziemiański (2022) demonstrated that SCCT constructs—including self-efficacy and outcome expectations—remain robust predictors of entrepreneurial intention across diverse cultural and economic contexts. Likewise, Duong (2023) and Pham et al. (2024) argue that interventions aimed at improving self-efficacy can lead to stronger entrepreneurial mindsets, particularly when supported by institutional frameworks such as entrepreneurship education and mentoring.

Taken together, the theories discussed—TPB, SLT, Expectancy Theory, and SCCT—highlight the pivotal role of perceived entrepreneurial ability (PEA) in shaping entrepreneurial motivation and behavior. Each framework, from different angles, converges on the idea that individuals' beliefs about their capacity to perform entrepreneurial tasks influence their intentions to act. Whether through perceived behavioral control, observational learning, expectations of outcomes, or self-regulated career planning, PEA emerges as a central cognitive determinant of entrepreneurial intention.

Building on this integrated theoretical foundation, the central hypothesis of this study proposes that perceived entrepreneurial ability has a positive and significant effect on entrepreneurial intention. This proposition is tested using panel data from the Global Entrepreneurship Monitor (GEM), allowing for a longitudinal, cross-national examination of how PEA influences the intention to initiate and manage a business across diverse economic and cultural environments.

3. Methodology

This section provides information on the dataset, method, and tests used in the research analysis process.

3.1. Data Set

The dataset used in this study was retrieved from the Global Entrepreneurship Monitor (GEM), which offers extensive cross-national data on entrepreneurial dynamics. Similar to approaches adopted in prior research (e.g., Amini Sedeh, Abootorabi & Zhang, 2021; Martínez-González et al., 2022; Fuentelsaz, González & Mickiewicz, 2023; Kansheba, Fubah & Marobhe, 2024), this study utilizes GEM data to facilitate cross-country comparisons of entrepreneurship indicators. However, unlike studies that rely on individual-level data, the current analysis is based on country-level aggregate scores. These scores reflect the collective responses to standardized survey questions administered across participating countries and serve as a proxy for national patterns in entrepreneurial activity.

This study analyzed data spanning the last five years, covering the period from 2017 to 2022. Data for 2023 were not available and thus were not included. This research included countries from Asia, Oceania, Europe, and North America, excluding others due to ease of access and comparability of data. Data inconsistencies or gaps between countries on other continents were considered likely to complicate the expansion of the study's scope. Given the large dataset, the objective was to explore the relationship between PEA and EI from a broad perspective, incorporating similarities and differences across the selected countries into the research model.

Table 1. List of countries (2017 – 2022)

Rank	Country	Rank	Country
1	Canada	12	Saudi Arabia
2	Croatia	13	Slovakia
3	Germany	14	Slovenia
4	Greece	15	South Cyprus
5	India	16	South Korea
6	Israel	17	Spain
7	Italy	18	Sweden
8	Luxembourg	19	Switzerland
9	Netherlands	20	United Arab Emirates
10	Poland	21	United Kingdom
11	Qatar	22	United States of America

The GEM provides data for 69 countries in Asia, Oceania, Europe, and North America of these 69 countries, only 22 had complete data for the period 2017 to 2022, which were used in the scope of the research. Therefore, the scope of this study is based on data from these 22 countries. Table 1 lists the countries included in this study.

In this study, the construct of perceived entrepreneurial ability (PEA) corresponds to the GEM variable based on the question: "Do you have the knowledge, skill, and experience required to start a new business?" Respondents answer with "yes" or "no," and the country-level percentage of affirmative responses is used to represent national PEA scores. According to GEM's official definition, this indicator reflects the percentage of the 18–64 population (excluding those already involved in any stage of entrepreneurial activity) who believe they have the required skills and knowledge to start a business.

Similarly, entrepreneurial intention (EI) is measured using responses to the question: "Are you expecting to start a new business within the next three years?" The corresponding GEM variable captures the percentage of the 18–64 population (excluding those already active in entrepreneurship) who intend to start a business within the next three years, often referred to as latent entrepreneurs. Both variables were obtained from the Adult Population Survey (APS) section of the GEM dataset and aggregated at the country-year level. These measures form the foundation for the longitudinal panel data model used in the subsequent analysis.

3.2. Research Method

The necessity of integrating data from diverse temporal and geographic contexts within this research mandated the adoption of econometric panel data analysis. This statistical technique is particularly well-suited for analyzing data that track the same entities—such as individuals, firms, or countries—across multiple time periods. Often referred to as "longitudinal data," this format enables researchers to capture both within-entity and between-entity variation, making it ideal for identifying temporal dynamics and context-specific effects.

Panel data analysis offers several advantages, as emphasized in the foundational works of Wooldridge (2010), Baltagi (2013), and Hsiao (2014). First, it allows for a more precise estimation of variables by controlling for unobserved heterogeneity across units. Second, it provides richer information by combining cross-sectional and time-series dimensions, thereby improving the efficiency of statistical inference. Third, it enables the detection of causal relationships that may evolve over time—something cross-sectional analyses often fail to capture.

Given the aim of this study—to investigate the effect of perceived entrepreneurial ability (PEA) on entrepreneurial intention (EI) over time and across countries—panel regression techniques were deemed most appropriate. The specific research model used in this study is as follows.

$$\textbf{Research Model: } EI_{it} = \beta_0 + \beta_1 PEA_{it} + \varepsilon_{it}$$

Where EI denotes entrepreneurial intention, PEA is perceived entrepreneurial ability, i represents countries, t denotes time (years), and ε is the error term.

The panel data modelling procedure employed in this study follows the step-by-step approach proposed by Park (2011), which is widely adopted in applied econometrics. This procedure involves a sequence of model selection tests to determine the most appropriate estimation technique. The Chow test is first applied to identify whether structural differences exist across time or entities. If the null hypothesis of no structural change is rejected ($p < 0.05$), it suggests that pooled ordinary least squares (OLS) is unsuitable.

Subsequently, the F-test is used to assess the relevance of fixed effects, and the Breusch–Pagan Lagrange Multiplier (LM) test is used to evaluate the appropriateness of random effects. If both tests indicate that pooled OLS is inappropriate, a Hausman test is conducted to determine whether the fixed effects or random effects model provides a more consistent estimation. A statistically significant Hausman result ($p < 0.05$) implies that the fixed effects model is preferred, while an insignificant result supports the use of a random effects model. This sequence of tests ensures that the final estimation model is both theoretically sound and statistically valid, taking into account unobserved heterogeneity and the panel structure of the data.

4. Results

The descriptive statistics related to the dataset and the results of tests for deviations from assumptions for consistent estimators in panel data analysis are presented below. The findings obtained in the research, conducted considering the panel data modeling process, are included in the continuation of this heading.

Table 2. Descriptive statistics

Variable	Data Quantity	Average	Std. Deviation	Min.	Max.
EI	131	16.174	10.369	2.5	56.33
PA	131	53.845	12.546	29.77	90.51

The results of the descriptive analysis conducted for the variables EI and PEA indicate that there are 131 observations for each of these variables. The average value of the EI variable was calculated as approximately 16.174. This average reflects the general trend in the EI levels in the countries included in the sample. The standard deviation was 10.369, indicating the spread of the values of the EI variable around the mean; a high standard deviation signifies a wide range of data distributions. The minimum and maximum values of the EI variable were 2.5 and 56.33, respectively, indicating the variability of EI between individuals in the sample. On the other hand, the average value for the PEA variable was approximately 53.845. While this average reflects the general trend of the PEA level, a standard deviation of 12.546 indicates that these variable values also have a wide distribution. The minimum and maximum values of PEA were 29.77 and 90.51, respectively, showing the variation in PEA scores in the countries in the sample. These descriptive statistics comprehensively present the distribution and general trends of the study's primary variables in the sample.

In panel data analysis, unit root tests are employed to ascertain the stationarity of the series. Stationary series have a constant mean and variance over time, whereas non-stationary series do not exhibit these characteristics. In a regression analysis, the use of a non-stationary (unit root containing) series can lead to misleading results. Random walks or trends within a series can indicate false relationships and reduce the validity of statistical results. Therefore, unit root tests are used in the regression analysis based on panel data to determine whether the analyzed series are stationary. Unit root tests play a crucial role in enhancing the accuracy of the model and the reliability of the results. These tests check whether the model's assumptions are met, thus playing a critical role in making more robust and reliable inferences. In this study, the stationarity of the variables was examined with and without a trend using Fisher-type unit root tests based on augmented Dickey-Fuller tests. Table 3 presents the results.

Table 3. Unit root test results

H_0: All panels contain unit roots.

	Entrepreneurial Intention		Perceived Ability	
	Without Trend	With Trend	Without Trend	With Trend
Statistic	73.27*	121.44*	121.57*	186.97*
p-value	0.0037	0.000	0.000	0.000

** represents $p<0,05$*

As shown in Table 3, both the EI and PEA variables included in the research model were found to be stationary at both trended and non-trended levels.

Table 4. Results of the panel data modelling process

Name of the Test		
Chow Test	Chow Value	7.71
	p-value	0.0000
F Test	F-value	10.16
	p-value	0.0000
Breusch-Pagan LM Test	chibar2	116.24
	p-value	0.0000
Hausman Test	chi2(1)	0.13
	p-value	0.7234
APPROPRIATE ESTIMATION METHOD		**Random Effects Model**
Chow Test H_0: no Structural Change - $p<0.05$ means that you use Random or Fixed Effect Model.		
F test H_0: All unit effects are equal to zero. - $p<0.05$ means that you use a fixed effect model.		
Breusch-Pagan LM test H_0: The variances between entities are zero. - $p < 0.05$ means that you use random effects model.		
Hausman test H_0: difference in coefficients not systematic – $p > 0.05$ means using a random effect model.		

After confirming the stationarity of the data in the research model, we applied the steps in the panel data modeling process sequentially. The outcomes of these steps are detailed in Table 4, which suggests that the random effects method is suitable for analyzing the research model. Prior to executing the model solution, it is essential to conduct diagnostic tests to ensure the accuracy of the estimators. We assessed heteroskedasticity, serial correlation (autocorrelation), and cross-sectional dependence. The findings from these assessments are documented in Table 5.

Table 5. Results of diagnostic tests

Diagnostic	**Test**		
Heteroskedasticity	Levene, Brown-Forsythe Test	W0 (4.94)	0.0000
		W50 (1.95)	0.1437
		W10 (4.94)	0.0000
Serial Correlation	Durbin-Watson	Value	0.937
	Baltagi-Wu LBI	Value	1.308
Cross-Sectional Dependence	Pesaran Test	Value	15.880
		p-value	0.0000
LBI values of Durbin-Watson and Baltagi-Wu LBI Values < 2 means there is autocorrelation.			
Pesaran test: $p<0,05$ means there is cross-sectional dependence in the panel data.			
Levene, Brown-Forsythe Test: $p<0.05$ means there is heteroskedasticity.			

When the results of diagnostic tests are examined, the research model exhibits heteroskedasticity, serial correlation (autocorrelation), and cross-sectional dependence. As elucidated in investigations by scholars such as Baltagi and Pesaran (2007), Eberhardt and Bond (2009), Gao et al. (2019) cross-sectional dependence emerges as a formidable challenge within macro panels characterized by extensive temporal spans ranging between 20 to 30 years. In this study, the time dimension was limited to 5 years. Based on these findings, clustered robust standard errors were used to estimate the efficiency of the research model.

Table 6. Regression results

	Coef.	St.Err	t-value	p-value
Perceived Ability	0.295*	0.112	2.64	0.008
Constant	0.279	5.091	0.05	0.956
Chi-square	6.95*	**R-squared**	0.278	
Prob > chi2	0.008	**Rho value**	0.783	

The regression analysis results in Table 6 demonstrate the effect of the independent variable PEA on the dependent variable EI. The coefficient of the PEA variable is estimated to be approximately 0.295. This value indicates that an increase in PEA has a positive effect on EI. With a standard error of 0.112, the t-value of this variable was 2.64, and the p-value was 0.008. Because the p-value is less than 0.05, it can be said that the effect of PEA on EI is statistically significant.

The intercept term represents the value that the dependent variable in the model takes when the variables are zero; this value is approximately 0.279. However, because the t-value of the intercept term is 0.05 and the p-value is 0.956, it is concluded that the intercept term is not statistically significant.

The R2 value is 0.278, indicating that the model explains approximately 27.8% of the variance in EI. A chi-square value of 6.95 indicates that the model is generally significant, while a p-value (chi-square) of 0.008 supports this general significance. The Rho value of 0.783 shows a correlation of random effects between countries, and this high value can be interpreted as a high level of correlation of these effects between countries.

These findings demonstrate that the PEA variable significantly influences EI, while the intercept term shows no significant impact. The general significance of the model and the high correlation of effects between countries present interesting findings for examining EI.

5. Discussion

This study's exploration of the relationship between PEA and EI enriches academic discourse by both aligning with prior findings and introducing new dimensions of analysis. Prior research conducted by Boyd and Vozikis (1994), Krueger and Brazeal (1994), Chen, Greene and Crick (1998), De Noble, Jung and Ehrlich (1999), Zhao, Seibert and Hills (2005), Amini Sedeh, Abootorabi and Zhang (2021), Pramudita (2021), and Nursyirwan et al. (2022) has underscored the paramount significance of self-efficacy within the entrepreneurial sphere. These studies accentuate its profound impact on the genesis of EI. Our longitudinal analysis extends these insights by demonstrating that the impact of PEA on EI is not only significant but also persists across time and transcends geographical boundaries. This observation is consistent with the Theory of Planned Behavior, which asserts that perceived behavioral control (comparable to PEA) substantially predicts behavioral intentions, underscoring the influence of individual perceptions on entrepreneurial activities. Moving to Social Learning Theory, we find that it similarly asserts that observational learning and modeled behaviors crucially shape an individual's entrepreneurial self-efficacy, thus influencing their EI.

Instead of treating these theoretical perspectives as isolated, this study interprets them as complementary lenses for understanding how individuals develop entrepreneurial intentions. Social Cognitive Career Theory, for instance, emphasizes the role of self-efficacy and expected outcomes in career-related decision-making, offering a cognitive framework that explains how perceived entrepreneurial ability influences entrepreneurial motivation and long-term action. Similarly, Expectancy Theory adds a motivational dimension by suggesting that individuals are more likely to act when they believe their efforts will lead to successful performance and when that performance yields desirable outcomes. Taken together, these perspectives converge on a shared insight: belief in one's own entrepreneurial competence—anchored in internal expectations and confidence—plays a central role in shaping the intention to pursue entrepreneurship. By adopting a cross-national lens, this study further illustrates how these psychological mechanisms operate consistently

5.1. Implication for Research

This research makes several important contributions to the academic literature by combining a longitudinal design with a multi-country dataset. Responding to earlier calls for more comprehensive and globally oriented entrepreneurship studies (Wennekers, Uhlaner & Thurik, 2002; Amini Sedeh, Abootorabi & Zhang, 2021), it highlights how the influence of perceived entrepreneurial ability (PEA) on entrepreneurial intention (EI) remains stable across time and national contexts. This consistency provides a strong empirical basis for further investigations into the cognitive drivers of entrepreneurship and encourages comparative studies to explore how these relationships may vary across institutional environments.

Moreover, the study offers theoretical value by reinforcing the place of PEA within broader cognitive frameworks in entrepreneurship. Demonstrating this relationship with robust longitudinal evidence not only supports existing models but also suggests that PEA should be more systematically included in future theoretical formulations. The use of panel data adds additional credibility by allowing researchers to observe how perceptions and intentions evolve over time, offering a more dynamic understanding of entrepreneurial behavior. These insights may inform the refinement of existing models and inspire more methodologically rigorous investigations in future research.

5.2. Implications for Practitioners and Policymakers

The practical relevance of this study lies in its clear demonstration that individuals' belief in their entrepreneurial capabilities strongly predicts their intent to pursue entrepreneurial activity. For practitioners and policymakers, this implies that interventions aimed at strengthening entrepreneurial self-efficacy could play a pivotal role in encouraging new business formation. Prior research (e.g., Bullough, Renko & Myatt, 2014) has emphasized the role of resilience and confidence in entrepreneurial outcomes, and the present findings reinforce that perspective on a broader scale. Accordingly, entrepreneurship education, mentorship programs, and policy incentives should be designed not only to impart knowledge but also to foster self-belief—tailored to fit different socio-cultural contexts.

5.3. Limitations and Future Research

While the findings offer robust evidence of a positive and consistent link between PEA and EI, certain limitations must be acknowledged. The analysis draws exclusively on GEM data, which, although comprehensive, does not cover all global regions equally. Future research could address this by including a more diverse set of countries, particularly from underrepresented regions, to enhance the generalizability of results. Additionally, examining the cultural dimensions that interact with PEA—such as norms, values, and institutional trust—could yield deeper insights into how context shapes entrepreneurial intention, as suggested by Liñán (2008).

Further, beyond establishing correlation, future studies should investigate the pathways through which PEA affects EI. This may include identifying mediating variables (such as opportunity recognition or perceived social support) or exploring how the relationship varies by demographic characteristics, educational background, or prior entrepreneurial experience. Unpacking these mechanisms would provide a more granular view of the psychological and social dynamics that underpin entrepreneurship.

6. Conclusion

In sum, this study contributes to the growing literature on entrepreneurial cognition by offering clear empirical evidence that perceived entrepreneurial ability is a consistent and significant predictor of entrepreneurial intention. By adopting a longitudinal and cross-national approach, it demonstrates that this relationship holds over time and across a variety of socio-economic settings. These findings not only support existing theoretical models but also extend their applicability to broader contexts. For researchers, educators, and policymakers alike, the study underscores the value of fostering self-efficacy as a means of promoting entrepreneurial behavior and, by extension, economic dynamism.

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Navigating Growth and Innovation: Challenges Faced by Sudanese Startup Companies

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ABSTRACT

Purpose: This study aims to analyze the challenges and opportunities faced by Sudanese startup companies by examining investment potential, the role of the innovation system, and the impact of economic growth on their development and sustainability.

Methodology: This study adopted a qualitative research approach, utilizing semi-structured and email interviews to gather in-depth insights from 21 Sudanese startup founders and key decision-makers. Data were analyzed using thematic analysis, combining descriptive and content analysis to identify key challenges, opportunities, and innovation strategies. By examining real-life experiences, the study provides a comprehensive understanding of the factors influencing startup growth in Sudan.

Findings: The findings reveal that internal factors, such as managerial practices and organizational culture, are more critical to innovation than external factors like market competition. Financial constraints were not a major barrier; instead, risk aversion, political issues, and resistance to change were the primary obstacles. The study concludes that fostering decentralized control, trust in team expertise, and a culture of creativity and risk-taking is essential for innovation.

Practical Implications: By adopting strategic planning, leveraging technology, and developing a shared vision, Sudanese companies can overcome these barriers and achieve sustainable growth. These insights offer practical guidance for entrepreneurs and contribute to understanding innovation and growth challenges in early-stage development contexts.

Originality: This study goes beyond theoretical analysis by offering practical insights into the challenges and opportunities faced by Sudanese startups. It highlights how innovation and strategic adaptability can drive business growth despite economic and structural barriers.

Büyüme ve İnovasyonu Yönetmek: Sudanlı Girişim Şirketlerinin Karşılaştığı Zorluklar

ÖZET

Amaç: Bu çalışma, yatırım potansiyelini, inovasyon sisteminin rolünü ve ekonomik büyümenin gelişim ve sürdürülebilirlik üzerindeki etkisini inceleyerek Sudanlı girişim şirketlerinin karşılaştığı zorlukları ve fırsatları analiz etmeyi amaçlamaktadır.

Yöntem: Çalışma, nitel bir araştırma yaklaşımı benimseyerek, yarı yapılandırılmış ve e-posta yoluyla gerçekleştirilen görüşmeler aracılığıyla 21 Sudanlı girişim kurucusu ve kilit karar alıcıdan derinlemesine bilgiler toplamıştır. Veriler, betimsel ve içerik analizi yöntemlerini birleştiren tematik analiz yoluyla incelenerek, temel zorluklar, fırsatlar ve inovasyon stratejileri belirlenmiştir. Gerçek yaşam deneyimlerinin incelenmesiyle, Sudan'daki girişim büyümesini etkileyen faktörler hakkında kapsamlı bir anlayış sunulmaktadır.

Bulgular: Bulgular, yönetim uygulamaları ve organizasyon kültürü gibi iç faktörlerin, piyasa rekabeti gibi dış faktörlerden daha kritik olduğunu göstermektedir. Finansal kısıtlamalar büyük bir engel olarak görülmemiş; bunun yerine riskten kaçınma, politik sorunlar ve değişime direnç, temel zorluklar olarak tespit edilmiştir. Çalışma, merkeziyetçi kontrolün azaltılması, ekip uzmanlığına güven duyulması ve yaratıcılık ile risk alma kültürünün teşvik edilmesinin inovasyon için önemli olduğunu ortaya koymaktadır.

Pratik Uygulamalar: Stratejik planlama, teknolojinin etkin kullanımı ve ortak bir vizyon geliştirme yoluyla Sudanlı şirketler bu engelleri aşarak sürdürülebilir büyümeyi sağlayabilir. Bu bulgular, girişimciler için pratik rehberlik sunarken, erken aşama gelişim bağlamında inovasyon ve büyüme zorluklarının anlaşılmasına katkıda bulunmaktadır.

Özgün değer: Bu çalışma, teorik analizin ötesine geçerek Sudanlı girişimlerin karşılaştığı zorluklar ve fırsatlar hakkında pratik içgörüler sunmaktadır. İnovasyon ve stratejik uyum yeteneğinin, ekonomik ve yapısal engellere rağmen iş büyümesini nasıl destekleyebileceğini vurgulamaktadır.

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1. Introduction

In Sudan, startups are becoming an important part of the country's efforts to rebuild its economy and create new opportunities. Young entrepreneurs are stepping up, filled with ambition and creativity, but their path is often blocked by serious challenges. Sudan's unpredictable economy, fragile political climate, and outdated systems make it hard for new businesses to survive, let alone thrive. This research study will attempt to analyze the challenges and opportunities faced by Sudanese startup companies by examining investment potential, the role of the innovation system, and the impact of economic growth on their development and sustainability. And shedding the light on through a thorough analysis of the body of current literature and the execution of both qualitative and quantitative empirical research. The traditional method of approaching innovation frequently revolves around the traditional definition of innovation, which is normally connected to R&D initiatives meant to progress technology and create new products tactics, and the incorporation of IT capabilities for information and communication. But since market dynamics keep changing because of things like globalization and changing consumer behavior, creative strategies need to have a wider view and make use of a wider variety of possible capabilities. According to Abdalla and Mohamed (2020), this entails utilizing marketing techniques, innovative business models, and the integration of information and communication technologies. Because of this, Sudan's economic climate has required the implementation of several strategies to promote an innovative culture, even though the country is home to many startups and small firms. This investigation delves into the financial challenges encountered by Sudanese startups and their impact on success and sustainability. Startups require ample financial resources but often encounter obstacles in securing investment. Through an analysis of current data and a review of existing literature, this study aims to identify specific financial issues that impede entrepreneurs' access to finance and funding in Sudan. It explores the repercussions of financial hurdles on the success and sustainability of Sudanese businesses. By examining their influence on revenue growth, long-term viability, and corporate performance, the study sheds light on the role of financial constraints in business success. Furthermore, the report offers recommendations on how to overcome these financial obstacles and support the growth and ingenuity of Sudanese startups. It provides suggestions to enhance the financial environment for business owners in Sudan, such as facilitating easier access to capital, exploring alternative funding options, and endorsing legislative initiatives. With its insights for investors, entrepreneurs, and regulators, this study contributes to the existing body of knowledge on startup funding in Sudan. The goal of this research is to cultivate an environment that nurtures creativity and economic development by addressing the financial challenges faced by Sudanese business owners and proposing targeted solutions to foster their expansion and sustainability (Suchek et al., 2021).

Even though there is a general understanding of innovation within these enterprises, there lacks a comprehensive framework for assessing their innovative capacities and the factors that shape them. This study aims to bridge this analytical void and establish precise criteria for evaluating levels of innovation. Such an undertaking is crucial in developing practical and evidence-based strategies to link perceived innovation with success in the ever-changing global market.

In Sudan, the cultivation of ingenuity has frequently served as a catalyst for attaining a competitive edge among numerous enterprises—be it in the realm of production, marketing, or even the overall administration of the business. This examination elucidates the degrees of inventiveness embraced by diverse enterprises, delving into how these perceived innovations are influenced by an array of macro and microeconomic obstacles. Furthermore, it proceeds to expound upon the disparities witnessed in terms of innovation and the prevailing factors contributing to such patterns (Mohamed et al., 2021).

This investigation has been primarily driven by the constant evolution of technology and the imperative for businesses to adapt and reorganize their operations. Accordingly, the study's focus centers on the difficulties encountered in this rapidly changing and dynamic business realm

and their ramifications for Sudanese startups. The exigencies of the global business landscape necessitate swifter and more efficient strategies for addressing the shifts in technology and the escalating global competition (Teece, 2020).

This study takes a closer look at these challenges and opportunities. We want to understand the environment Sudanese startups are working in and find practical ways to help them grow and innovate. The goal isn't just to highlight the problems—they're already well known—but to offer thoughtful insights and strategies that can help move things forward. This study aims to analyze the challenges and opportunities faced by Sudanese startup companies by examining investment potential, the role of the innovation system, and the impact of economic growth on their development and sustainability.

1.1 Background

Sudan's strategic location between the Arab world and Sub-Saharan Africa has shaped its unique cultural and economic landscape. However, decades of political instability, economic sanctions, and internal conflicts have left the country with underdeveloped infrastructure, limited access to technology, and a fragile economy. Much of Sudan's output still relies on agriculture and raw materials, offering little in terms of value-added production or innovation (Sudan & Taggar, 2021). These structural issues directly affect the startup scene. Entrepreneurs face a tough climbing capital is hard to access, expertise is in short supply, and government support is often directed toward specific sectors or projects (Dodo, 2020). Many startups struggle to survive beyond their first few years, not due to a lack of vision or creativity, but because of the deeply rooted challenges that define Sudan's economic reality (Mohamed, 2020). Still this environment has sparked resilience and creativity among a growing number of entrepreneurs. There's a rising awareness of the importance of innovation, digitization, and strategic planning. By shedding light on their experiences, this study aims to understand how Sudanese startups can overcome these barriers and thrive in a system not yet built to support them.

2. Literature Review

Understanding how startups grow, adapt, and innovate requires a deep dive into global experiences, while also acknowledging local realities. In developed countries like the United States and the United Kingdom, startups tend to benefit from robust technological infrastructure, accessible funding, and innovation-friendly policies (Balland et al., 2022). By contrast, developing economies such as Nigeria and Tunisia often rely on adapting existing technologies and face challenges in creating original innovation systems. This global comparison suggests that countries like Sudan can learn from both models while creating localized strategies that reflect their specific circumstances (Coenen and Morgan, 2020).

Startups are typically born from a vision to solve a specific problem using innovative ideas. According to Aichner et al. (2021), they often begin on a small scale, driven by passion, risk, and creativity. However, their early stages are risky. Noted startups operate with limited resources in unpredictable markets. Many don't survive past their second or fifth year. Despite these odds, successful startups such as those in Japan demonstrate the importance of speed and innovation in outpacing traditional corporate practices (Maritz et al., 2020).

To scale and grow, startups typically adopt one of two strategic paths—internal or external. suggested that internal strategies focus on improving operational efficiency and employee capacity, while external strategies rely on partnerships, mergers, or new market entry (Karen & Biziere, 2014; Frigenti, 2020; Yan et al., 2023). As business landscapes grow more complex, emphasized the need for flexible, adaptive strategies over rigid integration models. This adaptability is especially crucial in volatile environments like Sudan, where startup success depends on innovation and strategic foresight (Njenga, 2022).

Innovation is at the heart of startup survival and growth. Hyytinen, A., Pajarinen, M., & Rouvinen, P. (2015). emphasized that startups must engage in disruptive innovation—going beyond applying old tools to new problems. Innovation should be embedded in a startup's DNA. Bocken and Snihur (2020), and Ghezzi and Cavallo (2020) all highlighted the importance of embedding novel, valuable ideas in business models. However, Kuckertz et al. (2020) warned that innovation must also be protected to ensure a lasting competitive advantage. Other researchers, including Lerner and Nanda (2020), emphasized the role of technological tools and strategic foresight in reaching untapped markets and customer groups.

The Sudanese context presents a distinct set of challenges. Financial systems in Sudan often demand high collateral and detailed feasibility studies, which many early-stage startups struggle to provide (Arabi & Abdalla, 2020). Access to funding is limited, and the startup environment lacks administrative, technological, and legal infrastructure (Ahmed, 2020; Daffalla et al., 2021). Entrepreneurs also face political instability, unclear tax structures, and inefficient bureaucracies (Mohamed, 2020; Abbass Ali, 2023).

Despite these challenges, there are ways forward. Studies highlight the importance of adopting local strategies for innovation and growth, such as developing stronger strategic partnerships building capable teams (Monteil et al., 2020; Carson et al., 2020), and embracing technology early (Elbadawi et al., 2023; Sudan & Taggar, 2021). Sudanese startups must also invest in continuous learning to stay competitive in rapidly evolving markets (Steel, 2021; Said & Enslin, 2020).

By synthesizing these insights, this study contributes to a better understanding of both the global startup ecosystem and the Sudanese context. It offers a solid foundation for proposing tailored, evidence-based strategies to support innovation and resilience in Sudan's entrepreneurial landscape.

3. Research Methodology

3.1 Study Approach

This study employed a qualitative research approach, utilizing self-administered interview forms to collect data from Sudanese startup companies. The qualitative method provided in-depth insights into the challenges faced by these startups, particularly concerning growth and innovation. This study uses a qualitative approach to capture the real-life stories and experiences of Sudanese startup founders. It's not just about numbers—it's about understanding how people navigate the startup journey in a tough environment (Tomaszewski et al., 2020; Denscombe, 2003).

3.2 Area of Study

The study focused on Sudan, particularly Khartoum, Omdurman and Bahri those are the Capital and economic center of Sudan, with additional respondents from other cities to ensure diverse perspectives. The study was conducted in 2023.

3.3 Data Collection and Sampling Procedure

Between June and October 2023, we conducted interviews with 21 entrepreneurs. We chose them based on their active involvement in running startups for at least two years. These entrepreneurs were selected because of their unique insights into the challenges and opportunities facing startups in Sudan. Given the country's evolving economic landscape, they provide valuable perspectives on how local businesses navigate financial and technological obstacles. These were people who had seen the ups and downs of entrepreneurship and had valuable insights to share.

3.4 Interview Method

3.4.1 Semi-Structured Interviews

Semi-structured interviews provided flexibility, allowing respondents to elaborate on their experiences and challenges in startup growth and innovation (Stenfors, Kajamaa & Bennett, 2020).

3.4.2 Email Interviews

Email interviews were conducted to accommodate logistical and financial constraints in Sudan. This method allowed participants to provide detailed responses at their convenience Bowker and Tuffin (2004) suggests that email interviewing is potentially empowering for research participants because it allows them to control when, where, and how to respond (Bowker & Tuffin, 2004, as cited in James, 2016).

3.5 Ethical Considerations

We obtained ethical approval from the Karabuk University Research Ethics Committee (Approval No. 27/10/2023 tarih ve 2023/07(38,39). Everyone who took part gave their full consent, and we made sure their identities and data remained confidential.

3.6 Interview Process

We reached out to participants through local incubators, business networks, and referrals. Interviews were conducted in either English or Arabic, then transcribed and translated where necessary. Using thematic analysis, we carefully reviewed the data to identify recurring themes and meaningful insights, and we confirmed our findings through feedback from the participants themselves. Participants were selected based on their expertise in startup development. Semi-structured and email interviews were conducted with Sudanese entrepreneurs and financial representatives, ensuring comprehensive coverage of the study. By adopting this qualitative methodology, the study provides a deeper understanding of the challenges and opportunities faced by Sudanese startups (Strijker et al., 2020).

4. Analysis

This study took a qualitative research approach, using semi-structured, in-depth interviews to explore key aspects of growth and innovation among Sudanese entrepreneurs. Data were collected through both face-to-face and email interviews, with each session lasting around an hour. The primary research questions focused on understanding the main challenges Sudanese startups face in their early stages, the strategies they use to navigate market access and competition, and how entrepreneurs view the role of technology in driving business growth.

To analyze the interviews, a thematic analysis method was applied, following a two-step approach: descriptive analysis and content analysis. The descriptive analysis highlighted participants' perspectives through direct quotes, ensuring their voices were accurately represented. Meanwhile, the content analysis aimed to uncover key themes and relationships by organizing responses into broader categories. This was done by carefully reading through the transcripts multiple times, identifying recurring ideas, and grouping similar concepts together.

In the interpretative stage, the findings were compared with existing literature to provide deeper insights. Several key themes emerged, including challenges related to securing funding, strategies entrepreneurs use to access financial support, the government's role in fostering innovation, and how innovation contributes to business success. The study also identified critical obstacles hindering startup growth, such as a lack of long-term vision, an overemphasis on short-term operations, and a rigid management style characterized by centralized decision-making, risk aversion, and resistance to change.

By examining real-life experiences and market conditions, this research offers a clearer understanding of both the struggles and opportunities that Sudanese startups encounter. These insights carry important implications for policymakers and entrepreneurial support initiatives, highlighting areas where targeted interventions could help startups thrive.

5. Summary of Findings

The findings from this study shine a light on what truly drives innovation within Sudanese startups. While much of the existing literature emphasizes external pressures—like competition and market dynamics—as the main triggers for innovation, our research tells a slightly different story.

Across the interviews, most startup leaders pointed to internal motivators—things like leadership style, team dynamics, and company culture—as the real engines behind innovation. This aligns with the perspectives of Hyytinen, A., Pajarinen, M., & Rouvinen, P. (2015) ,who emphasized the importance of internal strategic vision in enabling disruptive innovation. Similarly, Waring et al. (2015) noted that fostering a supportive internal environment is essential for bold innovation to flourish.

Interestingly, financial constraints—often considered a major hurdle—were not seen as the biggest roadblock by our participants. In fact, many founders found ways to innovate despite limited funds, echoing findings by Ghezzi & Cavallo (2020), who argued that agility and creative strategy can often compensate for financial limitations. Kuckertz et al. (2020) also found that during crises, many startups found unconventional paths to growth, even with tight resources.

One of the strongest themes that emerged was the role of trust and decentralized decision-making. Participants shared how giving team members more autonomy led to greater creativity and more successful projects. These insights are supported by Eriksen et al. (2021) and Didonet et al. (2020), who emphasized that empowerment and long-term thinking improve innovation performance.

Finally, the study's ambition to develop an innovation profiling system for future research resonates with ideas put forth by Saunila (2020) and Linde et al. (2021), who advocated for the need to measure and benchmark innovation capability in developing countries.

Taken together, these findings don't just confirm what's already been written—they add a fresh, grounded perspective based on real stories from the Sudanese startup ecosystem. They also offer a strong foundation for future research and practical tools that can help local entrepreneurs turn innovation into action.

6. Conclusion

The investigation concludes that the primary obstacles to innovation and expansion in the Sudanese business landscape are closely intertwined with a lack of long-term foresight and an excessive preoccupation with short-term operational concerns. The majority of companies in Sudan adhere to a "control typology," prioritizing rigorous and centralized information control, limited delegation of decision-making authority, and a reluctance to take risks. This approach to corporate management is largely influenced by an unpredictable and turbulent environmental context, characterized by stringent government regulations, an unstable and underdeveloped market, and socio-political issues stemming from wealth inequality. Consequently, the local business environment tends to reject innovation in favor of existing, tried-and-true solutions, hindering the establishment of a sustainable knowledge-based economy in Sudan. The current Sudanese government faces mounting pressure to find prudent resolutions to the array of socio-political and economic challenges it confronts. This research underscores the need for policymakers to recognize the impact of indigenous corporate management practices in constraining the capacity for sustainable technological progress. Rigid, fact-based approaches to formulating corporate strategies, driven by a predetermined vision and a managerial focus on cost reduction, which are characteristic of a "control typology," are unlikely to foster the broader societal objectives of innovation and advancement in Sudan. This study has yielded a comprehensive and nuanced understanding of the difficulties faced by Sudanese companies in embracing and effectively leveraging technology for profitability. It is imperative that Sudanese startups be guided by a well-defined roadmap for sustainable innovation and growth, achieved through the crystallization of a enduring and shared vision and mission throughout the organization, as well as the cultivation of a corporate culture that encourages creativity and risk-taking.

By departing from traditional and potentially outdated managerial practices and transitioning to more innovative strategic and operational solutions, Sudanese companies can chart a course towards success. These findings have relevance beyond Sudanese entrepreneurs and companies, as they contribute to a broader comprehension of the practical challenges associated with implementing innovation programs in countries at the early stages of technological advancement and innovation-driven structural and socio-economic changes. Success stories like those of Apple Computer, Yahoo, and Google can be attributed to the fundamental concept of "creativity," which involves the generation of novel products and ideas. However, such successful practices and strategies necessitate a strong strategic orientation. The pursuit of alternative approaches and improvement efforts hinges on the essential need for intelligent and effective strategic planning practices, whether in Sudan or in more digitally advanced economies like that of the United States. This includes a necessary emphasis on technology, the utilization and management of existing knowledge, the cultivation of strategic thinking, and the recognition of potential opportunities on a global scale.

7. Implications and Recommendations for Future Research

The growth of businesses is vital across all industries, including Sudanese startups, which face significant challenges. As discussed earlier, Sudan's unstable legal, social, and economic environment makes it difficult for startups to establish a strong market presence. Additionally, without robust technological infrastructure, startups may struggle to compete in a research-driven market. This study offers valuable insights into these challenges and practical strategies to address them. Crafting well-structured recommendations for future research requires justifying the need for novel research topics rather than addressing common industry issues. Each suggestion should be supported by thorough analysis, examples, and evidence. Organizing ideas with clear headings and logical progression helps connect research findings to meaningful recommendations. This section allows doctoral candidates to propose focused, innovative research agendas that explore modern, critical issues with purpose and credibility.

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Examining the Mediating Role of Social Worth in the Effect of Employees' Person Environment-Fit on Entrepreneurial Intention

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Abstract
Purpose: To examine how employees' person-environment fit influences their entrepreneurial intentions and whether perceived social worth mediates this effect, in the context of Türkiye.
Methodology: Survey data from 289 employees with at least five years' work experience (251 valid responses) were analyzed using confirmatory factor analysis and structural equation modeling to test hypothesized relationships.
Findings: Person-environment fit significantly increased entrepreneurial intention, particularly in the person-job fit dimension. Perceived social worth partially mediated this effect.
Practical implications: Organizations can foster inclusive, supportive work environments to enhance employees' social worth, strengthening entrepreneurial motivation and aiding talent retention and adaptability.
Originality: The study provides a novel contribution to the literature by integrating person-environment fit and social worth perspectives to explain entrepreneurial intention.
Keywords : Person Environment Fit, Social Worth, Entrepreneurial Intention
JEL Codes : L26, M13, D91

Çalışanların Çevre Uyumlarının Girişimcilik Niyetleri Üzerindeki Etkisinde Algıladıkları Sosyal Değerin Aracı Rolünün İncelenmesi

Öz
Amaç: Türkiye'de çalışanların kişi-çevre uyumunun girişimcilik niyeti üzerindeki etkisi ve bu ilişkide algılanan sosyal değerin aracı rolünün incelenmesidir.
Yöntem: En az beş yıl deneyime sahip 289 çalışanla yapılan anketten elde edilen 251 geçerli yanıt, yapısal eşitlik modellemesiyle analiz edilmiştir.
Bulgular: Kişi-çevre uyumunun, özellikle kişi-iş uyumu boyutunun, girişimcilik niyeti üzerinde anlamlı bir etkisi olduğu görülmüştür. Ayrıca, algılanan sosyal değerin bu ilişkide aracı bir rol oynadığı doğrulanmıştır.
Pratik çıkarımlar: İşletmelerin çalışanların sosyal değer algısını yükseltmek amacıyla kapsayıcı ve destekleyici iş ortamları oluşturması, girişimcilik motivasyonunu güçlendirip yeteneklerin elde tutulması ve uyum sağlamasına katkı sağlayabilir.
Özgünlük: Bu çalışma, kişi-çevre uyumu ve sosyal değer algısı perspektiflerini bütünleştirerek girişimcilik niyeti literatürüne özgün bir katkı sunmaktadır.
Anahtar Kelimeler : Kişi-Çevre Uyumu, Sosyal Değer, Girişimcilik Niyeti
JEL Kodları : L26, M13, D91

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1. Introduction

The notion of person-environment fit (PEF) has emerged as a prime subject of exploration in academic studies due to its recognition as a primary influencing factor on the success and the overall job satisfaction of individuals (Kristof-Brown & Guay, 2011; Yonuari et al., 2024). Attaining alignment with one's job and environment is an intricate journey that affects not merely individual performance but also social acceptance, perceived value, and workplace engagement (Cable & DeRue, 2002). Literature indicates that when individuals are in sync with their work environments, they tend to build higher levels of self-confidence that lays the groundwork for entrepreneurial inclinations (A. Chuang et al., 2015). This indirect connection of PEF with individuals' entrepreneurial intentions (EI) has grown so significant that it is now being considered a motivational factor in entrepreneurship (Riedo et al., 2019).

Moreover, the results of some studies demonstrate significant interactions between social worth (SW) perception and the EI of individuals. SW is the specific attribute that relates to the social acceptance and the support of people who are in their own social environments and feel appreciated (Rothers & Cohrs, 2024). The mismatch between environmental alignment and SW perception is high. This low SW perception serves as an environmental barrier that prevents the development of mental health and social skills and promotes maladaptive behaviors (Riedo et al., 2019). Environmental alignment facilitates the proper social identity of individuals and social support provides them with flexibility and power when starting new businesses. Their perception of SW plays a key role also in this process (Kimakwa et al., 2023).

In addition to this, challenges in the post-pandemic environment are partly addressed through social capital mechanisms and workplace fit dynamics that also have gained increased attention during the period (Stephan et al., 2020). The pandemic precipitated uncertainties in many sectors, which raised the importance of one's alignment of the environment and the social support within one' s social context as a factors acquired, thus, both pathways strengthened the EI of individuals (Gabarrell-Pascuet et al., 2023). In line with these results, socially supported individuals experienced more job satisfaction and autonomy, which further stimulated their entrepreneurial inclination. Alongside, SW perception has been highlighted as the source of individuals' happiness and has also led them not only to job satisfaction but autonomy as well to be the motivating factor for their entrepreneurial tendencies (Rothers & Cohrs, 2024).

As well as that, it is also found that environmental alignment promotes individuals' perception of SW, which in turn this perception has a very strong effect on EI (Anderson & Kilduff, 2009; Liñán & Chen, 2009). Elevated levels of environmental alignment result in more supportive and validating the social environment among individuals. This alignment process rings up good self-esteem and makes one's decision of working independently and becoming an entrepreneur feel right (Begley & Tan, 2001). People with high SW perception express more risk-taking behaviors which in turn lead them to areas like entrepreneurship which deal with uncertainty. The latest literature notes that social product and acceptability play as the dual mediators, acting the way which strengthens the EI. These essentially indicate the necessity of the tie between SW and PEF (Riedo et al., 2019).

Modernity in this research is derived from the fact that PEF, SW perception, and EI will be scrutinized to a greater extent. Based on the advancements in the literature, it will analyze how the individuals' adjustment to their environments and their social acceptance perception condition their EI. The exclusive aim of this inquiry is to vividly demonstrate the growth of the literature by showing the individual and social power conjunction in the factors of EI.

The purpose of this study is to explore the relationship between Person-Environment Fit (PEF), Social Worth (SW) perception, and Entrepreneurial Intention (EI), focusing on how an individual's alignment with their workplace and perceived social value influences their motivation for entrepreneurship in Türkiye.

In an era where workplace adaptability and career autonomy are becoming increasingly critical (Stephan et al., 2020), understanding the psychological and social mechanisms that drive individuals towards entrepreneurial pursuits is essential. While existing studies have examined the direct impact of personality traits, risk-taking propensity, and external support systems on EI (Liñán & Chen, 2009), there remains a limited understanding of how workplace fit and social validation contribute to the entrepreneurial mindset. This research addresses this gap by analyzing how the alignment between individuals and their work environments fosters entrepreneurial motivation through the mediating role of social worth perception in Turkish culture.

The significance of this study is grounded in its contribution to both theoretical and practical domains. Theoretically, this study expands the Person-Environment Fit Theory by demonstrating its relevance beyond traditional job satisfaction and organizational commitment outcomes (Kristof-Brown & Guay, 2011) and linking it to entrepreneurial career choices. Prior research suggests that individuals with higher levels of job alignment are more likely to exhibit higher confidence and proactive career behaviors (Gaffar et al., 2024); however, its role in fostering entrepreneurial motivation has yet to be comprehensively examined. Additionally, the Social Worth Theory suggests that individuals who perceive themselves as valued members of their work environment tend to seek greater autonomy and self-actualization. By integrating these perspectives, this study provides a novel framework for understanding how workplace dynamics and social validation influence entrepreneurial tendencies.

From a practical perspective, the findings offer valuable insights for organizational leaders, policymakers, and entrepreneurship educators. In modern work environments where employee engagement and talent retention are becoming key challenges, understanding the connection between workplace fit, social validation, and entrepreneurial aspirations can help managers design supportive work environments that nurture intrinsic motivation and professional growth. Organizations can benefit from creating more flexible and inclusive work cultures that reinforce social belonging and empower employees with entrepreneurial mindsets. Furthermore, in a post-pandemic business landscape, where career uncertainty and job transitions are increasingly common, this study highlights the importance of fostering workplace adaptability and psychological empowerment as critical elements for both corporate success and individual career development.

Ultimately, this research contributes to the broader discourse on entrepreneurship, workplace psychology, and career development by offering a multidimensional perspective on how individuals' fit within their professional environments and their social validation experiences shape their entrepreneurial aspirations. By addressing these interactions, the study bridges existing research gaps and lays a foundation for future empirical investigations into the evolving nature of career autonomy, workplace engagement, and entrepreneurial decision-making.

This study follows a systematic research process to explore the relationship between person-environment fit (PEF), social worth (SW) perception, and entrepreneurial intention (EI). The study is structured around several key methodological steps. Data were collected through an online survey. The target population consisted of employees with a minimum of five years of professional experience, ensuring that respondents had substantial exposure to workplace environments. The study utilized validated measurement scales for each construct. PEF was assessed using four dimensions (Person-Organization Fit, Person-Job Fit, Person-Group Fit, and Person-Supervisor Fit). SW perception was measured based on the degree of social validation and acceptance individuals experience in their work environments. EI was measured using a six-item scale adapted from previous entrepreneurship literature. A confirmatory factor analysis (CFA) was conducted to ensure construct validity and reliability before proceeding with the hypothesis tests. The research employed Structural Equation Modeling (SEM) to test the hypothesized relationships. Goodness-of-fit indices were examined to validate the measurement model, ensuring that the constructs adequately represented their respective latent variables. Mediation analysis was conducted using the Hayes Process macro, testing whether SW perception mediates the effect of PEF on EI.

The findings are consistent with prior research on workplace adaptability, psychological empowerment, and entrepreneurial motivation. The results contribute to post-pandemic entrepreneurship research, highlighting how workplace fit and social support mechanisms impact career decisions. The study's cross-sectional design limits its ability to capture long-term changes in EI. Future research could employ longitudinal studies to examine how PEF and SW perception evolve over time. The study primarily focuses on individual-level factors; future research could explore organizational or cultural-level moderating effects. Expanding the study across different industries and regions could further enhance generalizability and external validity.

2. Literature Review

2.1. Theoretical Background

The literature supporting the link between PEF and entrepreneurial intent is about the mirror effect explaining PEF impacts on entrepreneurial intent. PEF is the degree of a person's internal compatibility with the job and the organization, while feelings such as ease, support, and security within the workplace can directly affect the individuals' EI (Kristof, 1996). This mean compatibility makes the person yearning for an entrepreneurial process more likely because PEF mediates their self-feeling of success and capability, which then, in the case of / entrepreneurship, helps self-efficacy (Cable & DeRue, 2002).

According to PEF theory, when people are in a good relationship with their work and environment, they are more satisfied and committed, so they can have a good attitude in the workplace (Kristof-Brown & Guay, 2011). Feeling attuned to their surroundings often leads people to perceive not only that they are more valued and confident, but also that perhaps they should start their own business or do independent entrepreneurial activities (Chhabra et al., 2023; Kristof-Brown et al., 2005). The positive impact of PEF on job satisfaction and organizational commitment which is more pronounced than anything else, can be the reason for the increased entrepreneurship projects and consequently stronger entrepreneurial intentions (A. Chuang et al., 2015).

According to the Cable & DeRue' s (2002) needs-supply fit model, the better people are with their environment, the more they can balance the demands of the job with their skills, which in turn contributes to the confidence and competence required for entrepreneurship. This fit-based assurance and sense of capability can lead people to make decisions involving risks, for example, investing in new business ventures, because they feel supported and have the chance to learn and grow in their current situation (Cable & Edwards, 2004).

Thus, PEF has a favorable effect on entrepreneurial intent because it not only helps individuals feel secure and supported in their work setting but also it strengthens their preference for choosing innovative and independent work paths such as becoming an entrepreneur (Arshad et al., 2024; Liñán & Chen, 2009).

H1: Person-environment fit has an effect on entrepreneurial intention.

The literature examining the relationship between PEF and SW offers a robust framework for understanding how fit influences individuals' perceptions by their social surroundings and how this perception contributes to their sense of SW. PEF fosters alignment between individuals and their work and social environments, thereby supporting their sense of social acceptance and perceived SW (Cable & DeRue, 2002). SW encompasses an individual's social status within society, their perceived social position among others, and the social interactions they deem suitable for that position (Anderson & Kilduff, 2009; Tesi et al., 2023). Alignment with their environment can enhance an individual's SW, enabling them to be perceived more positively by those around them (Kristof, 1996).

Achieving fit allows individuals to feel secure and accepted within their social circles, contributing to their sense of SW and reinforcing their acceptance in the workplace or in border social contexts (Kristof-Brown et al., 2005).

Research exploring the relationship between PEF and SW has shown that individuals' degree of fit within their work environment directly impacts how they are perceived and their level of social acceptance (A. Chuang et al., 2015). This alignment contributes to individuals attributing a higher SW and prestige to themselves within societal hierarchies, as individuals who fit well into their environments tend to earn higher levels of acceptance and respect from others (Piasentin & Chapman, 2006).

One study supporting the link between PEF and SW, conducted by Kristof-Brown et al. (2005) examined how different types of fit influence individuals' perceptions within their work and social groups. The findings demonstrated that achieving fit in the workplace is associated with being valued more highly by others and gaining social status. Additionally, fit was found to enhance social acceptance and positive social interactions, which, in turn, support an individual's sense of SW (Cable & Edwards, 2004).

In conclusion, PEF strengthens individuals' sense of SW and enhances their tendency to gain acceptance within their environment. This alignment forms a basis for individuals to be valued by their surroundings, as those who achieve fit are more widely accepted and associated with higher SW within both work settings and social groups (Henry, 2009; Jusri & Lechner, 2024).

H2: Person-environment fit has an impact on social worth.

SW and entrepreneurial intent are linked, and the literature describes that individuals' positioning in society and their level of social acceptance are the two important factors influencing their intent to become entrepreneurs. SW is indicative of one's social acceptance and status among the people and this self-perceived status can be directly associated with those particular matters which are of importance to the formation of entrepreneurial intent, such as assuming risks, autonomy, and being creative (Crocker & Major, 1989).

Research has confirmed that those people who have a significant SW are more likely to be more confident and assume risks while making their own decisions due to the larger extent of support they get from the environmental (Anderson & Kilduff, 2009). The perception of SW in high amounts helps to take risks by making the individual more certain that they will be accepted and supported by their units. The social self-efficacy theory by Bandura' s (1997) states that the perceptions of social support and value act as a motivating force which in its turn leads the people to the entrepreneur's journey.

The contact with the individuals who have SW ensures that the person with the SW can get a chance to engage their feelings that deriving empowerment from such interactions; thus, become oriented with an entrepreneurship (Pratto et al., 2006). In collectivist societies, specifically, SW is the type of social catalyst which can bolster an individual' s capacity with additional benefits to an individual's life such as decision-making, for example, entering into entrepreneurship. In this case, the SW and entrepreneurial intent are based on the individual's popularity in the society and being recognized positively by the people around them (Begley & Tan, 2001).

On the whole, the perception of SW is a significant determinant of the entrepreneurial intention that comes from it. By having a higher rank and gaining respect in a particular social group one is more likely to be persuaded and enter a new business with the assurance of the community (Aloulou et al., 2023; Matthews & Moser, 1995).

H3: Social worth has an effect on entrepreneurial intention.

The mediation of SW in the PEF-entrepreneurial intent relationship illustrates the main way through which individuals' perceived SW affects their EI. The perceived SW from PEF by individuals' is in alignment with their surroundings, thus leading to acceptance and value within their social environment. This feeling of acceptance and value can enhance individuals' confidence and perception of social support, consequently causing them to lean more towards risky and independent options such as entrepreneurship (Cable & DeRue, 2002).

Acceptance of a well-aligned work or social environment is like a SW, which is a high SW of being accepted, which contributes to the positive effect on entrepreneurial intent (Kristof-Brown & Guay, 2011). The mediating role of SW is supported in the literature, as the individual's feelings of acceptance and support in their environment show entrepreneurial intent to prosper. (Anderson & Kilduff, 2009) also point out that in contexts of high SW, people are more likely to take actions that involve risk and independence. Therefore, the SW derived from PEF can foster the entrepreneurial intent.

In the meantime, Kristof-Brown et al. (2005), emphasize the pivotal role of fit in fostering social acceptance and support with social value acting as an effective mediator of individuals' EI. The more individuals are aligned with their work and social environments, the more they get approval and support from the surroundings, which will definitely increase the SW and self-confidence that will inspire (Piasentin & Chapman, 2006). The level of support and acceptance they get from the environment results in being more determined to make challenging decisions, for example, about entrepreneurship (Cahyadi et al., n.d.; Liñán & Chen, 2009).

To sum up, SW is the mediating variable in the association between PEF and entrepreneurial intent based on the feeling of acceptance and support that individuals get from their social environment. PEF gives individuals SW, which in return makes them more confident and motivated in their decisions regarding entrepreneurship.

H4: Social worth has a mediating effect on the impact of person-environment fit on entrepreneurial intent.

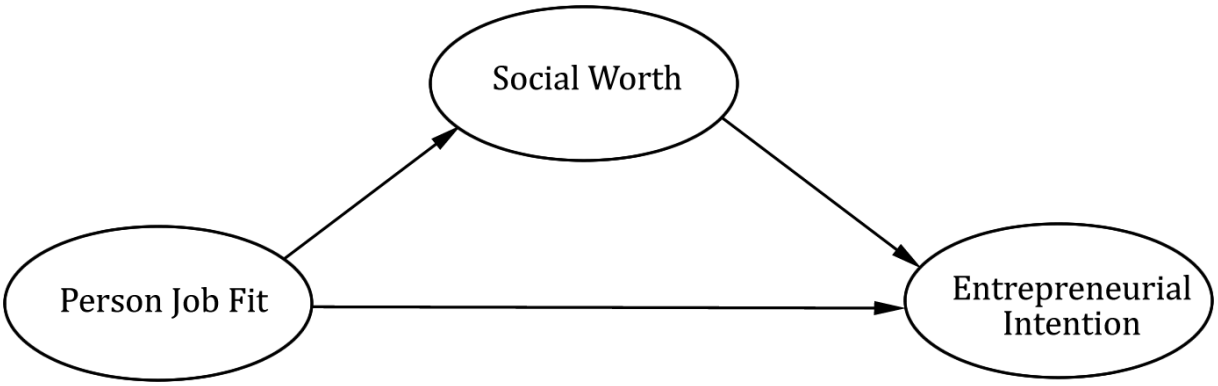

Figure 1: Research Model
Source: Autors' own creation

3. Methodology

3.1. Participants and procedure

The target population for this research consists of professionals employed in various industries with at least five years of business experience in Turkey. Participants were selected using a purposive sampling method to ensure that all respondents had a minimum of five years of professional experience. Invitations to participate in the survey were distributed through professional networks and online platforms. The sample was designed to capture a diverse range of professionals across industries, ensuring representation of different age groups, genders, and educational backgrounds. It was made possible to collect data from June 2024 until October 2024 within this time period. The number of submitted surveys stands at 289. To ensure data quality, survey responses were screened for consistency and completeness. Responses that failed to meet these criteria were excluded from the final dataset.Out of these, the ones indicated to be inconsistent were neglected, thus, 251 usable resumes were gotten. The sample of the group featured a higher number of female research participants (55.8%). Those in the age group 31-40 constituted about 39.8% of the sample. In relation to the service term, 27% had spent 5-10 years working in the company, followed by 25% with 11-20 years of experience. To illustrate the educational process, in this case,

3.2. Measures

The scales used to obtain the measurements for the variables are described below. All items were rated on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree.

3.2.1. Person-Environment Fit

Chuang et al., (2013) PEF scale comprises four dimensions. These dimensions are person organization fit (POF) (4 items), person supervisor fit (PSF) (5 items), person-group fit (PGF) (7 items), and person job fit (PJF) (4 items). The scale was translated and adapted by Tatlı & Çakmak (2019). An example item from the scale is: "Please indicate the alignment between the importance your organization places on honesty as a value and your personal approach to it." The Cronbach' s alpha values for original and Turkish version scales were 0.89 and 0.95, respectively. In this study, the Cronbach's alpha was found to be 0.89.

3.2.2. Entrepreneurial Intention

Liñán & Chen, (2009) entrepreneurial intention scale is unidimensional and consists of 6 items. The scale was translated and adapted into Turkish by Şeşen & Basım (2012). An example item from the scale is: "I will make every effort to start and sustain my own business." The Cronbach's alpha values for both scales were 0.94 and 0.86, respectively. In this study, the Cronbach's alpha was found to be 0.91.

3.2.3. Social Worth

Davis & Reyna' s (2015) SW scale is unidimensional and consists of 8 items. The Turkish version of the scale was made according to the method recommended by (Brislin, 1986). Two-stage translation was used for the scale items: firstly, from English to Turkish and then, through a blind translation process, back-translated from Turkish to English. The English items that were arrived from Turkish translations were compared with the original scale items by three persons in the committee, with the first one being the author himself, and the Turkish translations of items that were discordant in the meanings were corrected consequently.An example item from the scale is: "I feel that the worth I deserve as a person is disregarded by others." Since the original scale measures threatened SW and assesses SW in a negative direction, scale scores were reverse-coded in this study. The Cronbach's alpha for the original scale is 0.85, and in this study, the Cronbach's alpha was found to be 0.83.

3.3. Data Analysis

Before conducting SEM analysis, the data set was first screened and purified to ensure that the data meet the requirement of data analysis with a multivariate normal distribution. First, missing data were examined using the listwise deletion method, removing all incomplete cases from the data set. Several methods, such as descriptive statistics, box plots and the bootstrap technique were then used to locate outliers (Byrne, 2001).

The analysis of the data was conducted through Structural Equation Modeling (SEM) using the software AMOS. SEM is a confirmatory approach by which the analysis is made of the structural theory, and it is a powerful statistical tool for comprehending the linkages among various latent variables (Byrne, 2001). SEM can evaluate whether the model fits the data and inform of the p-values for hypothesized relationships. Confirmatory factor analysis (CFA) was performed in order to show the relationships between the observable indicators and the underlying latent factors (Podsakoff et al., 2003). Fit indices used to evaluate model fit included the Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) (Kaplan, 2000).

In the subsequent stage, the hypothesis was tested with the help of a structural equation model, analyzed with SPSS 24's Hayes Process Model (Model 4), a software package for structural equation modeling (Hayes, 2019).

While single-source survey method data collection is cost-efficient and allows you to use a large sample, it can result in common method variance bias (Podsakoff et al., 2003). To solve this problem, procedural and statistical methods were carried out. Because the data were taken from one source, it was important to check the presence of common method variance in order to ensure the reliability of the research data. In the first step, we made it clear to the participants that their responses would be kept confidential in the cover letter of the study.

4. Findings

4.1. Individual Measurement Model

The fit of the measurement model serves as a foundation for assessing the fit of the overall latent variable model (Hair et al., 2006). We conducted the CFA test to finalize the measurement model before proceeding to SEM. To analyze the validity and reliability of the 3 scales, a Level 1 Confirmatory Factor Analysis (CFA) was conducted. To determine the scope of the observed variables in the latent variable paths, the adjusted measurement model was subjected to first-level confirmatory factor analysis. Additionally, the variances and standardized and unstandardized values calculated to determine the validity and reliability of the measurement model were tabulated. The tables provide the standardized and unstandardized factor loadings, standard errors, and t-values of the parameters in the measurement models.

4.1.1. Confirmatory Factor Analysis Results of Person Environment Fit

It was decided earlier that person-environment fit will be assessed with a four-item scale. The model fit criteria obtained from the analysis fell short of the required threshold, so the modification indices were reviewed. In the light of this, covariances were added between item 2 and 4 for POF, item 6 and 7 for PSF, item 11 and 13 for PGF, and item 19 and 20 for PJF. These added covariances were the ones that caused the fit indices to arrive at their expected values. The results indicated that the model fits the data fairly well (X^2/df= 4,072; GFI=0,920; CFI=0.932 and RMSEA=0.079).

Table 1: Person Environment Fit Confirmatory Factor Analysis

Latent Variables	Observed Variables	β_0	Standart Error	t-value	p
POF	POFS_01	0,872			
POF	POFS_02	0,755	0,063	13,801	***
POF	POFS_03	0,823	0,063	16,421	***
POF	POFS_04	0,733	0,067	13,194	***
PSF	PSFT_01	0,842			
PSF	PSFT_02	0,775	0,061	13,319	***
PSF	PSFT_03	0,712	0,065	11,906	***
PSF	PSFT_04	0,630	0,071	10,249	***
PSF	PSFT_05	0,805	0,071	13,953	***
PGF	PGFS_01	0,960			
PGF	PGFS_02	0,852	0,044	21,767	***
PGF	PGFS_03	0,865	0,038	22,772	***
PGF	PGFS_04	0,789	0,043	18,057	***
PGF	PGFS_05	0,670	0,056	13,256	***
PGF	PGFS_06	0,730	0,044	15,465	***
PGF	PGFS_07	0,686	0,049	13,832	***
PJF	PJFS_01	0,926			
PJF	PJFS_02	0,848	0,048	17,898	***
PJF	PJFS_03	0,777	0,055	15,396	***
PJF	PJFS_04	0,773	0,056	15,258	***

Note: POF=Person Organization Fit; PSF=Person Supervizor Fit; PGF=Person Group Fit; PJF=Person Job Fit
***=p<0,01

The factor analysis to confirm the assumption showed that the path coefficients for all items under PEF were statistically significant. The examination of the standardized path coefficients illustrated that the biggest impact on PEF was that of the first item of POF (β = 0.872), the first item of PSF (β = 0.842), the first item of PGF (β = 0.960), and the first item of PJF (β = 0.926), respectively. In addition, the respective first absolute t-values of these coefficients were more than 1.96, thus confirming the high convergent validity.

4.1.2. Confirmatory Factor Analysis Results of Entreprenurial Intention

The entrepreneurial intention was measured with a six-item scale as it was previously talked about. The analysis showed that the model fit indices were not in the required thresholds, which led to the checking of the modification indices. This examination showed that the first item had a covariance connection with other items. Thus, the problematic item was taken out from the scale, and the analysis was conducted again. The model fit criteria were considered only after the removal of this item. The results indicated that the model fits the data fairly well (X^2/df= 3,078; GFI=0,990, CFI=0.998 and RMSEA=0.082).

Table 2: Entrepreneurship Intention Confirmatory Factor Analysis

Latent Variables	Observed Variables	β_0	Standart Error	t-value	p
EI	EI_02	0,861			
EI	EI_03	0,870	0,038	26,019	***
EI	EI_04	0,942	0,049	22,449	***
EI	EI_05	0,981	0,056	21,667	***
EI	EI_06	0,976	0,048	24,395	***

Note: EI= Entreprenerial Intention
***=p<0,01

In the confirmatory factor analysis, it is determined that the path coefficients for all items included in the Entrepreneurial Intention are statistically important. The path coefficient for EI02 was β=0.861; for EI03, β=0.870; for EI04, β=0.942; for EI05, β=0.981; and for EI06, β=0.976. Out of the standardized path coefficients, EI05 had the most significant influence on Entrepreneurial Intention (β=0.981). Furthermore, the respective absolute t-values of these coefficients were even higher than 1.96 which indicates a strong convergent validity.

4.1.3. Confirmatory Factor Analysis Results of Social Worth

SW was assessed using an eight-item scale as mentioned before. The model fit indices that were acquired from the evaluation were outside the required limits that is why there was a need to check the modification indices. Based on this review, covariances were made between item 1 and 2, item 1 and 4, as well as item 6 and 8. Through these covariances, the model fit indices were upgraded and, accordingly, got within the expected thresholds. The results indicated that the model fits the data fairly well (x^2/df= 2,380; GFI=0,969; CFI=0.989 and RMSEA=0.074).

Table 3: Social Vorth Confirmatory Factor Analysis

Latent Variables	Observed Variables	β_0	Standart Error	t-value	p
SW	SW_01	0,719			
SW	SW_02	0,830	0,062	16,21	***
SW	SW_03	0,915	0,078	14,479	***
SW	SW_04	0,589	0,053	12,218	***
SW	SW_05	0,930	0,083	14,725	***
SW	SW_06	0,597	0,065	9,332	***
SW	SW_07	0,941	0,083	14,893	***
SW	SW_08	0,842	0,064	16,375	***

Note: SW=Social Worth
***=p<0,01

In the confirmatory factor analysis, the path coefficients for all items under SW were found to be statistically significant. The path coefficient for SW01 was β=0.719; for SW02, β=0.830; for SW03, β=0.915; for SW04, β=0.589; for SW05, β=0.930; for SW06, β=0.597; for SW07, β=0.941; and for SW08, β=0.842. Among the standardized path coefficients, SW07 was identified as having the greatest impact on SW (β=0.941). In addition, the absolute t-values for all items exceeded 1.96, indicating a high level of convergent validity.

4.2. Overall Measurment Model

The overall measurement model was examined after testing the fit and construct validity of each individual measurement model. The results of the overall measurement model test showed that x2/df= 3,480; GFI=0,912; CFI=0.942 and RMSEA=0.069 and all the testing indices met the required standards. In addition, the AVE value was greater than 0.50 and higher than the squared correlation coefficient as shown in Table 4. In summary, all the results obtained from the overall measurement model test reached a satisfactory level.

In the confirmatory factor analysis, the path coefficients for all items across all scales were found to be statistically significant. Among the standardized path coefficients, the highest coefficient was observed for the 6th item of the entrepreneurial intention scale (β=0.960), while the lowest coefficient was observed for the 4th item of the SW scale (β=0.91). In addition, the absolute t-values for all items exceeded 1.96, indicating a high level of convergent validity.
To confirm the convergent validity of the CFA results, it is essential to examine item reliability, construct reliability, and average variance extracted (AVE).
Factor loadings for all items surpass the threshold value of 0.50, as illustrated in Tables, where all t-values are significant ($p < 0.01$). Construct reliability (CR) values are between 0.87 and 0.97, which is above the minimum recommended threshold of 0.70 (Hair et al., 2006). The AVE, which indicates the proportion of variance accounted for by the latent variable in comparison to measurement error variance, ranges from 0.63 to 0.86, exceeding the suggested minimum value of 0.50 by Fornell & Larcker (1981). These findings suggest that the measurement items demonstrate strong reliability and validity.

Table 4: Overall Measurment Model

Latent Variables	Observed Variables	β_0	Standart Error	t-value	p
POF	POFS_01	0,871			
POF	POFS_02	0,760	0,064	13,851	***
POF	POFS_03	0,818	0,063	16,223	***
POF	POFS_04	0,738	0,067	13,235	***
PSF	PSFT_01	0,771			
PSF	PSFT_02	0,874	0,068	14,657	***
PSF	PSFT_03	0,809	0,071	13,421	***
PSF	PSFT_04	0,676	0,079	10,892	***
PSF	PSFT_05	0,794	0,082	13,137	***
PGF	PGFS_01	0,944			
PGF	PGFS_02	0,870	0,044	22,653	***
PGF	PGFS_03	0,861	0,040	21,997	***
PGF	PGFS_04	0,825	0,042	19,771	***
PGF	PGFS_05	0,713	0,055	14,651	***
PGF	PGFS_06	0,726	0,046	15,154	***
PGF	PGFS_07	0,682	0,051	13,576	***
PJF	PJFS_01	0,802			
PJF	PJFS_02	0,728	0,048	17,425	***
PJF	PJFS_03	0,881	0,069	15,899	***
PJF	PJFS_04	0,911	0,071	16,411	***
EI	EI_01	0,633			
EI	EI_02	0,876	0,120	13,836	***
EI	EI_03	0,874	0,119	13,527	***
EI	EI_04	0,939	0,146	12,278	***
EI	EI_05	0,977	0,156	12,605	***
EI	EI_06	0,976	0,151	12,603	***
SW	SW_01	0,737			
SW	SW_02	0,850	0,059	16,681	***
SW	SW_03	0,914	0,073	15,151	***
SW	SW_04	0,591	0,050	12,538	***
SW	SW_05	0,922	0,076	15,307	***
SW	SW_06	0,610	0,061	9,746	***
SW	SW_07	0,936	0,076	15,569	***
SW	SW_08	0,864	0,074	14,231	***

Note: ***=p<0,01

4.3. Discriminant validity

Discriminant validity was evaluated by comparing each construct's correlations with the square root of its average variance extracted (Fornell & Larcker, 1981). The results are presented in below.

Table 5: Discriminant validity

	POFS	PSFS	PGFS	PJFS	SW	EI
POFS	**0,798**					
PSFS	0,572***	**0,855**				
PGFS	0,672***	0,577***	**0,808**			
PJFS	0,239**	0,156*	0,522***	**0,791**		
SW	0,102	0,292***	-0,01	-0,342***	**0,928**	
EI	0,081	0,114	⁂	0,018	⁂	**0,878**

Note. *= p < .05, **= p < .01;*** =p < .01; ⁂Correlation is not specified in the model.

The discriminant validity is confirmed, as the square root of the average variance extracted for each construct exceeds the correlation levels involving that construct.

4.4. Structural model and hypotheses testing

Based on the results above, the model is consistent and provides a solid starting point for testing the hypothesis.

Table 6: Hypothesis tests (Hayes Process Model 4)

		R	R^2	p	β	LLCI	ULCI	
	X to Y							
	PJF to EI	0,128	0,016	**0,043**	0,172	0,0053	3,3389	Accepted
H1	POF to EI	0,083	0,007	0,1857	-0,0559	-0,0501	0,2572	Not Accepted
	PSF to EI	0,1033	0,011	0,1025	0,1291	-0,0298	0,2843	Not Accepted
	PGF to EI	0,046	0,002	0,4622	-0,0665	-0,2444	0,1114	Not Accepted
H2	**X to M**							
	PJF to SV	0,310	0,096	**0,000**	-0,356			Accepted
H3	**M to Y**							
	SV to EI	0,158	0,025	**0,012**	-0,185			Accepted
	X+M to Y							
H4	Model	0,178	0,032	0,018				
	PJF to EI			**0,186**	0,117	0,0571	0,2920	Partially
	SV to EI			0,0474	-0,154	-0,3060	-0,0018	Accepted

As a result of the analyses, hypotheses H1, H2, H3, and H4 were tested, and the findings are presented in Table 6. As shown in the first row, PJF (X) was found to have an effect on entrepreneurial intention (Y) (R=0.128; R^2=0.016; p<0.05; β=0.172; LLCI: 0.0053; ULCI: 3.3389). In light of these data, H1 is partialy supported. The second row shows that PJF (X) was found to have an effect on SW (M) (R=0.310; R^2=0.096; p<0.05; β= -0.356), supporting H2. In the third row, SW (M) was found to have an effect on entrepreneurial intention (Y) (R=0.158; R^2=0.025; p<0.05; β= -0.185), supporting H3.

In the final row, the analysis results for the mediator effect are presented. Since the conditions for mediation were met in H1, H2, and H3, the model with all three variables was analyzed in the last row. The effect of the independent variable PJF (X) on the dependent variable entrepreneurial intention (Y) ($p<0.05$) was found to become insignificant when the mediator variable SW (M) was included in the model ($R=0.178$; $R^2=0.032$; $p<0.05$; LLCI: 0.0571; ULCI: 0.2920). In light of these findings, H4 is partially supported.

5. Conclusion

This research evaluates the interrelations among PEF, SW, and EI, hence offering a comprehensive account of how the environmental and social factors shape the individuals' EI. The results illustrate that social and environmental aspects are of great importance to entrepreneurial intent and the paper provides an innovative contribution to the literature by exploring the subject further.

H1 was confirmed based on the results of this study. The research showed that PEF carries a strong weight on entrepreneurial intent; notwithstanding, such an effect was seen to be of a significance level only in the endpoint of PJF. Cable & DeRue (2002) accounted the role of PJF on individual's job satisfaction & commitment, with the note that the fit not only explains job performance but also has a broader impact on behavior. Additionally (Kristof, 1996) Kristof (1996) and Kristof-Brown et al., (2005) noted the alignment of the work values as a condition for the workers to feel more skilled, therefore, the alignment leads to entrepreneurial traits.

The result that PJF was the only one to be significant in the study hints that if an employee associates the job with personal skills, the person understands their own potential and becomes more autonomous. Alignment with job requirements and personal abilities has been pointed out (Piasentin & Chapman, 2006) as a factor fostering the independent decision-making process and allowing the person to take more risks in such areas as entrepreneurship. This shows that PJF is clearly the most important factor in increasing the will to be an entrepreneur, while the person-organization or person-group dimensional have practically no effect. In this way, PJF leads to the growth of the employee in accordance with his/her job, which in turn gives the confidence and the feeling of a telescopic person needed for entrepreneurship.

The results on H2 show that PEF has a positive impact on how people see SW. This finding matches with Anderson & Kilduff (2009) theory, which states that making the environmental fit will be a factor contributing to the holistic acceptance and perceived value by the society. A study which concluded that alignment between individuals and their environment leads to their enhanced social hierarchy (Pratto et al., 2006) is consistent with the findings of this survey. As literature suggests, PEF is the factor that creates the lifeline of social support, thus, the individuals' sense of SW grows alongside, and they feel more accepted in their environment, e.g. Kristof-Brown & Guay (2011), Cable & Edwards (2004). In this context, the alignment of PEF and SW found in our study shows that people who coordinate with the environment feel they are more worthwhile which in turn protects their self-acceptance. The SW that is tied to environmental alignment has an effect on motivational level and thus shifts the focus on SW; this is especially the case in higher-value collectivist societies.

H3 identified a connection that SW has a positive outcome in business ventures aligning with literature which indicates that social backing and sense of being valued by the community come out with good independent decisions and taking the risk. As said by Crocker & Major (1989) when people perceive the acceptance from the social sphere their self-confidence is enhanced, thus, they are pursuing the area of entrepreneurship which demands independence. The advantageous influence of SW on entrepreneurship is also deducted from Anderson & Kilduff (2009) works that claimed that the facilitating conditions of people's choices about the business are the positive reactions and the support they get from their social networks.

The research has pointed out the fact that the individuals who have great SW canvas carry a lot of entrepreneurial intent, which suggests that the support from the social environment is the factor that advances outward business sense among them. For those individuals, being a SW manager means the reassuring feeling that they are accepted more and hence such value increases their bravery to act in a manner of entrepreneurship. All in all, it could be said that these two factors social support and perceived value are directly influencing the independent decision-making process by enhancing the propensity toward the entrepreneurial intent in people who feel that they are valued in the society.

H4 was additionally confirmed with the results of the study, which proved the significant mediating role of SW in the PEF-entrepreneurial intent realm. This outcome was consistent with Liñán & Chen (2009) studies, which argue that environmental fit promotes entrepreneurs' intentions through the increment in the perceived SW of individuals. Kristof-Brown & Guay (2011) pinned down that when the individuals are in tune with their surroundings they experience gain in SW through the endorsement of their environment, which begs the question of increasing them in the EI.

The mediating function of SW works in such a way that by fitting in with their surroundings, individuals feel valued more, thus the support they receive is higher which ultimately increases their intention to become entrepreneurs. The study findings here show that the people's belief and backing from their social environment which are often adroitly embraced by the individuals lead them to the paths that require their own creation like entrepreneurship. Research like Cable & DeRue (2002), who point out that those who have social approval from their environment take higher risks, enforces the idea by showing how PEF through SW causes an increase in the entrepreneurial intent.

The current research proposes a new, broadened approach to the study of social and environmental issues that lifts the veil from such equipment loaning as entrepreneurship. It is clear that employees' affinity with their work combined with their perception of social support or the outside influence is the major element that steers them in the direction of independence and entrepreneurship (Segaf, 2023). The fact that particularly PJF and SW perceptions demonstrate significantly higher effects on entrepreneurial intent indicates that individuals, who are able to adjust to their work environment are likely to get more social support which, in turn, drives them to entrepreneurship (Udin, 2024).

The research has contributed to the literature on theory PEF and SW and has served as a connecting element on the dynamics of entrepreneurial intent and social environment. The outcomes are a grievous broad picture of literature since it shows how SW perceptions that arise from job fit and student assistance could determine individuals' EI.

Despite the notable results, this study has some limitations. Primarily, the research sample is exclusively made of people who are in a specific work environment which limits the research to the individuals of that specific social structure. This drawback could question the transfer of results; PEF, SW, and entrepreneurial intent are the orientations that may alter based on context, culture, or a combination of both. These relations may turn into divergent in collectivistic and individualistic cultures; thus, research in different cultural settings may reinstate the generalizability of the findings.

Secondly, the study was a cross-sectional research design which leads to the consequence that the causal aspect of the relationship between them cannot be drawn to PEF, SW, and entrepreneurial intent. It turns out that the exploration of time through longitudinal studies which approach these relations would help understandfully develop and clarify causality. Third, as the data originated from self-reporting, the risk of bias by people chasing positive social image and the use of the same method has affected the results accordingly. To dismiss these issues, further incitements should focus on the metrics that are more objective and the data collection methods accordingly.

On the basis of the results of this research, a few directions can be provided for future research. First, the relationship between PEF and SW should be explored across various cultural and sectoral contexts. It is considered that the PEF's effect on SW varies between individualistic and collectivistic cultures; therefore the running of similar studies on culturally diverse samples can question and fortify the validity of these findings over different cultures.

Second, forthcoming research should anchor on discovering other mediating and moderating variables in the role of PEF and entrepreneurial intent. Eventually, how the individuals' risk-taking proclivity, innovation rate, or their involvement in social networks upturn these relationships could be explored. The inclusion of such variables can broaden the assessment of the factors impacting the entrepreneurial intent and the social and environmental aspects involved.

Finally, while the study was concentrated on the aggregate effect of PEF and SW on entrepreneurial intent, conducting research specific to entrepreneurship fields in different sectors can help understand better the contextual aspects of this relationship. For instance, the comparison of entrepreneurial intent between individuals working in high risk sectors and those in low risk sectors can provide a more comprehensive picture of how PEF and SW perceptions influence entrepreneurial intent in different sectors.

These limitations and suggestions for future research may extend the literature and contribute to a broader and deeper understanding far beyond the current findings.

Practical Implications

This study's outcomes present the very practical steps for the managers who want to help their employees develop an entrepreneurship mindset. The Person-Environment Fit (PEF) role in promoting the entrepreneurial intent is of utmost importance, with the Person-Job Fit (PJF) dimension being the most significant one. The managers are recommended to devise recruiting and leadership strategies that will help the employees to develop the skills that they need for their jobs. Regular evaluations of the agreement between job role and employee can identify misalignments beforehand, which will enable managers to use proactive measures to boost employee happiness and entrepreneurial orientation.

Social Worth (SW) was found to be a significant mediator in the link between PEF and entrepreneurial intention. Thus, it is instrumental to nurture a workplace environment that classes priority to recognition, value, and support. Managers need to take into account the implementation of the formal acknowledgment systems such as employee awards, peer recognition programs, and transparent feedback mechanisms to enrich the employee perception of social worth. These initiatives should, in addition to the increase in the percentage of the entrepreneurial take-up, make the teams more engaged and innovative.

In business sectors that target the acquisition and development of entrepreneurial capabilities as a part of their organizational culture, setting up training sessions based on risk-taking, creativity, and independent decision-making should be the way forward. These should mostly promote the importance of a supportive work environment and social validation in the success of an entrepreneur, through the relaying of the most significant findings from this study.

Furthermore, managers in the multinational or diverse workplaces should take into account the cultural aspects of PEF and SW. The management practices of tailoring to people of different cultures should be based on the concept that all employees will be included and therefore the potential of entrepreneurship among diverse employees will be maximized.

Last but not least, the managers are advised to distribute time-to-time employee surveys that can be used to assess the PEF and SW in their organizations. The experience that comes in such form will help in the formulation of policy changes, structure adjustment, or individualized career development plans, all of which will make the employees to have the feeling of being valued and thus promote their entrepreneurship efforts.

These practical measures that stem from the study results again prove the value of combining individual and organizational goals, which in turn accelerates and maintains innovation and competitiveness.

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Türkiye'nin Yenilikçi Sınıfı Perspektifinden: OSB ve TGB'lerin Mekânsal Dinamiklerinin Karşılaştırılması

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Öz

Amaç: Bu araştırma, Türkiye'de Organize Sanayi Bölgeleri (OSB) ve Teknoloji Geliştirme Bölgeleri (TGB) bağlamında Ar-Ge çalışanlarının mekânsal dinamiklere dair algılarını incelemeyi amaçlamaktadır. Araştırma ayrıca, bu bölgelerin yenilikçi sınıfın ihtiyaçlarını karşılama kapasitesini değerlendirmeyi ve OSB ile TGB'lerin ekonomik ve bölgesel kalkınmaya katkılarını karşılaştırmayı hedeflemektedir.

Metodoloji: Araştırmada nicel yöntemler kullanılmış, veri toplama aracı olarak yapılandırılmış anket formları uygulanmıştır. Veriler, Türkiye'nin 14 ilinde OSB ve TGB'lerde çalışan toplam 1.112 Ar-Ge çalışanından toplanmıştır. Anket soruları, tolerans düzeyi, teknoloji ilgisi, girişimcilik potansiyeli ve yenilikçilik düzeylerini değerlendirmeyi hedeflemiştir. Verilerin analizi için SPSS programında bağımsız örneklem t-testi ve ANOVA testleri uygulanmıştır.

Bulgular: Araştırma sonuçlarına göre, OSB'lerde çalışan Ar-Ge personelinin teknoloji ilgisi daha yüksekken, TGB'lerde çalışan personelin girişimcilik potansiyeli ve yenilikçilik düzeylerinin daha yüksek olduğu belirlenmiştir. TGB'lerin modern altyapısı ve sosyal olanakları, çalışanların motivasyon ve verimlilik düzeylerini olumlu etkilemektedir. Buna karşın, OSB'lerin fiziksel altyapı avantajlarına rağmen sosyal ve psikolojik unsurlarda eksiklikler bulunduğu görülmüştür.

Pratik Çıkarımlar: Bu araştırma, Türkiye'nin yerel ve bölgesel kalkınma politikalarının geliştirilmesinde OSB ve TGB'lerin tamamlayıcı roller oynayabileceğini göstermektedir. OSB'lerin sosyal ve kültürel imkanlarının artırılması, TGB'lerin ise bürokratik süreçlerin sadeleştirilmesi gibi stratejik adımlar önerilmektedir. Bu yaklaşımlar, Türkiye'nin yenilikçilik kapasitesini artırarak, ekonomik ve teknolojik kalkınmaya önemli katkılar sağlayabilir.

Özgünlük: Bu çalışma, OSB ve TGB'lerin mekânsal dinamiklerini karşılaştıran kapsamlı bir değerlendirme sunarak, yenilikçi sınıfın mekânsal tercihlerine odaklanmaktadır. Böylece, OSB ve TGB'lerin geliştirilmesine yönelik özgün politika önerileri sunarak mevcut literatüre önemli katkılar sağlamaktadır.

Jel Kodları: L26, O30, M10

Anahtar Kelimeler: Yenilikçi Sınıf, Ar-Ge Çalışanı, Mekân, OSB, TGB,

Comparison of the Spatial Dynamics of OIZs and TDZs from the Perspective of Turkey's Innovative Class

Abstract

Objective: This study aims to examine the perceptions of R&D employees regarding the spatial dynamics of Organized Industrial Zones (OIZs) and Technology Development Zones (TDZs) in Turkey. Additionally, the study evaluates these regions' capacities to meet the needs of the innovative class and compares the contributions of OIZs and TDZs to economic and regional development.

Methodology: Quantitative methods were used in the research and structured questionnaires were used as data collection tools. Data were collected from a total of 1,112 R&D employees working in OIZs and TDZs in 14 provinces of Turkey. The survey questions aimed to assess the level of tolerance, technology interest, entrepreneurial potential and innovation. For data analysis, independent sample t-test and ANOVA tests were applied in SPSS program.

Findings: The results reveal that while R&D employees in OIZs exhibit higher levels of interest in technology, employees in TDZs demonstrate higher entrepreneurial potential and innovation levels. The modern infrastructure and social amenities of TDZs positively impact employee motivation and productivity. However, despite the physical infrastructure advantages of OIZs, deficiencies in social and psychological factors were identified.

Practical Implications: This research shows that OIZs and TDZs can play complementary roles in the development of Turkey's local and regional development policies. Strategic steps such as increasing social and cultural opportunities in OIZs and simplifying bureaucratic processes in TDZs are recommended. These approaches can make significant contributions to economic and technological development by increasing Turkey's innovation capacity.

Originality: This study focuses on the spatial preferences of the innovative class by providing a comprehensive assessment comparing the spatial dynamics of OIZs and TDZs. Thus, it contributes to the existing literature by providing original policy recommendations for the development of OIZs and TDZs.

Jel Codes: L26, O30, M10

Keywords: Innovative Class, R&D Employee, Space, OIZ, TDZ,

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1. Giriş

Teknolojik değişim ve yenilik faaliyetleri, ekonomik büyüme ve verimlilik artışının göstergeleridir. Küreselleşme ile artan rekabet, teknolojik yeniliklerin geliştirilmesini ve sürekli değişime uyumu gerektirmektedir. Bu nedenle, Ar-Ge çalışmalarına önem vermeyen ülkeler sürdürülebilir ekonomik büyümeyi sağlamakta zorlanabilmektedir (Kutbay & Öz, 2017, s.333). Türkiye'de Organize Sanayi Bölgeleri (OSB) ve Teknoloji Geliştirme Bölgeleri (TGB), bu çalışmalara ev sahipliği yapan iki temel yapıdır. Bu makalede, yenilikçi Ar-Ge çalışanlarının perspektifinden, bu iki yapının mekânsal dinamikleri karşılaştırmalı olarak incelenmiştir. Çalışma, nicel veriler üzerinden yenilikçi Ar-Ge çalışanlarının mekân tercih ve ihtiyaçlarına odaklanmaktadır.

Bilgiye dayalı yeni dünya düzeninde, bilgiyi üreten ve etkin şekilde kullanan bir sınıf olan "yenilikçi sınıf" ortaya çıkmıştır. Bu sınıfın önemi, Ar-Ge ve yenilikçiliğe yapılan yatırımların artmasıyla daha da belirgin hale gelmiştir. Ar-Ge ve yenilikçilik çalışmaları, ekonomik büyüme ve kalkınmanın itici gücü olarak kabul edilmektedir (OECD, 2018). Türkiye'de Ar-Ge çalışmalarının en önemli mekânları TGB'ler ve OSB'lerdir. Bu bölgelerde yer alan Ar-Ge bazlı firmalar, Türkiye'nin teknolojik gelişimine önemli katkılar sağlamaktadır (Cansız vd., 2018; Yavan, 2018; Akçomak vd., 2021).

Yaratıcı sınıf, yenilikçilik, bilgi ve teknoloji üretimi gibi alanlarda faaliyet gösteren, yeni fikirleri hayata geçiren ve ekonomik değer yaratan bireylerden oluşmaktadır. Bu sınıfın üyeleri arasında bilim insanları, mühendisler, mimarlar, tasarımcılar, sanatçılar, yazarlar ve müzisyenler gibi farklı disiplinlerdeki profesyoneller bulunmaktadır. Bu sınıfın özellikleri arasında yüksek eğitim seviyesi, problem çözme yeteneği, özgün düşünme tarzı ve risk alma cesareti yer almaktadır. Florida'ya (2002, 2012) göre, yaratıcı sınıf teknoloji, sanat, medya, eğitim ve diğer bilgi-yoğun alanlarda çalışan bireylerden oluşmaktadır. Bu sınıfın ihtiyaçlarını karşılayabilen bölgeler, daha hızlı ekonomik büyüme ve kalkınma gösterebilmektedir.

Ar-Ge çalışanları, yeni ürünler, hizmetler veya teknolojiler geliştirmek için bilimsel ve teknik bilgi kullanarak yenilikçi çözümler üreten profesyonellerdir. Bu çalışanlar, yaratıcı düşünme ve problem çözme yetenekleriyle yeni ürünler veya süreçler geliştirir, bilimsel bilgiye dayanarak araştırmalar yapar ve bu bilgiyi pratik uygulamalarda kullanırlar. Ayrıca, araştırma ve geliştirme projelerini planlar, yürütür ve yönetirler. Çok disiplinli takımlarla iş birliği yapar ve diğer birimlerle koordineli çalışarak geliştirilen ürünlerin pazar ihtiyaçlarına ve müşteri taleplerine uygun olmasını sağlarlar.

Florida vd. (2008) "Bölgesel Kalkınmanın Kara Kutusunun İçinde: İnsan Sermayesi, Yaratıcı Sınıf ve Hoşgörü" adlı çalışmalarında bölgesel ekonomik kalkınmanın birbiriyle bağlantılı üç faktör tarafından yönlendirildiğini ileri sürmektedir; insan sermayesi, yaratıcı sınıf ve hata payı. Daha yüksek düzeyde eğitimli bireylerin (beşerî sermaye), yaratıcı mesleklerdeki insanların daha büyük bir kısmının (yaratıcı sınıf) ve daha açık ve kapsayıcı bir ortamın (hoşgörü) olduğu bölgelerin daha fazla ekonomik büyüme ve daha yüksek üretkenlik deneyimleme eğiliminde olduğu düşünülmektedir. Yapılan çalışmalar, bu faktörlerin yalnızca bireysel olarak değil aynı zamanda kolektif olarak yetenekleri çekmeye ve yenilikçiliği teşvik etmeye, dolayısıyla bölgesel ekonomik sonuçları artırmaya katkıda bulunduğunu göstermektedir.

Bu kapsamda, bu çalışma, yaratıcı sınıfın tamamını değil, önemli bir bölümünü kapsamaktadır. Florida'nın (2002) tanımladığı süper yaratıcı çekirdek (teknoloji, inovasyon ve Ar-Ge alanlarında çalışan mühendisler ve yazılımcılar) ile yaratıcı profesyoneller (yöneticiler) yani Ar-Ge çalışanları incelenmiş, ancak bohemleri ve akademisyenleri kapsamamıştır. Bu çalışmanın bulguları, OSB'lerin sanayiye sağladığı fiziki koşullar bakımından güçlü olduğunu, ancak sosyal ve rekreasyonel olanaklarda eksiklikler bulunduğunu ve Ar-Ge ile inovasyon faaliyetlerine 14 il bazında farklı ölçülerde de olsa yeterli desteğin sağlanamadığını göstermektedir. Diğer yandan, TGB'ler teknoloji, Ar-Ge ve inovasyon odaklı yapılarıyla ön plana çıkmakta, yenilikçi ekosisteme entegrasyon, sosyal olanaklar ve yaşam kalitesi açısından avantajlı olmakla birlikte, bürokratik süreçlerde zorluklarla karşılaşmaktadır.

Bu çalışma, yenilikçi sınıfın beklentilerini karşılayacak şekilde OSB ve TGB'lerin daha çekici ve yenilikçi hale getirilerek yeniden tasarlanması için önemli veriler sunmaktadır. Ayrıca, yenilikçi sınıfın mekânsal tercihleri ve beklentilerinin anlaşılması, Türkiye'nin yerel ve bölgesel kalkınma politikalarının şekillendirilmesine de katkı sunacaktır. Bu çalışmanın amacı, yenilikçi sınıfın girişimcilik eğilimlerini etkileyen tolerans/hoşgörü düzeyi, teknoloji ilgi düzeyi, girişimcilik potansiyeli ve yenilikçilik düzeyinin çeşitli demografik değişkenler (cinsiyet, yaş, firma türü ve ihracat durumu) açısından farklılık gösterip göstermediğini incelemektir.

2. Literatür Taraması

2.1 Kuramsal Yaklaşım

Organize Sanayi Bölgeleri (OSB) ve Teknoloji Geliştirme Bölgeleri (TGB), Türkiye'nin sanayileşme ve teknolojik kalkınma stratejileri kapsamında bölgesel gelişimi desteklemek amacıyla uyguladığı iki önemli mekanizmadır. Bu yapıların etkililiğini analiz edebilmek için çalışmanın kuramsal temelini iki ana yaklaşım oluşturmaktadır: Triple Helix Modeli ve Bölgesel Yenilik Sistemleri (RIS).

Triple Helix modeli, Etzkowitz ve Leydesdorff (2000) tarafından geliştirilen ve üniversite, sanayi ve devlet arasında etkileşimsel bir iş birliği modelini esas alan yenilik sistemleri yaklaşımıdır. Bu modele göre, bilgi temelli ekonomilerde yenilik üretimi yalnızca bir kurumun değil, bu üç aktörün karşılıklı etkileşimlerinin sonucudur. Modelin neo-institüsyonel boyutu, kurumlar arası ağlara odaklanırken; neo-evolüsyonist boyutu, bu ağların zaman içindeki dinamik dönüşümünü vurgular (Leydesdorff & Meyer, 2006). TGB'ler bu modelin en somut örneklerinden biridir. Üniversite-sanayi iş birliğini kurumsal düzeyde gerçekleştiren, kamu destekli Ar-Ge faaliyetlerinin yoğunlaştığı ve özel sektörün bilgiye doğrudan erişebildiği yapılar olarak Triple Helix'in sinerjik etkilerini sergilerler (Leydesdorff & Ivanova, 2016; Ye vd., 2013). Bu bağlamda TGB'ler, OSB'lere kıyasla daha güçlü bir bilgi üretim ve dönüşüm sistemine sahiptir. OSB'ler ise genellikle üretim odaklı, geleneksel sanayi kümelenmeleri olup bilgi üretimi fonksiyonunu ikinci planda tutarlar (Erdil & Çetin, 2012). Ayrıca, Triple Helix modeli yalnızca üç kurumun sabit iş bölümüyle değil, fonksiyonlar arasında geçişkenlik ile de tanımlanır. Örneğin, üniversitelerin girişimcilik faaliyetlerine katılması ya da kamu kurumlarının Ar-Ge destekleyici aktörler haline gelmesi gibi (Leydesdorff, 2012). Bu esneklik, TGB'lerin hem yapısal hem de işlevsel olarak daha yenilikçi ortamlar sunduğunu göstermektedir.

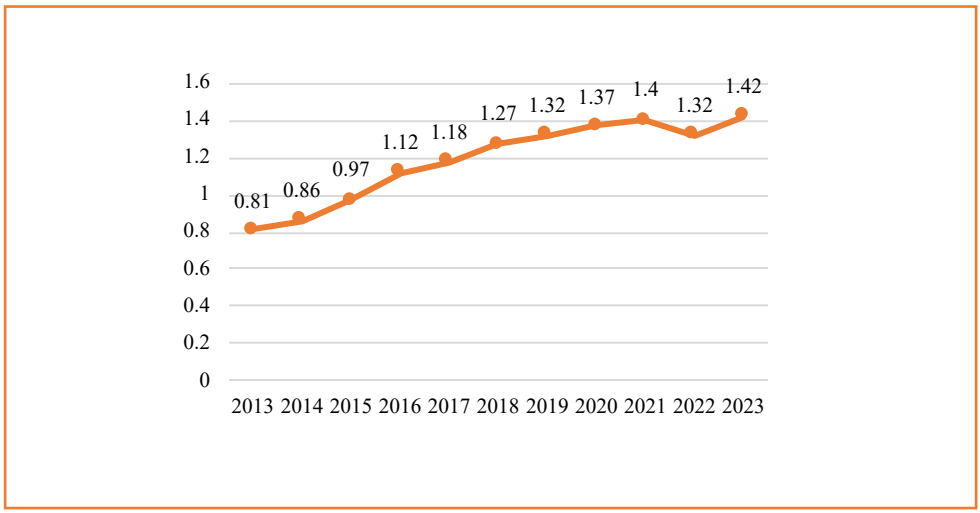
Cooke ve arkadaşlarının (1997) öncülüğünde geliştirilen Bölgesel Yenilik Sistemleri yaklaşımı, yenilik kapasitesinin yalnızca ulusal değil, alt-ulusal düzeyde de değerlendirilmesi gerektiğini ileri sürer. RIS; üniversiteler, firmalar, kamu kurumları ve destekleyici aktörlerin yerel düzeydeki iş birlikleriyle bilgi akışını ve inovasyonu sistematik hale getiren yapılardır. Bu yaklaşımda, yerel bağlam, kurumsal kapasite ve öğrenme süreçleri ön plandadır. TGB'ler RIS yaklaşımının temel yapı taşlarını taşır: üniversite merkezli bilgi üretimi, girişimcilik ekosistemleri, Ar-Ge teşvikleri ve çok aktörlü iş birliği kültürü (Cooke et al., 1997; Mutlu & Arıkoğa, 2023). Bu nedenle TGB'ler, RIS modeli bağlamında bölgesel inovasyon merkezleri olarak değerlendirilebilir. OSB'ler ise RIS bağlamında daha sınırlı bir konuma sahiptir. Erdil ve Çetin (2012), Ankara OSB'lerine ilişkin mekânsal ekonometrik analizlerinde bilgi sıçramalarının (spillovers) varlığını doğrulamakla birlikte, bu etkilerin çoğunlukla üretim ve lojistik ilişkileri üzerinden gerçekleştiğini ve kurumsal iş birlikleriyle sınırlı kaldığını göstermiştir. OSB'lerde RIS için gerekli olan üniversite iş birlikleri, Ar-Ge merkezleri veya bilgiye dayalı işletme kültürü büyük ölçüde eksiktir. RIS yaklaşımı, ayrıca bölgeler arası yenilik kapasitesindeki asimetrileri de vurgular. Bu bağlamda OSB'lerin RIS potansiyelleri, kurumsal kapasite, yönetişim yapısı ve yerel destek mekanizmalarının yetersizliği nedeniyle sınırlı kalmaktadır (Cooke et al., 1997).

Bu çalışmada, Türkiye'deki Organize Sanayi Bölgeleri (OSB) ile Teknoloji Geliştirme Bölgeleri (TGB) arasında yenilikçi sınıfın oluşumu ve desteklenmesi açısından karşılaştırmalı bir analiz yapılmaktadır. Yukarıda sunulan Triple Helix ve Bölgesel Yenilik Sistemleri (RIS) kuramsal yaklaşımları, makalenin temel sorunsalına teorik bir zemin sunmaktadır. Nitekim çalışmanın bulguları, TGB'lerin üniversite, sanayi ve devlet aktörleri arasındaki iş birliğini daha etkin şekilde tesis ettiğini ve RIS kapsamında daha dinamik, öğrenmeye açık ve bilgi odaklı bir yapı sunduğunu göstermektedir.

Buna karşılık OSB'lerin üretim temelli yapılar olarak bu iş birliklerini sınırlı düzeyde gerçekleştirebildiği görülmüştür. Bu bağlamda kuramsal çerçevede sunulan modeller, çalışmanın nicel bulgularını açıklamakta ve OSB-TGB ayrımının sadece fiziksel yapı değil, aynı zamanda sistemsel inovasyon kapasitesi açısından da anlamlı olduğunu ortaya koymaktadır.

2.2 Ar-Ge Çalışmalarının Önemi

Ar-Ge çalışmaları, yenilikçi ürün ve hizmetlerin geliştirilmesinde kritik bir rol oynamaktadır. Türkiye'nin Ar-Ge harcamalarının Gayri Safi Yurt İçi Hasıla (GSYH) içindeki payı yıllar içinde artış göstermiştir. Bu durum, ülkenin yenilikçilik kapasitesini artırma hedefinin bir göstergesidir.



Grafik 1: Ar-Ge Harcamasının GSYH içindeki Payı (%) (Kaynak: TÜİK Araştırma-Geliştirme Faaliyetleri Araştırması, 2023)

Ar-Ge, küresel zorluklarla mücadele etmek, ekonomik büyümeyi desteklemek ve yeniliği teşvik etmek için gerekli görülmektedir. (OECD, 2023)

2020 yılında Türkiye'nin gayrisafi yurt içi Ar-Ge harcamasının GSYH'ye oranı %1,37 iken, bu oran 2021 yılında %1,40'a yükselmiştir. 2023 yılı itibarıyla ise bu oran %1,42 olarak gerçekleşmiştir. Son yıllarda oranlarda gözlemlenen artış, olumlu bir eğilime işaret etmekle birlikte, bu seviyeler hala gelişmiş ülkelerin hedeflediği oranların gerisinde kalmaktadır. (OECD 2022 Ortalaması: %2,73) Türkiye'nin yenilikçilik kapasitesini artırması, küresel rekabet gücünü güçlendirmesi ve toplumsal refah düzeyini yükseltmesi için Ar-Ge yatırımlarını hem artırması hem de etkin bir şekilde kullanması gerekmektedir. 2023 yılı verileri, bu yönde daha kapsamlı ve stratejik adımların atılması gerektiğini göstermektedir.

Bu çerçevede, Cansız vd.'nin (2019) UNDP raporuna göre, Organize Sanayi Bölgelerindeki firmaların Ar-Ge, inovasyon ve yeni teknolojilere yatırım yapma kapasitelerinin geliştirilmesi önemli bir konudur. Söz konusu Rapor, OSB'lerdeki firmaların Ar-Ge ve inovasyon kapasitelerinin yetersiz olduğunu vurgulamakta ve rekabet gücünü artırmak ve yenilikçi ürünler geliştirmek için Ar-Ge yatırımlarının artırılması gerektiğini belirtmektedir.

2.2. Mekân Algısı ve Yenilikçi Sınıfın Mekân Tercihlerini Etkileyen Faktörler

2.2.1. Mekân Algısı

Mekân, sadece fiziksel bir boşluk veya zemin değil, insanların deneyimleri, anlamlandırmaları ve etkileşimleriyle şekillenen dinamik bir kavramdır. Florida (2012, s.188)'nın vurguladığı gibi, günümüz bilgi ve inovasyon ekonomisinde mekân, ekonomik büyümenin önemli bir itici gücü haline gelmiştir. Bunun nedeni, mekânın bireylerin yaratıcılığını, inovasyon kapasitelerini ve yeni endüstrilerin doğmasını sağlayan bir "ekosistem" olarak işlev görmesidir.

Özellikle bilgiye dayalı inovasyon ekonomisinde, mekâna dayalı ekosistemlerin yaratıcılığı, inovasyonu ve yeni endüstrilerin oluşumunu desteklemesi nedeniyle, mekânın önemi daha da artmıştır. Mekân artık sadece bir platform veya tuval değil, olayların neden ve nasıl gerçekleştiğini açıklayan bir kavram haline gelmiştir (Scott & Storper, 2003; Coe vd., 2013, s.5).

Mekân algısı da bu bağlamda kritik öneme sahiptir. Lynch (1960)'in analizleri, insanların şehirleri belirli fiziksel öğeler üzerinden nasıl anlamlandırdıklarını ve zihinlerinde nasıl bir "kent imajı" oluşturduklarını göstermektedir. Ancak Gifford (2007)'un vurguladığı gibi, mekân algısı yalnızca fiziksel değil, sosyal, kültürel ve psikolojik faktörlerden de etkilenmektedir. Bireyler, geçmiş deneyimleri, beklentileri, duygusal durumları ve sosyal etkileşimleri doğrultusunda çevrelerindeki mekânları algılamakta ve anlamlandırmaktadır.

Bu bakış açısı, mekânın ve mekân algısının karmaşık ve çok boyutlu yapısını ortaya koymaktadır. Mekân, yalnızca fiziksel bir boşluk değil, insanların deneyimleri, anlamlandırmaları ve etkileşimleriyle şekillenen dinamik bir kavramdır. Mekân algısı da yalnızca fiziksel özelliklere indirgenemez, sosyal ve psikolojik faktörlerden de etkilenmektedir. Bu karmaşık yapı, mekânın ve mekân algısının kentsel planlama, bölgesel kalkınma, mimari ve kentsel tasarım gibi alanlarda nasıl dikkate alınması gerektiğini göstermektedir.

Sonuç olarak, mekân ve mekân algısı konusu, disiplinler arası bir bakış açısını gerektiren, çok boyutlu ve kompleks bir konudur. Analitik bir yaklaşımla bu kavramların derinlemesine anlaşılması, günümüzün inovasyon odaklı ekonomisinde ve giderek daha da önem kazanan sürdürülebilir mekanlar gündeminde kritik bir öneme sahiptir.

2.2.2. Yenilikçi Sınıfın Mekân Tercihlerini Etkileyen Faktörler

Yenilikçi sınıfın mekân tercihleri, bu sınıfın karakteristik özellikleri, iş yapma biçimleri ve ihtiyaçları doğrultusunda şekillenmektedir denilebilir. Yenilikçi sınıf, genellikle yüksek eğitimli, yaratıcı düşünebilen ve risk alma kapasitesi yüksek bireylerden oluşmaktadır. Bu bireylerin verimli çalışabilmesi için ihtiyaç duydukları mekânsal özellikler, belirli faktörler çerçevesinde değerlendirilebilir.

Baum ve Mezias (1992), mekânın, yerel rekabetin ve organizasyonel başarısızlıkların dinamiklerini incelerken, yerel rekabetin yoğun olduğu alanlarda yenilikçi sınıfın daha başarılı olabileceğini öne sürmüştür. Bu durum, yenilikçi sınıfın rekabetçi ve dinamik ortamlarda daha etkin çalışabileceğini göstermektedir. Antoncic ve Hisrich (2001) ise, yenilikçi sınıfın mekân tercihlerini etkileyen faktörler arasında iç girişimcilik ve yenilikçilik faaliyetlerinin önemli olduğunu belirtmişlerdir. İç girişimcilik, çalışanların kendi organizasyonları içinde yenilikçi projeler geliştirme ve uygulama yeteneği olarak tanımlanabilir. Bu bağlamda, yenilikçi sınıfın tercih ettiği mekânlar, yaratıcı düşünmeye ve girişimcilik faaliyetlerine olanak tanıyan özelliklere sahip olmalıdır. Bu nedenle, yenilikçi sınıfın çalıştığı mekanların fiziksel, sosyal ve psikolojik unsurları önemli görülmektedir.

2.3. Türkiye'de OSB'ler ve TGB'ler

Türkiye'de ekonomik ve teknolojik gelişim, Organize Sanayi Bölgeleri ve Teknoloji Geliştirme Bölgeleri aracılığıyla desteklenmektedir.

OSB'ler, sanayi tesislerinin planlı bir şekilde yerleştirildiği ve altyapı hizmetlerinin toplu olarak sunulduğu alanlar olarak öne çıkmaktadır. Bu bölgeler, geniş üretim alanları, ekonomik altyapı hizmetleri ve sanayiye yönelik destekleyici imkanlar sunmaktadır. Böylece, sanayi firmalarının ihtiyaçlarına yönelik bir ekosistem oluşturulmaktadır. Diğer yandan, TGB'ler ise üniversiteler, araştırma kurumları ve teknoloji odaklı şirketlerin bir araya geldiği, Ar-Ge ve yenilikçilik faaliyetlerinin yoğunlaştığı bölgeler olarak tanımlanmaktadır. Bu bölgeler, yüksek teknolojili laboratuvarlar, kuluçka merkezleri ve teknoloji transfer ofisleri gibi unsurlarıyla yenilikçi sınıfın ihtiyaçlarına cevap vermektedir.

Bu çerçevede, fiziksel, sosyal ve psikolojik unsurlar göz önünde bulundurularak yenilikçi sınıfın OSB'leri ve TGB'lerini nasıl algıladıkları ortaya konmaya çalışılmaktadır.

2.3.1 Organize Sanayi Bölgeleri (OSB)

Organize Sanayi Bölgeleri, sanayi kuruluşlarının belirli bir düzen ve plan çerçevesinde faaliyet gösterebilmesi için tasarlanmış, altyapısı tamamlanmış ve çeşitli teşviklerle desteklenen sanayi alanlarıdır. OSB'ler, sanayi yatırımlarını teşvik etmek, sanayi kuruluşlarını bir araya getirerek verimliliği artırmak, çevresel etkileri minimize etmek ve ülkenin ekonomik kalkınmasını desteklemek amacıyla kurulmaktadır. (Sanayi ve Teknoloji Bakanlığı, 2024) OSB'lerin başlıca amaçları arasında sanayi yatırımlarını teşvik etmek, üretim ve istihdamı artırmak, sanayi tesislerinin modernizasyonunu sağlamak ve çevresel koruma önlemlerini hayata geçirmek bulunmaktadır. Bu bölgeler, sanayi kuruluşlarına modern altyapı hizmetleri sunarak, üretim maliyetlerini düşürmekte ve rekabet gücünü artırmaktadır. Ayrıca, OSB'ler, sanayi tesislerinin belirli bir düzen ve plan çerçevesinde faaliyet göstermesini sağlayarak çevresel etkilerin kontrol altına alınmasına yardımcı olmaktadır.

OSB'ler, firmalara sundukları çeşitli teşvikler ve hizmetler ile sanayi yatırımlarını cazip hale getirmektedir. OSB'lerde sunulan başlıca hizmetler arasında altyapı hizmetleri (yol, su, elektrik, doğalgaz), arıtma tesisleri, ortak kullanım alanları (laboratuvarlar, sosyal tesisler), teknik destek ve danışmanlık hizmetleri bulunmaktadır.

OSB'ler, Türkiye'nin sanayi üretimine ve ekonomik kalkınmasına önemli katkılar sağlamaktadır. Bu bölgeler, sanayi yatırımlarının belirli bir alanda yoğunlaşmasını sağlayarak verimlilik artışını ve maliyet tasarrufunu teşvik etmektedir. Ayrıca, OSB'ler, bölgesel kalkınmayı destekleyerek işsizlik oranlarının düşürülmesine ve yerel ekonomilerin güçlenmesine katkıda bulunmaktadır (Koç & Bulmuş, 2014). OSB'ler, aynı zamanda ihracat potansiyelini artırarak Türkiye'nin uluslararası pazarlarda rekabet gücünü yükseltme amacıyla kurgulanmıştır (Özden, 2016). İlaveten, Organize Sanayi Bölgelerinde aynı alanda faaliyet gösteren firmaların tek bir coğrafi konumda yer alması, kümelenme etkisini doğurmaktadır. Bu sayede, firmalar arasındaki etkileşim ve iş birliği olanakları artmaktadır. Firmaların işlem maliyetlerinde azalma sağlanmakta ve sinerji oluşturarak verimliliğe katkı sunmaktadırlar. Böylelikle, ortak bir lokasyonda buluşan ve birbirlerini tamamlayan firmalar, rekabet gücünü artırma ve ekonomik kazanç elde etme fırsatı yakalamış olur (Çam & Esengün, 2011).

Türkiye'deki OSB'lerin gelişimi, 1960'lı yıllarda başlamış ve günümüze kadar hızla devam etmiştir. İlk OSB, 1961 yılında Bursa'da kurulmuş olup, bu tarihten itibaren Türkiye genelinde birçok OSB faaliyete geçmiştir. Halihazırda Türkiye'de toplam 408 OSB bulunmaktadır (OSBÜK, Aralık 2024). Bu bölgeler, 4562 sayılı OSB Kanunu çerçevesinde ülkenin dört bir yanına yayılmış olup, sanayi üretiminin önemli merkezleri haline gelmiştir.

OSB'ler, sanayileşme ve çevre koruması arasındaki dengeyi gözetmek amacıyla tasarlanan yerleşim alanlarıdır. Bu bölgeler, endüstriyel gelişimi teşvik ederken aynı zamanda çevresel etkileri de dikkate alan bütüncül yaklaşımla planlanmaktadır. (Côté & Cohen-Rosenthal, 1998). OSB'ler, sanayi tesislerinin çevresel etkilerini minimize etmek amacıyla çeşitli çevre koruma önlemleri uygulamaktadır. Bu bölgelerde yer alan arıtma tesisleri, sanayi atıklarının kontrol altına alınmasını ve çevreye zarar vermeden bertaraf edilmesini sağlamaktadır. Ayrıca, OSB'ler, çevre dostu üretim teknolojilerini teşvik ederek sürdürülebilir sanayi üretimini desteklemektedir. Sosyal açıdan ise, OSB'ler, istihdam olanakları yaratarak yerel halkın ekonomik refahını artırmakta ve bölgesel kalkınmayı teşvik etmektedir. OSB'lerde istihdamın artırılması ile tamamlayıcı mesleki eğitimlerin daha düzenli bir biçimde yapılmasına imkân oluşmaktadır.

Sonuç olarak, Organize Sanayi Bölgeleri, Türkiye'nin sanayi üretiminde ve ekonomik kalkınmasında kritik bir rol oynamaktadır. OSB'ler, sanayi yatırımlarını teşvik ederek üretim ve istihdamı artırmakta, çevresel etkileri minimize ederek sürdürülebilir sanayi üretimini desteklemekte ve bölgesel kalkınmayı teşvik etmektedir. Bu süreç, Türkiye'nin uluslararası rekabet gücünü artırmakta ve ekonomiye yüksek katma değer sağlamaktadır.

2.3.2. Teknoloji Geliştirme Bölgeleri (TGB)

Teknoloji Geliştirme Bölgeleri, üniversiteler, araştırma kurumları ve sanayi kuruluşlarının bir araya gelerek Ar-Ge ve yenilikçi faaliyetlerde bulunduğu, teknoloji transferini ve yüksek katma değerli ürünlerin geliştirilmesini hedefleyen özel alanlardır. Bu bölgelerde girişimcilik faaliyetleri desteklenmekte ve Ar-Ge projeleri teşvik edilmektedir (Şengür & Bayzin, 2019).

TGB'ler, yenilikçi fikirlerin ekonomik değere dönüştürülmesini sağlamak, bilgi ve teknoloji üretimini teşvik etmek ve yüksek teknolojiye dayalı sanayilerin gelişimini desteklemek amacıyla kurulmaktadır (Bengisu, 2004; Beyhan, 1999; Şahin, 2006). Yüksek teknolojili laboratuvarlar ve araştırma merkezleri gibi ileri düzey olanaklar sunarak, araştırmacıların ve mühendislerin en güncel teknolojileri kullanarak çalışmalar yapabilmesine olanak tanınmaktadır. Ayrıca, bu bölgelerde bulunan kuluçka merkezleri, yeni girişimlere destek sağlayarak yenilikçi fikirlerin hayata geçirilmesini teşvik eder ve genç girişimciler için mentorluk, eğitim ve finansman gibi destekler sunulmaktadır.

TGB'ler, üniversite-sanayi iş birliğini güçlendirmek ve Ar-Ge çalışmalarının ticari ürüne dönüştürülme sürecini hızlandırmak için önemli platformlar sunmaktadır. Bu bölgelerde faaliyet gösteren firmalar, üniversitelerin bilgi birikiminden ve araştırma altyapısından faydalanarak yenilikçi projeler geliştirebilmekte ve ticarileştirebilmektedir. TGB'lerde yer alan teknoloji transfer ofisleri, akademik araştırmaların sanayiye aktarılmasını kolaylaştırarak üniversiteler ile sanayi arasındaki iş birliğini artırmakta ve Ar-Ge sonuçlarının ticarileştirilmesini sağlamaktadır (Şengür & Bayzin, 2019). Bu iş birliği, 4691 sayılı Teknoloji Geliştirme Bölgeleri Kanunu ile düzenlenmekte olup, kanun TGB'lerin kuruluş, işleyiş ve yönetimi ile ilgili esasları belirlemektedir.

Türkiye'deki TGB'ler, firmalara sağladıkları çeşitli teşvikler ve avantajlar sayesinde Ar-Ge ve yenilikçilik ekosistemini desteklemektedir. Bu avantajlar arasında vergi muafiyetleri, hibe ve kredi imkanları, altyapı ve ofis desteği, teknik danışmanlık hizmetleri ve uluslararası pazarlara erişim fırsatları bulunmaktadır.

Ayrıca, TGB'ler girişimcilik ekosistemini güçlendirmek ve start-up şirketlerin gelişimini desteklemek için de önemli mekanlar sunmaktadır. (Şen & Biliş, 2023) Bu bölgelerde farklı disiplinlerden profesyonellerin bir araya gelerek iş birliği yapabileceği ortamlar sunulmakta, düzenlenen seminerler, konferanslar ve ağ oluşturma etkinlikleri bilgi paylaşımını ve ortak projelerin geliştirilmesini teşvik etmektedir.

TGB'ler, inovasyon süreçlerinde kritik bir rol oynayarak yüksek katma değerli ürünlerin geliştirilmesini sağlamaktadır. Bu bölgelerde yürütülen Ar-Ge faaliyetleri, ülkenin teknolojik kapasitesini artırmakta ve uluslararası rekabet gücünü yükseltmektedir. Ayrıca, TGB'ler, nitelikli iş gücünün yetiştirilmesi ve istihdam edilmesi açısından da önemli fırsatlar sunmaktadır (Şengür & Bayzin, 2019). Bu bölgelerde çalışan Ar-Ge personeli, yenilikçi düşünme ve problem çözme yetenekleriyle yeni ürünler ve teknolojiler geliştirmekte ve bu bilgiyi pratik uygulamalara dönüştürmektedir. Esnek ve yaratıcı çalışma alanları, çalışanların verimli çalışmasını sağlayarak yaratıcı düşünme ve problem çözme yeteneklerini maksimize etmektedir. (Uzun, 2015)

Dünyada ilk Teknoloji Geliştirme Bölgesi, 1950 yılında Amerika Birleşik Devletleri'ndeki Stanford Üniversitesi bünyesinde kurulmuştur. Bu bölge, "Silikon Vadisi" olarak bilinen ve dünyanın en tanınan Teknoloji Geliştirme Bölgesidir (Canbaz Akça, 2024). Silikon Vadisi, teknoloji ve inovasyon alanında öncü konumdadır ve birçok küresel teknoloji şirketinin merkezinin yer aldığı bir ekosistem olarak öne çıkmaktadır. Doğal ve kendiliğinden bir oluşumla oluşan bu teknoparkın referansıyla dünya genelinde birçok teknopark ilerleyen süreçlerde oluşmaya başlamıştır.

Teknolojik ilerlemeler, ülkelerin rekabet gücünü sürdürmek için Teknoloji Geliştirme Bölgeleri oluşturmalarına yol açmıştır. Bu hareket, 1980'lerde dünyada ve 1990'lı yıllarda Türkiye'de başlamıştır. Türkiye'de inovasyon konusundaki ilk adım, Devlet Planlama Teşkilatı'nın 1984-1989 yıllarını kapsayan Beşinci Beş Yıllık Kalkınma Planı'nda bu konunun yer almasıyla atılmıştır.

Sonraki kalkınma planlarında da teknokent kurulması ve geliştirilmesi için yeni adımlar gündeme gelmiştir. 1990 yılında, Birleşmiş Milletler Kalkınma İçin Bilim ve Teknoloji Fonu (UNFSTD) ve Türkiye arasında imzalanan "Türkiye'de Teknopark Kurulması İçin Program" projesi kapsamında, İTÜ, ODTÜ, Ege Üniversitesi, Anadolu Üniversitesi ve TÜBİTAK-MAM Araştırma Merkezi'nde 5 adet teknokent kurulması kararlaştırılmıştır. (Sarıhan, 1998). 2002 yılında "Teknoloji Geliştirme Bölgeleri Kanunu" çıkarıldıktan sonra birçok TGB'nin kurulumu başlamıştır. Halihazırda Türkiye'de 105 TGB bulunmaktadır (Sanayi ve Teknoloji Bakanlığı, Aralık 2024).

Sonuç olarak, Teknoloji Geliştirme Bölgeleri, Türkiye'nin bilgi ve teknolojiye dayalı ekonomik büyüme stratejisinde kritik bir rol oynamaktadır. TGB'ler, üniversiteler, araştırma kurumları ve sanayi kuruluşları arasındaki iş birliğini güçlendirerek, Ar-Ge ve inovasyon faaliyetlerinin etkinliğini artırmakta ve ülkenin teknolojik dönüşümünü hızlandırmaktadır. Bu süreç, Türkiye'nin uluslararası rekabet gücünü artırmakta ve ekonomiye yüksek katma değer sağlamaktadır.

2.3.3. OSB ve TGB'lerin Mekânsal Dinamikleri

Organize Sanayi Bölgeleri ve Teknoloji Geliştirme Bölgeleri, Ar-Ge çalışanlarının verimliliği ve memnuniyeti üzerinde farklı iş ortamları sunmaktadır. OSB'ler, geniş üretim tesisleri ve daha formal, endüstriyel yapılarıyla öne çıkmaktadır. Çalışanlar, büyük ölçüde üretim süreçlerine entegre edilmiş, düzenli ve kapalı iş ortamlarında çalışmaktadır. Bu yapı, Ar-Ge faaliyetlerinin üretimle entegre olmasına olanak tanırken, sosyal etkileşim ve yaratıcılık açısından sınırlı fırsatlar sunmaktadır. OSB'lerde verimlilik ve üretim odaklı çalışma düzeni, çalışanlar üzerinde daha fazla baskı ve stres yaratma potansiyeline sahiptir.

OSB'lerdeki Ar-Ge çalışmalarına destek veren 619 Ar-Ge Merkezi ve 132 Tasarım Merkezi (OSBÜK, Aralık 2024) bulunsa da bu rakam OSB'ler için oldukça düşük bir oran teşkil etmektedir. OSB'lerin Ar-Ge ekosistemine tam entegrasyonu sınırlıdır ve bu bölgelerde çalışanların yaratıcılık ve sosyal etkileşim potansiyeli, TGB'lere kıyasla daha düşüktür.

TGB'ler ise teknoloji ve inovasyona dayalı projelerin yürütüldüğü, esnek ve yaratıcı bir çalışma ortamı sunmaktadır. Bu bölgelerde, çalışanların üniversiteler, araştırma merkezleri ve diğer teknoloji firmalarıyla iş birliği yapma imkânı bulunmaktadır. Daha modern ve sosyal açıdan zengin bir ortam sunan TGB'ler, Ar-Ge personelinin projelerinde daha fazla özgürlük ve yaratıcılık geliştirmesine olanak tanımaktadır. Bu durum, çalışanların motivasyonunu ve psikolojik iyilik hâlini olumlu etkileyerek, daha yüksek verimlilik sağlamasına yardımcı olabilmektedir. Her iki bölge de Ar-Ge faaliyetleri için farklı avantajlar sunmaktadır. OSB'lerde üretimle entegre, düzenli ve hiyerarşik bir yapı, TGB'lerde ise yenilikçiliği teşvik eden esnek ve sosyal bir atmosfer ön plana çıkmaktadır. Ar-Ge çalışanlarının verimliliği ve memnuniyeti bağlamında, bu bölgelerdeki fiziksel, sosyal ve psikolojik unsurların bütüncül bir şekilde ele alınmasıyla mekânsal olarak bu alanların daha iyi anlaşılabileceği düşünülmüştür.

2.3.4. Fiziksel Unsurlar

OSB'ler, sanayi üretimi için gerekli tüm altyapı hizmetlerine sahip olup, bu durum Ar-Ge faaliyetlerinin üretim süreçleriyle entegrasyonunu kolaylaştırmaktadır. Elektrik, su, doğalgaz, iletişim, yol ve atık yönetimi gibi temel hizmetler eksiksiz bir şekilde sunulmakta ve kesintisiz operasyon imkânı tanımaktadır. Buna karşılık, TGB'ler teknoloji ve inovasyon odaklı altyapıya sahiptir. Yüksek hızlı internet, ileri teknoloji laboratuvarları, modern ofis alanları ve toplantı salonları gibi olanaklar, Ar-Ge çalışmalarının verimliliğini artırmaktadır.

Cansız vd. (2019), OSB'lerde daha fazla Ar-Ge merkezi ve test laboratuvarı kurulması gerektiğini belirtmekte ve bu tesislerin, OSB'deki firmalara teknoloji geliştirme, test etme ve yenilikçi ürünler tasarlama konularında destek sağlayacağını vurgulamaktadır. Ar-Ge çalışanlarının geri bildirimlerine göre, TGB'lerdeki iş ortamları inovasyonu teşvik edici bulunurken, OSB'lerdeki çalışma koşullarının daha katı ve sınırlayıcı olduğu belirtilmiştir.

OSB'lerin genellikle şehir merkezlerine uzak konumlarda yer alması da ulaşım zorluklarına neden olabilmektedir. Ulaşım süresinin uzunluğu ve toplu taşıma imkanlarının sınırlılığı, çalışanların günlük yaşam kalitelerini düşürmektedir. Buna karşın, TGB'ler üniversite kampüsleri veya şehir merkezlerine yakın konumlarda bulunmakta, bu sayede ulaşım sorunlarını azaltmakta ve çalışanların akademik kaynaklara erişimini kolaylaştırmaktadır. Ayrıca, TGB'ler teknik destek ve danışmanlık hizmetleri sunarak firmaların Ar-Ge projelerini daha verimli bir şekilde gerçekleştirmelerine yardımcı olmaktadır.

2.3.5. Sosyal Unsurlar

OSB'lerde sosyal yaşam olanakları genellikle sınırlıdır. Sosyal tesisler, spor alanları, dinlenme ve eğlence mekanlarının yetersizliği, çalışanların iş-yaşam dengesini sağlamalarını zorlaştırmaktadır. Buna karşılık, TGB'ler sosyal ve kültürel faaliyetlere erişim açısından avantajlıdır. Üniversitelerle entegre çalıştıkları için kütüphaneler, konferans salonları, spor tesisleri ve kültürel etkinliklere kolay erişim imkânı sunmaktadır.

OSB'lerde çalışan Ar-Ge personeli, sosyal ve kültürel faaliyetlerin yetersizliği sebebiyle işlerinin gelişimini desteklemediğini düşünmektedir. Bu durum, iş tatminini ve motivasyonunu olumsuz etkilemektedir. TGB'lerde ise sosyal ve kültürel etkinliklerin çeşitliliği, çalışanların iş-yaşam dengesini sağlamalarına ve motivasyonlarını artırmalarına yardımcı olmaktadır.

2.3.6. Psikolojik Unsurlar

OSB'lerde çalışma koşullarının daha katı ve sınırlayıcı olması, iş stresini artırmakta ve çalışanların psikolojik sağlığını olumsuz etkilemektedir. Buna karşılık, TGB'lerdeki esnek ve yaratıcı iş ortamları, inovasyonu teşvik etmekte ve iş stresini azaltmaktadır. TGB'lerde çalışan Ar-Ge personeli, iş yerlerinde geçirdikleri zamanı daha verimli ve tatmin edici bulmaktadır.

Ar-Ge çalışan sayısı genellikle TGB'lerde yoğunlaşmış olup, bu durumun TGB'lerin sunduğu fiziksel, sosyal ve psikolojik avantajlarla ilişkili olduğu söylenebilir. OSB ve TGB çalışanları için kentin gelişmişlik düzeyi, işyerinin fiziki koşulları, sosyal haklar, ekonomik, sosyal ve ulaşım imkanları önemli faktörler arasında yer almaktadır. Ancak OSB'lerde çalışan Ar-Ge personeli, işlerinin bulunduğu bölgede sosyal ve kültürel faaliyetlerin yetersizliği sebebiyle gelişimlerinin desteklenmediğini düşünmektedir. Ayrıca, OSB ve TGB'lerde çalışan Ar-Ge personeli, işlerini kolaylaştıran etkili ve güçlü bir kamu/bürokrasi, siyasi ve yurt dışı çevresinin eksikliğinden şikayetçidir. İş stresi, psikolojik olarak OSB'lerde çalışan Ar-Ge personelini daha fazla etkilerken, TGB'lerde çalışanlar daha az stres yaşamakta ve işlerinden daha fazla memnuniyet duymaktadır.

Sonuç olarak, bu bulgular, OSB'lerin ve TGB'lerin Ar-Ge çalışanlarının verimliliği ve memnuniyeti üzerindeki etkilerini anlamak için önemli ipuçları sunmaktadır. OSB'lerin fiziksel altyapı avantajlarına rağmen, sosyal ve psikolojik unsurlarda yetersiz kalmaları, TGB'lerin ise daha dengeli ve destekleyici bir ortam sunmaları, bu bölgelerin tercih edilme sebeplerini açıklamaktadır. Bu nedenle, her iki bölge için de stratejik planlamalar yapılırken, çalışanların tüm ihtiyaçlarını karşılayacak kapsamlı yaklaşımlar benimsenmelidir.

2.3.7. OSB ve TGB'lerde Yenilikçi Düşünceyi Besleyen Unsurlar ve Girişimcilik Ekosistemi

Organize Sanayi Bölgeleri ve Teknoloji Geliştirme Bölgeleri, yenilikçi düşünceyi ve girişimcilik ekosistemini besleyen kritik yapılardır denilebilir. Bu bölgelerde faaliyet gösteren firmalar, girişimcilik ve yenilikçilik faaliyetleriyle hem yerel hem de ulusal ekonomilere katkıda bulunmaktadır. Yenilikçi düşünceyi besleyen başlıca unsurlar arasında tolerans, teknoloji takibi, girişimcilik kültürü ve yenilikçi düşüncenin beslendiği çeşitli kaynaklar bulunmaktadır. Yaratıcı sınıfın faaliyet gösterdiği bölgenin ve yaşadığı kentin Ar-Ge çalışanlarına sunduğu imkanların artırılması, hem çalışanların yetenek ve kapasitelerinin gelişimine katkı sağlayacak hem de onların gelecekte girişimci olmalarına olanak tanıyacaktır (Yavan vd., 2023). OSB ve TGB gibi mekanlarda bu unsurların gelişimine katkı sağlayacak faaliyetlerin yürütülmesi Ar-Ge çalışanlarının yani yenilikçi sınıfın bu mekanlarda çalışma arzusunu artıracaktır.

Öncelikle, tolerans, OSB ve TGB'lerde yenilikçi düşünceyi besleyen en önemli unsurlardan biridir. Bu bölgelerde çalışan Ar-Ge çalışanları, farklı yaşam tarzlarına, ideolojilere ve inançlara karşı hoşgörülü olduklarını ifade etmektedir. Florida'nın "Yaratıcı Sınıf Teorisi" de bu durumu desteklemektedir. Florida'ya göre, yaratıcı sınıf yenilikçiliğin ve ekonomik büyümenin en önemli itici gücüdür ve bu sınıfın temel özelliklerinden biri, farklılıklara karşı toleranslı olmalarıdır (Florida, 2002). Tolerans, Florida'nın kuramında kent/bölge/mekân ölçeğinde yenilikçiliği, yaratıcılığı ve girişimciliği geliştiren önemli bir faktör olarak görülmektedir. Toleransın yüksek olduğu bölgelerde, farklı düşünce yapılarına ve kültürel çeşitliliğe açık olma, iş birliği kültürünü geliştirmektedir. Bireyin toleransını artıran imkân ve mekanların aynı zamanda yenilikçilik kapasitesini de artıracağı varsayımında bulunulabilir. Özellikle, TGB'lerde bu durumun, yenilikçiliğin ortaya çıkmasını ve girişimcilik faaliyetlerinin artmasını sağladığı söylenebilir. Bu bağlamda, farklılıklara hoşgörülü olmak, iş birliği projelerini güçlendirerek yenilikçi düşüncelerin gelişmesine olanak tanımaktadır. Örneğin, çeşitli kültürel ve akademik altyapılara sahip bireylerin bir araya gelmesi, ortak projelerde daha yaratıcı çözümler üretilmesine olanak tanıyabilmektedir. Bu tür iş birlikleri, özellikle yenilikçi fikirlerin hızla yayılmasını ve girişimcilik ruhunun gelişmesini desteklemektedir.

OSB ve TGB'lerde yenilikçi düşünceyi besleyen bir diğer önemli unsur, teknoloji takibi ve entegrasyonudur. Bu bölgelerde çalışan yenilikçi sınıf, iş hayatında karşılaştıkları yeni teknolojileri hızla projelerine entegre edebilme yeteneğine sahip olduğu için yenilikçilik bakış açısı ile ürünlerini ya da projelerini geliştirerek faaliyetlerini sürdürebileceklerdir. Teknolojik yeniliklerin hızlıca benimsenmesi, firmaların Ar-Ge süreçlerini daha etkin hale getirmekte ve yenilikçiliğin hızlanmasını sağlamaktadır (Dosi, 1982). Schumpeter'in "Yaratıcı Yıkım Teorisi" de bu durumu açıklamaktadır; ona göre teknolojik yenilikler, eski sistemlerin yerini alarak yeni yapıların ortaya çıkmasına olanak tanımaktadır (Schumpeter, 1942). Bu bağlamda, TGB'lerdeki teknoloji odaklı çalışmalar firmalara rekabet avantajı sağlamaktadır. Teknolojik gelişmelerin yakından takip edilmesi ve projelere entegre edilmesi, firmaların yenilikçi çözümler üretmesine ve küresel pazarda daha güçlü bir konuma gelmelerine olanak tanımaktadır.

Girişimcilik, OSB ve TGB'lerdeki ekosistemin vazgeçilmez bir bileşenidir denilebilir. Girişimcilik Florida'nın teorisinin merkezinde değildir. Florida'ya göre inovasyonda girişimcilikte çok önemlidir ancak her ikisi de yaratıcılığın bir sonucudur. Dolayısıyla yaratıcı yani yenilikçi sınıfın yüksek ve yoğun olduğu bölgelerde yeni şirket oluşumu ve yenilikçi startupların oluşumu kısaca girişimciliğin fazla olması beklenmektedir (Florida, 2005) Yine Stolarick et al (2011) bir bölgede yaratıcı sınıfın oranı arttıkça o bölgenin girişimcilik düzeyi ve bölgesel büyüme düzeyinin artmakta olduğunu belirtmiştir. OSB ve TGB'lerde girişimcilik faaliyetlerinin yoğun olması, bölgesel kalkınmayı destekleyecektir. Girişimciliğin desteklenmesi hem bölgesel hem de ulusal düzeyde ekonomik kalkınmanın önemli bir bileşeni olarak kabul edilmektedir.

Yenilikçi düşüncenin beslendiği kaynaklar ise oldukça çeşitlidir. Bu kaynaklar içinde akademik araştırmalar ve üniversiteler de yer almaktadır. TGB'lerde faaliyet gösteren firmalar, üniversitelerle iş birliği yaparak inovatif çözümler geliştirmekte ve bu sayede bilgi ve teknoloji transferi sağlamaktadır (Etzkowitz & Leydesdorff, 2000). Üniversiteler, Ar-Ge süreçlerinin hızlanmasına ve firmaların yeni teknolojilere daha hızlı adapte olmasına olanak tanımaktadır.

OSB ve TGB'lerde yenilikçi düşünceyi besleyen unsurlar arasında tolerans, teknoloji takibi, girişimcilik ve yenilikçi düşüncenin beslendiği kaynaklar kritik bir öneme sahiptir. Tolerans, iş birliği ortamını güçlendirirken; teknoloji takibi, inovasyon süreçlerinin hızlanmasına katkı sağlamaktadır. Girişimcilik ise bu bölgelerdeki ekonomik büyümenin itici gücüdür. Akademik iş birlikleri ve eğitim faaliyetleri de yenilikçi düşüncenin sürekliliğini sağlarken, bölgesel kalkınmanın hızlanmasına yardımcı olmaktadır. Bu unsurların uyumlu bir şekilde bir araya gelmesi, OSB ve TGB'lerin inovasyon ve girişimcilik ekosistemlerinde önemli bir yere sahip olmasını sağlamaktadır.

3. Yöntem

Bu çalışmada nicel araştırma yöntemi kullanılmıştır. Örneklem grubu, OSB ve TGB'lerde çalışan Ar-Ge personelinden oluşmaktadır. Bu çalışma, Türkiye'de OSB ve TGB'lerde çalışan Ar-Ge personelinin girişimcilik eğilimlerini etkileyen unsurları cinsiyet, yaş, firma türü ve ihracat durumu gibi demografik değişkenler bağlamında incelemektedir.

Türkiye'nin Ar-Ge çalışanlarının %95'inin bulunduğu Ankara, Antalya, Bursa, Denizli, Eskişehir, İstanbul, İzmir, Kayseri, Kocaeli, Konya, Manisa, Mersin, Sakarya ve Tekirdağ 14 ilde istihdam edilen OSB ve TGB'de çalışan 1.112 kişiye uygulanan anket sonucunda elde edilen veri seti bu çalışmada kullanılmıştır. Araştırmada kullanılan veri toplama aracı, yapılandırılmış bir anket formudur. Anket formu, çalışanların tolerans/hoşgörü düzeyi, teknoloji ilgisi, girişimcilik potansiyeli ve yenilikçilik düzeylerini ölçmeye yönelik sorular içermektedir. Çalışmada kullanılan ölçekler Sanayi ve Teknoloji Bakanlığı'nın yürütücü ortaklığı ile Birleşmiş Milletler Kalkınma Programı'nın uygulayıcılığıyla yürütülen "OSB'lerde Teknoloji Geliştirme Projesi" kapsamında geliştirilmiştir.

Türkiye'de sanayi ve teknoloji altyapısının önemli bir bölümünü temsil eden bu iller, toplam 59 Teknoloji Geliştirme Bölgesi (TGB) ve 140 Organize Sanayi Bölgesi (OSB) ile ülke genelindeki TGB ve OSB yapısının önemli bir örüntüsünü yansıtmaktadır (Sanayi ve Teknoloji Bakanlığı, 2025; OSBÜK, 2025). Bu dağılım, Türkiye genelindeki yaklaşık 105 TGB ve 410 OSB'lik yapının (Sanayi ve Teknoloji Bakanlığı, 2025; OSBÜK, 2025) önemli bir kısmını kapsamakta ve araştırmanın temsiliyet düzeyini güçlendirmektedir. Özellikle İstanbul, Ankara, İzmir, Bursa ve Kocaeli gibi sanayi ve teknoloji yoğunluğu yüksek illerin dâhil edilmiş olması, örneklemin sektörel ve bölgesel anlamda Türkiye sanayi yapısını yansıttığını göstermektedir. Ayrıca, çalışmada yer alan iller; yalnızca Ar-Ge personeli sayısı veya OSB/TGB yoğunluğu gibi nicel göstergelerle değil, aynı zamanda stratejik ve yapısal kriterler temelinde de seçilmiştir. Bu kriterler arasında; illerin yüksek Ar-Ge yoğunluğuna sahip olmaları, güçlü bir OSB ve TGB altyapısına ev sahipliği yapmaları, ulusal ve bölgesel kalkınma planlarında öncelikli konumda yer almaları ve sektörel çeşitlilik düzeyleri gibi faktörler yer almaktadır. Söz konusu çok boyutlu seçim yaklaşımı, araştırmanın yalnızca temsiliyet gücünü değil, aynı zamanda stratejik anlamda anlamlılık düzeyini de artırmaktadır. Bu bağlamda, illerin belirlenme süreci, araştırmanın sahaya dayalı özgün katkısını desteklemekte ve Türkiye'nin Ar-Ge ekosistemine dair derinlemesine bir analiz yapabilme olanağı sunmaktadır.

Sorular, 5'li Likert ölçeği ile cevaplanmıştır (1: Kesinlikle Katılmıyorum, 5: Kesinlikle Katılıyorum). Araştırmanın hipotezleri, bağımsız örneklem t-testi ve ANOVA testi ile analiz edilmiştir. Hipotezlerin test edilmesinde SPSS istatistik programı kullanılmıştır. Verilerin normal dağılım gösterip göstermediği Shapiro-Wilk testi ile kontrol edilmiştir. Varyansların eşitliği ise Levene testi ile değerlendirilmiştir. Farklılıkların hangi grup ya da gruplar arasında olduğunu belirlemek amacıyla Post-Hoc testleri uygulanmıştır

Araştırma kapsamın kurulan hipotezler şu şekildedir;

-H1a: Yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü düzeyi cinsiyete göre farklılık göstermektedir.

-H1b: Yenilikçi sınıfın girişimcilik eğilimini etkileyen teknoloji ilgi düzeyi cinsiyete göre farklılık göstermektedir.

-H1c: Yenilikçi sınıfın girişimcilik eğilimini etkileyen girişimcilik potansiyeli cinsiyete göre farklılık göstermektedir.

-H1d: Yenilikçi sınıfın girişimcilik eğilimini etkileyen yenilikçilik düzeyi cinsiyete göre farklılık göstermektedir.

-H2a: Yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü düzeyi yaşa göre farklılık göstermektedir.

-H2b: Yenilikçi sınıfın girişimcilik eğilimini etkileyen teknoloji ilgi düzeyi yaşa göre farklılık göstermektedir.

-H2c: Yenilikçi sınıfın girişimcilik eğilimini etkileyen girişimcilik potansiyeli yaşa göre farklılık göstermektedir.

-H2d: Yenilikçi sınıfın girişimcilik eğilimini etkileyen yenilikçilik düzeyi yaşa göre farklılık göstermektedir.
-H3a: Yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü düzeyi çalışanın firmanın türüne göre farklılık göstermektedir.
-H3b: Yenilikçi sınıfın girişimcilik eğilimini etkileyen teknoloji ilgi düzeyi çalışanın firmanın türüne göre farklılık göstermektedir.
-H3c: Yenilikçi sınıfın girişimcilik eğilimini etkileyen girişimcilik potansiyeli çalışanın firmanın türüne göre farklılık göstermektedir.
-H3d: Yenilikçi sınıfın girişimcilik eğilimini etkileyen yenilikçilik düzeyi çalışanın firmanın türüne göre farklılık göstermektedir
-H4a: Yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü düzeyi çalışılan firmanın faaliyet gösterdiği mekan türüne göre farklılık göstermektedir.
-H4b: Yenilikçi sınıfın girişimcilik eğilimini etkileyen teknoloji ilgi düzeyi çalışılan firmanın faaliyet gösterdiği mekan türüne göre farklılık göstermektedir.
-H4c: Yenilikçi sınıfın girişimcilik eğilimini etkileyen girişimcilik çalışılan firmanın faaliyet gösterdiği mekan türüne göre farklılık göstermektedir.
-H4d: Yenilikçi sınıfın girişimcilik eğilimini etkileyen yenilikçilik çalışılan firmanın faaliyet gösterdiği mekan türüne göre farklılık göstermektedir
-H5a: Yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü düzeyi çalışılan firmanın ihracat durumuna göre farklılık göstermektedir.
-H5b: Yenilikçi sınıfın girişimcilik eğilimini etkileyen teknoloji ilgi çalışılan firmanın ihracat durumuna göre farklılık göstermektedir.
-H5c: Yenilikçi sınıfın girişimcilik eğilimini etkileyen girişimcilik çalışılan çalışılan firmanın ihracat durumuna göre farklılık göstermektedir.
-H5d: Yenilikçi sınıfın girişimcilik eğilimini etkileyen yenilikçilik çalışılan firmanın ihracat durumuna göre farklılık göstermektedir
Araştırmanın hipotezlerinin testi için Bağımsız Örneklem t testi ve ANOVA testi uygulanmıştır.

4. Bulgular: OSB ve TGB'lerin Fiziksel, Sosyal ve Psikolojik Unsurlar Açısından Karşılaştırılması

4.1. Demografik Özellikler

Tablodaki veriler, örneklem grubunun demografik bilgileri ve çalıştıkları firmalara ilişkin özellikler Tablo 1'de göstermektedir. Bu özellikler, cinsiyet, yaş, firma türü, firmanın faaliyet gösterdiği mekân türü ve firmanın ihracat yapma durumunu kapsamaktadır.

Tablo 1: Demografik Özellikler

		Frekans	%
Cinsiyet	Kadın	242	%21,6
	Erkek	880	%78,4
Yaş	20-29	459	%40,9
	30-39	467	%41,6
	40-49	148	%13,2
	50 ve üzeri	48	%4,3
Firma Türü	AR-Ge Merkezi	366	%32,6
	Teknopark	738	%65,8
	Tasarım Merkezi	18	%1,6
Firmanın faaliyet gösterdiği mekan türü	OSB	308	%27,5
	TGB	814	%72,5
Firmanın ihracat yapma durumu	İhracat yapıyor	487	%43,4
	İhracat yapmıyor	635	%56,6

Örneklem grubunun %21,6'sı kadınlardan, %78,4'ü erkeklerden oluşmaktadır. Çalışanların yaş dağılımı, büyük ölçüde genç ve orta yaşlı bireylerden oluşmaktadır. 20-29 yaş aralığı %40,9, 30-39 yaş aralığı %41,6'lık bir oranla temsil edilmektedir. Bu yaş grupları, iş gücünün en dinamik ve üretken kesimlerini oluşturmakta olup, çalışma hayatındaki genç nüfusun etkin rol oynadığını göstermektedir. Buna karşın, 40-49 yaş aralığındaki bireyler %13,2, 50 yaş ve üzeri bireyler ise yalnızca %4,3 oranında temsil edilmektedir. Çalışanların firmalarının türüne bakıldığında, en büyük kısmın (%65,8) teknoparklarda çalıştığı görülmektedir. AR-GE merkezlerinde çalışanların oranı %32,6 iken, tasarım merkezlerinde çalışanların oranı %1,6'dır. Firmaların faaliyet gösterdiği mekân türüne göre yapılan sınıflandırmada, %72,5'i TGB (Teknoloji Geliştirme Bölgesi) ve %27,5'i OSB (Organize Sanayi Bölgesi) içinde faaliyet göstermektedir. Firmaların ihracat yapma durumu da araştırılmış ve %43,4'ünün ihracat yaptığı, %56,6'sının ise ihracat yapmadığı tespit edilmiştir.

4.2. Hipotez Testleri

Yenilikçi sınıfın girişimcilik eğilimlerini etkileyen tolerans/hoşgörü düzeyinin, teknoloji ilgi düzeyinin, girişimcilik potansiyelinin ve yenilikçilik düzeyinin cinsiyete göre farklılık gösterip göstermediği ile ilgili kurulan H1a, H1b, H1c ve H1d hipotezlerinin test sonuçları Tablo 3'te yer almaktadır.

Tablo 2: Cinsiyet Gruplarının Karşılaştırması

Değişken	Cinsiyet	N	Arit. Ort.	SS	Ort. St. Ht.
Tolerans/Hoşgörü Düzeyi	Kadın	242	4,3430	,66642	,04284
	Erkek	880	4,3977	,66378	,02238
Teknoloji İlgi Düzeyi	Kadın	242	4,0475	,64642	,04155
	Erkek	880	4,2591	,65004	,02191
Girişimcilik Potansiyeli	Kadın	242	3,6219	,87057	,05596
	Erkek	880	3,8330	,89934	,03032
Yenilikçilik Düzeyi	Kadın	242	4,2500	,57840	,03718
	Erkek	880	4,2847	,65918	,02222

Tablo 3: Yenilikçi Sınıfın Girişimcilik Eğilimini Etkileyen Unsurların Cinsiyete Göre Bağımsız Örneklem T-Testi

		Levene Testi		T testi		
		F	Sig.	T	Sig. (2-tailed)	Ort. Fark.
Tolerans/Hoşgörü Düzeyi	VEOD	,008	,929	-1,135	,256	-,05475
	VFOD			-1,133	,258	-,05475
Teknoloji İlgi Düzeyi	VEOD	,441	,507	-3,255	,001	-,21105
	VFOD			-3,316	,001	-,21105
Girişimcilik Potansiyeli	VEOD	2,617	,106	-4,489	,000	-,21157
	VFOD			-4,504	,000	-,21157
Yenilikçilik Düzeyi	VEOD	4,942	,026	-,743	,458	-,03466
	VFOD			-,800	,424	-,03466
VEOD= Varyansların Eşit Olması Durumu, VFOD= Varyansların Farklı Olması Durumu						

Kadınların tolerans/hoşgörü düzeyi ortalaması 4,4330, erkeklerin ortalaması ise 4,3977'dir. Standart sapmalar sırasıyla 0,66642 ve 0,67773'tür. Bu veriler kadınların tolerans düzeyinde çok az bir farkla erkeklerden daha yüksek olduğunu göstermektedir.
Levene testi sonucuna göre (F = 0,008; p = 0,929) varyansların eşit olduğu tespit edilmiştir. Eşit varyanslar için yapılan t-testi sonucunda (t=-1,135;p=0,256) cinsiyetler arasında tolerans/hoşgörü düzeyi açısından istatistiksel olarak anlamlı bir fark bulunmamıştır. Ortalama fark -0,05475 olarak hesaplanmıştır. Bu bulgu, H1a hipotezinin reddedildiğini ve cinsiyetin tolerans/hoşgörü düzeyi üzerinde etkili olmadığını göstermektedir.
Kadınların teknoloji ilgi düzeyi ortalaması 4,2591, erkeklerin ortalaması 4,2951'dir. Standart sapmalar sırasıyla 0,65442 ve 0,64964'tür. Erkeklerin teknoloji ilgisinin kadınlara göre biraz daha yüksek olduğu gözlemlenmiştir. Levene testi sonucunda (F=0,441; p = 0,507) varyansların eşit olduğu tespit edilmiştir. Eşit varyanslar için t-testi sonucuna göre (t =-1,001; p=0,317), cinsiyetler arasında teknoloji ilgi düzeyi açısından istatistiksel olarak anlamlı bir fark bulunmamaktadır. Ortalama fark -0,03601 olarak hesaplanmıştır. H1b hipotezi reddedilmiştir ve teknoloji ilgi düzeyi cinsiyete göre farklılık göstermemektedir.
Kadınların girişimcilik potansiyeli ortalaması 3,6980, erkeklerin ise 3,8330'dur. Standart sapmalar sırasıyla 0,8930 ve 0,88984'tür. Erkeklerin girişimcilik potansiyeli kadınlara göre daha yüksektir. Levene testi sonucunda (F=2,617; p=0,106) varyansların eşit olduğu tespit edilmiştir. Eşit varyanslar için yapılan t-testi sonucunda (t=-2,060; p=0,040), %5 anlamlılık düzeyinde girişimcilik potansiyelinde cinsiyetler arasında anlamlı bir fark olduğu bulunmuştur. Ortalama fark -0,13525 olarak hesaplanmıştır. Bu sonuç, H1c hipotezini desteklemektedir ve erkeklerin girişimcilik potansiyelinin kadınlara göre daha yüksek olduğunu göstermektedir.
Kadınların yenilikçilik düzeyi ortalaması 4,5704, erkeklerin ise 4,2847'dir. Standart sapmalar sırasıyla 0,5805 ve 0,65918'dir. Kadınların yenilikçilik düzeyinin erkeklerden daha yüksek olduğu gözlemlenmiştir. Levene testi sonucunda (F=4,942; p=0,026) varyansların eşit olmadığı görülmüştür. Eşit olmayan varyanslar için t-testi sonucunda (t=4,066; p< 0,001), cinsiyetler arasında yenilikçilik düzeyi açısından %1 anlamlılık düzeyinde anlamlı bir fark olduğu bulunmuştur. Ortalama fark -0,2857 olarak hesaplanmıştır. Bu sonuç H1d hipotezini desteklemektedir ve kadınların yenilikçilik düzeyinin erkeklere göre daha yüksek olduğunu ortaya koymaktadır. Yapılan analiz sonucunda, girişimcilik potansiyeli (H1c) ve yenilikçilik düzeyi (H1d) açısından cinsiyetler arasında anlamlı farklılıklar bulunmuştur. Erkeklerin girişimcilik potansiyeli kadınlardan daha yüksekken, kadınların yenilikçilik düzeyi erkeklerden daha yüksektir. Ancak, tolerans/hoşgörü düzeyi (H1a) ve teknoloji ilgi düzeyi (H1b) açısından cinsiyetler arasında istatistiksel olarak anlamlı bir fark tespit edilmemiştir.
Yenilikçi sınıfın girişimcilik eğilimlerini etkileyen tolerans/hoşgörü düzeyinin, teknoloji ilgi düzeyinin, girişimcilik potansiyelinin ve yenilikçilik düzeyinin yaşa göre farklılık gösterip göstermediği ile ilgili kurulan H2a, H2b, H2c ve H2d hipotezlerinin test sonuçları Tablo 4'te yer almaktadır.

Tablo 4: Yenilikçi Sınıfın Girişimcilik Eğilimini Etkileyen Unsurların Yaşa Göre ANOVA Testi

		Kareler Toplamı	df	Ort. Kareler	F	Sig
Tolerans/Hoşgörü Düzeyi	Gruplar Arası	1.980	3	.660	1.497	.214
	Gruplar İçi	492.917	1118	.441		
	Toplam	494.898	1121			
Teknoloji İlgi Düzeyi	Gruplar Arası	4.337	3	1.446	3.393	.017
	Gruplar İçi	476.290	1118	.426		
	Toplam	480.627	1121			
Girişimcilik Potansiyeli	Gruplar Arası	1.039	3	.346	.430	.732
	Gruplar İçi	901.014	1118	.806		
	Toplam	902.053	1121			
Yenilikçilik Düzeyi	Gruplar Arası	1.146	3	.382	.925	.428
	Gruplar İçi	461.650	1118	.413		
	Toplam	462.796	1121			

Tolerans/hoşgörü düzeyi açısından, ANOVA testi sonuçları yaş grupları arasında anlamlı bir fark olmadığını göstermektedir (F=1,497; p=0,214). p değeri 0,05'ten büyük olduğu için, yaş gruplarının tolerans/hoşgörü düzeyi üzerinde anlamlı bir etkisi bulunmamaktadır. Bu bulgu, H2a hipotezinin reddedildiğini ve yaş gruplarının tolerans/hoşgörü düzeyinde fark yaratmadığını göstermektedir.
Teknoloji ilgi düzeyi açısından, ANOVA testi sonuçları yaş grupları arasında anlamlı bir fark olduğunu göstermektedir (F=3,393; p=0,017). p değeri 0,05'ten küçük olduğu için, yaş gruplarının teknoloji ilgi düzeyi üzerinde anlamlı bir etkisi vardır. Bu sonuç, H2b hipotezinin desteklendiğini ve yaş gruplarının teknoloji ilgi düzeyinde farklılık gösterdiğini ortaya koymaktadır. Post-hoc analizlerine göre, özellikle 40-49 yaş aralığı ile 20-29 ve 30-39 yaş aralığı arasında anlamlı bir fark bulunmaktadır. 20-29 yaş aralığındaki bireylerin (Ortala Fark=0,16127; p<0,05) ve 30-39 yaş aralığındaki bireylerin (Ortalama Fark=0,19373; p < 0,05 teknoloji ilgisi, 40-49 yaş aralığındaki bireylere göre daha yüksektir.
Girişimcilik potansiyeli açısından, ANOVA testi sonuçları yaş grupları arasında anlamlı bir fark olmadığını göstermektedir (F=0,430; p=0,732). p değeri 0,05'ten büyük olduğu için, yaş gruplarının girişimcilik potansiyeli üzerinde anlamlı bir etkisi bulunmamaktadır. Bu bulgu, H2c hipotezinin reddedildiğini ve yaş gruplarının girişimcilik potansiyeli üzerinde fark yaratmadığını göstermektedir.
Yenilikçilik düzeyi açısından, ANOVA testi sonuçları yaş grupları arasında anlamlı bir fark olmadığını göstermektedir (F=0,925, p=0,428). p değeri 0,05'ten büyük olduğu için, yaş gruplarının yenilikçilik düzeyi üzerinde anlamlı bir etkisi bulunmamaktadır. Bu bulgu, H2d hipotezinin reddedildiğini ve yaş gruplarının yenilikçilik düzeyinde fark yaratmadığını göstermektedir.
Sonuç olarak, yaşın teknoloji ilgi düzeyi üzerinde etkili olduğu, ancak diğer girişimcilik eğilimlerinde anlamlı bir fark yaratmadığı ortaya konmuştur. Yaş grupları arasında teknoloji ilgi düzeyi açısından anlamlı bir fark vardır. Bu durum, teknolojiye olan ilginin yaşa bağlı olarak değişiklik gösterdiğini göstermektedir.
Yenilikçi sınıfın girişimcilik eğilimlerini etkileyen tolerans/hoşgörü düzeyinin, teknoloji ilgi düzeyinin, girişimcilik potansiyelinin ve yenilikçilik düzeyinin çalışılan firma türüne göre farklılık gösterip göstermediği ile ilgili kurulan H3a, H3b, H3c ve H3d hipotezlerinin test sonuçları Tablo 5'te yer almaktadır.

Tablo 5: Yenilikçi Sınıfın Girişimcilik Eğilimini Etkileyen Unsurların Firma Göre ANOVA Testi

		Kareler Toplamı	df	Ort. Kareler	F	Sig
Tolerans/Hoşgörü Düzeyi	Gruplar Arası	1.899	2	.950	2.156	.116
	Gruplar İçi	492.998	1119	.441		
	Toplam	494.898	1121			
Teknoloji İlgi Düzeyi	Gruplar Arası	1.753	2	.877	2.048	.129
	Gruplar İçi	478.874	1119	.428		
	Toplam	480.627	1121			
Girişimcilik Potansiyeli	Gruplar Arası	5.435	2	2.718	3.392	.034
	Gruplar İçi	896.617	1119	.801		
	Toplam	902.053	1121			
Yenilikçilik Düzeyi	Gruplar Arası	4.890	2	2.445	5.975	.003
	Gruplar İçi	457.906	1119	.409		
	Toplam	462.796	1121			

Tolerans/hoşgörü düzeyi açısından, ANOVA testi sonuçları firmanın türüne göre anlamlı bir fark olmadığını göstermektedir (F=2,156; p=0,116). p değeri 0,05'ten büyük olduğu için, firmanın türünün tolerans/hoşgörü düzeyi üzerinde anlamlı bir etkisi yoktur. Bu bulgu, H3a hipotezinin reddedildiğini ve çalışılan firmanın türüne göre tolerans/hoşgörü düzeyinde anlamlı bir fark olmadığını gösterir.

Teknoloji ilgi düzeyi açısından, ANOVA testi sonuçları firmanın türüne göre anlamlı bir fark olmadığını göstermektedir (F=2,048; p=0,129). p değeri 0,05'ten büyük olduğu için, firmanın türünün teknoloji ilgi düzeyi üzerinde anlamlı bir etkisi bulunmamaktadır. Bu bulgu, H3b hipotezinin reddedildiğini ve firmanın türüne göre teknoloji ilgi düzeyinde anlamlı bir fark olmadığını gösterir.
Girişimcilik potansiyeli açısından, ANOVA testi sonuçları firmanın türüne göre anlamlı bir fark olduğunu göstermektedir (F=2,392; p=0,034). p değeri 0,05'ten küçük olduğu için, firmanın türü girişimcilik potansiyeli ü3erinde anlamlı bir etkisi vardır. Bu sonuç, H3c hipotezinin desteklendiğini ve çalışılan firmanın türüne göre girişimcilik potansiyeli düzeyinde farklılık bulunduğunu ortaya koymaktadır. AR-GE merkezlerinde çalışanların girişimcilik potansiyeli, Teknoparklarda çalışanlara göre anlamlı derecede daha düşüktür (ortalama fark = -0,14341; p = 0,033). p değeri 0,05'in altında olduğu için bu fark anlamlıdır. Bu fark, AR-GE merkezlerinde çalışanların girişimcilik potansiyelinin Teknoparklarda çalışanlardan daha düşük olduğunu göstermektedir. Diğer firma türleri arasında girişimcilik potansiyeli açısından anlamlı bir fark bulunmamaktadır (p değerleri 0,05'in üzerindedir).
Yenilikçilik düzeyi açısından, ANOVA testi sonuçları firmanın türüne göre anlamlı bir fark olduğunu göstermektedir (F=5,975; p=0,003). p değeri 0,05'ten küçük olduğu için, firmanın türü yenilikçilik düzeyi üzerinde anlamlı bir etkiye sahiptir. Bu bulgu, H3d hipotezinin desteklendiğini ve firmanın türüne göre yenilikçilik düzeyinde anlamlı bir fark bulunduğunu gösterir. Teknoparklarda çalışanların yenilikçilik düzeyi, Tasarım Merkezlerinde çalışanlara göre anlamlı derecede daha yüksektir (ortalama fark = 0,14054; p = 0,002). p değeri 0,05'in altında olduğu için bu fark anlamlıdır. Bu fark, Teknoparklarda çalışanların yenilikçilik düzeyinin Tasarım Merkezlerindeki çalışanlardan daha yüksek olduğunu göstermektedir. Diğer firma türleri arasında yenilikçilik düzeyi açısından anlamlı bir fark bulunmamaktadır (p değerleri 0,05'in üzerindedir).
Analiz sonuçların göre firmanın türüne göre tolerans/hoşgörü düzeyi ve teknoloji ilgi düzeyi açısından anlamlı bir fark bulunmamaktadır. Girişimcilik potansiyeli ve yenilikçilik düzeyi açısından firmanın türüne göre anlamlı farklılıklar bulunmaktadır. Sonuç olarak, firmanın türü girişimcilik potansiyeli ve yenilikçilik düzeyinde farklılık yaratmakta, ancak tolerans/hoşgörü ve teknoloji ilgisinde belirleyici bir faktör olarak öne çıkmamaktadır.
Tablo 6 ve Tablo 7'de yenilikçi sınıfın girişimcilik eğilimini etkileyen unsurların çalışılan firmanın OSB'de veya TGB'de faaliyet göstermesine göre farklılık gösterip göstermediği ile ilgili kurulan H4a, H4b, H4c ve H4d hipotezlerine ilişkin sonuçlar yer almaktadır.

Tablo 6: Çalışılan Firmanın Faaliyet Gösterdiği Mekan Gruplarının Karşılaştırması

Değişken	Mekân Türü	N	Arit. Ort.	SS	Ort. St. Ht.
Tolerans/Hoşgörü Düzeyi	OSB	308	4,4481	0,57264	0,03263
	TGB	814	4,3624	0,69490	0,02436
Teknoloji İlgi Düzeyi	OSB	308	4,2987	0,55193	0,03145
	TGB	814	4,1812	0,68728	0,02409
Girişimcilik Potansiyeli	OSB	308	3,6981	0,91124	0,05192
	TGB	814	3,8213	0,88984	0,03119
Yenilikçilik Düzeyi	OSB	308	4,3912	0,52960	0,03018
	TGB	814	4,2340	0,67568	0,02368

Tablo 7: Yenilikçi Sınıfın Girişimcilik Eğilimini Etkileyen Unsurların Çalışılan Firmanın Faaliyet Gösterdiği Mekan Türüne Göre Bağımsız Örneklem T-Testi

		Levene Testi		T testi		
		F	Sig.	T	Sig. (2-tailed)	Ort. Fark.
Tolerans/Hoşgörü Düzeyi	VEOD	7,521	0,006	1,929	0,054	0,08564
	VFOD			2,103	0,036	0,08564
Teknoloji İlgi Düzeyi	VEOD	4,980	0,026	2,690	0,007	0,11750
	VFOD			2,966	0,003	0,11750
Girişimcilik Potansiyeli	VEOD	0,367	0,545	-2,056	0,040	-0,12320
	VFOD			-2,034	0,042	-0,12320
Yenilikçilik Düzeyi	VEOD	13,836	0,001	3,678	0,001	0,15720
	VFOD			4,098	0,001	0,15720
VEOD= Varyansların Eşit Olması Durumu, VFOD= Varyansların Farklı Olması Durumu						

H4a hipotezi için Levene testi sonucunda (F = 7,521; p = 0,006) varyansların eşit olmadığı tespit edilmiştir. Bu durumda, eşit olmayan varyanslar için t-testi (VFOD) sonucuna bakılmalıdır. T-test sonucu (t = 2,103; p = 0,036) %5 anlamlılık düzeyinde anlamlı bir farklılık olduğunu göstermektedir. Ortalama fark 0,08564 olarak hesaplanmıştır. Bu sonuç, tolerans/hoşgörü düzeyinin cinsiyete göre farklılık gösterdiği hipotezini (H4a) desteklemektedir. Tablo 10'daki sonuçlara göre, OSB'de çalışan yenilikçi sınıfın tolerans/hoşgörü düzeyi ortalaması (Aritmetik Ort.) 4,4481 iken, TGB'de çalışanların ortalaması 4,3624 olarak hesaplanmıştır. SS (Standart Sapma) değerleri sırasıyla 0,57264 ve 0,69490'dır. TGB'de çalışanların hoşgörü düzeyi OSB'de çalışanlara göre biraz daha düşük olmakla birlikte, bu fark istatistiksel açıdan anlamlıdır.

H4b hipotezi için Levene testi sonucunda (F = 4,980; p = 0,026) yine varyansların eşit olmadığı tespit edilmiştir. VFOD sonucuna göre, t-testi (t = 2,966; p = 0,003) %1 anlamlılık düzeyinde anlamlı bir farklılık olduğunu göstermektedir. Ortalama fark 0,11750 olarak hesaplanmıştır. Bu sonuç, teknolojiye olan ilginin cinsiyete göre farklılık gösterdiğini ve H4b hipotezini desteklediğini göstermektedir. OSB'de çalışanların teknoloji ilgi düzeyi ortalaması 4,2987 iken, TGB'de çalışanların ortalaması 4,1812'dir. Standart sapmalar sırasıyla 0,55193 ve 0,68728'dir. OSB'de çalışanların teknoloji ilgisi, TGB'de çalışanlardan biraz daha yüksek görünmektedir. Bu durum, OSB'deki firmaların teknoloji ile daha yakından ilgilendiği anlamına gelebilir.

H4c hipotezi için Levene testi (F = 0,367; p = 0,545) ile varyansların eşit olduğu tespit edilmiştir. Eşit varyanslar için t-testi (VEOD) sonucuna göre (t = -2,056; p = 0,040), %5 anlamlılık düzeyinde girişimcilik potansiyelinde cinsiyetler arasında anlamlı bir farklılık bulunmaktadır. Ortalama fark -0,12320 olarak hesaplanmıştır. Bu sonuç H4c hipotezini desteklemekte ve girişimcilik potansiyelinin cinsiyete göre farklılık gösterdiğini ortaya koymaktadır. Girişimcilik potansiyeli açısından OSB'de çalışanların ortalaması 3,6981 iken, TGB'de çalışanların ortalaması 3,8213'tür. Standart sapmalar sırasıyla 0,91124 ve 0,88984'tür. TGB'de çalışanların girişimcilik potansiyeli OSB'de çalışanlardan daha yüksektir. Bu bulgu, teknoloji geliştirme bölgelerinde çalışan bireylerin girişimcilik potansiyellerinin daha yüksek olduğunu göstermektedir.

H4d hipotezi için Levene testi sonucunda (F = 13,836; p = 0,001) varyansların eşit olmadığı tespit edilmiştir. VFOD için t-testi (t = 4,098; p = 0,001) %1 anlamlılık düzeyinde cinsiyetler arasında anlamlı bir farklılık olduğunu göstermektedir. Ortalama fark 0,15720 olarak hesaplanmıştır. Bu bulgu, yenilikçilik düzeyinin cinsiyete göre farklılık gösterdiği hipotezini (H4d) desteklemektedir. Bu bulgular, yenilikçi sınıfın girişimcilik eğilimini etkileyen tolerans/hoşgörü, teknoloji ilgi düzeyi, girişimcilik potansiyeli ve yenilikçilik düzeyinin cinsiyete göre anlamlı bir farklılık gösterdiğini ortaya koymaktadır.

Yenilikçilik düzeyine baktığımızda, OSB'de çalışanların ortalama yenilikçilik düzeyi 4,3912 iken, TGB'de çalışanların ortalaması 4,2340 olarak hesaplanmıştır. Standart sapmalar sırasıyla 0,52960 ve 0,67568'dir. OSB'de çalışanlar yenilikçilik düzeyinde TGB'de çalışanlardan daha yüksek bir ortalamaya sahiptir. Bu sonuç, OSB'deki firmaların yenilikçiliğe daha fazla vurgu yaptığını gösterebilir.

Tablo 8 ve Tablo 9'da yenilikçi sınıfın girişimcilik eğilimini etkileyen unsurların çalışılan firmanın ihracat durumuna göre farklılık gösterip göstermediği ile ilgili kurulan H5a, H5b, H5c ve H5d hipotezlerine ilişkin sonuçlar yer almaktadır.

Tablo 8: Çalışılan Firmanın İhracat Durumu Gruplarının Karşılaştırması

Değişken	İhracat yapıyor mu?	N	Arit. Ort.	SS	Ort. St. Ht.
Tolerans/Hoşgörü Düzeyi	Evet	487	4,4097	,63428	,02874
	Hayır	635	4,3677	,68661	,02725
Teknoloji İlgi Düzeyi	Evet	487	4,2454	,63817	,02892
	Hayır	635	4,1890	,66672	,02646
Girişimcilik Potansiyeli	Evet	487	3,7197	,91060	,04126
	Hayır	635	3,8394	,88371	,03507
Yenilikçilik Düzeyi	Evet	487	4,3214	,64223	,02910
	Hayır	635	4,2433	,64120	,02545

Tablo 9: Yenilikçi Sınıfın Girişimcilik Eğilimini Etkileyen Unsurların İhracat Durumuna Göre Bağımsız Örneklem T-Testi

		Levene Testi		T testi		
		F	Sig.	T	Sig. (2-tailed)	Ort. Fark.
Tolerans/Hoşgörü Düzeyi	VEOD	3,232	,072	1,048	,295	,04193
	VFOD			1,059	,290	,04193
Teknoloji İlgi Düzeyi	VEOD	,827	,363	1,431	,153	,05640
	VFOD			1,439	,150	,05640
Girişimcilik Potansiyeli	VEOD	,643	,423	-2,218	,027	-,11966
	VFOD			-2,210	,027	-,11966
Yenilikçilik Düzeyi	VEOD	,398	,528	2,019	,044	,07805
	VFOD			2,019	,044	,07805
VEOD= Varyansların Eşit Olması Durumu, VFOD= Varyansların Farklı Olması Durumu						

İhracat yapan firmalarda çalışanların tolerans/hoşgörü düzeyi ortalaması 4,4097, ihracat yapmayan firmalarda çalışanların ortalaması ise 4,3677'dir. Standart sapmalar sırasıyla 0,63428 ve 0,68601'dir. Bu veriler, ihracat yapan firmalarda çalışanların hoşgörü düzeylerinin biraz daha yüksek olduğunu göstermektedir. Levene testi sonucuna göre (F = 3,232; p = 0,072) varyansların eşit olduğu tespit edilmiştir. Eşit varyanslar için yapılan t-testi sonucunda (t = 1,048; p = 0,295), tolerans/hoşgörü düzeyi açısından ihracat yapma durumuna göre anlamlı bir fark bulunmamıştır. Ortalama fark 0,04193 olarak hesaplanmıştır. Bu sonuç, H5a hipotezinin reddedildiğini ve ihracat yapma durumunun hoşgörü düzeyi üzerinde anlamlı bir etkisi olmadığını göstermektedir.

İhracat yapan firmalarda çalışanların teknoloji ilgi düzeyi ortalaması 4,4297, ihracat yapmayan firmalarda çalışanların ortalaması 4,1812'dir. Standart sapmalar sırasıyla 0,58661 ve 0,68728'dir. İhracat yapan firmalarda çalışanların teknolojiye olan ilgisi daha yüksek görünmektedir. Levene testi sonucunda (F = 0,827; p = 0,363) varyansların eşit olduğu tespit edilmiştir. T-testi sonucuna göre (t = 2,909; p = 0,004), %1 anlamlılık düzeyinde teknoloji ilgi düzeyinde ihracat yapan ve yapmayan firmalar arasında anlamlı bir fark olduğu bulunmuştur. Ortalama fark 0,05460 olarak hesaplanmıştır. Bu sonuç, H5b hipotezini desteklemekte ve ihracat yapan firmalarda çalışanların teknoloji ilgisinin daha yüksek olduğunu göstermektedir.

İhracat yapan firmalarda çalışanların girişimcilik potansiyeli ortalaması 3,7197, ihracat yapmayan firmalarda çalışanların ortalaması 3,6193'tür. Standart sapmalar sırasıyla 0,64627 ve 0,88070'tir. İhracat yapan firmalarda çalışanların girişimcilik potansiyeli biraz daha yüksektir.

Levene testi sonucunda (F = 0,643; p = 0,423) varyansların eşit olduğu tespit edilmiştir. T-testi sonucuna göre (t = 1,439; p = 0,150), girişimcilik potansiyeli açısından ihracat yapan ve yapmayan firmalar arasında anlamlı bir fark bulunmamaktadır. Ortalama fark 0,04604 olarak hesaplanmıştır. Bu sonuç, H5c hipotezinin reddedildiğini ve girişimcilik potansiyelinin ihracat yapma durumuna göre anlamlı bir farklılık göstermediğini ortaya koymaktadır.

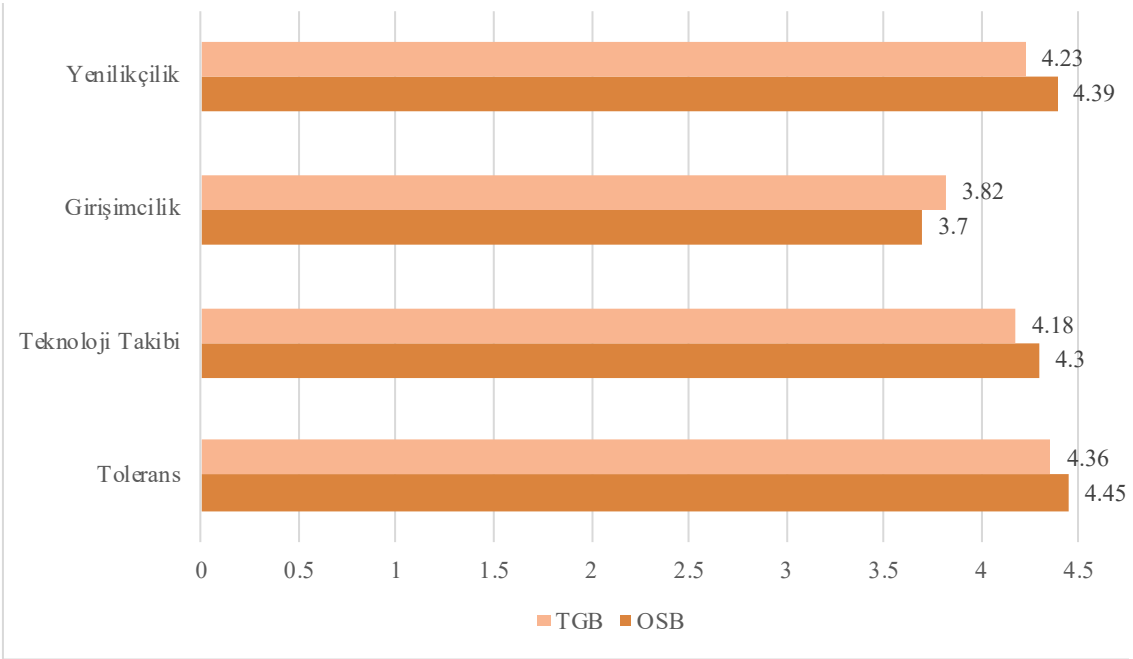
İhracat yapan firmalarda çalışanların yenilikçilik düzeyi ortalaması 4,3912, ihracat yapmayan firmalarda çalışanların ortalaması ise 4,2340'tır. Standart sapmalar sırasıyla 0,52960 ve 0,67568'dir. İhracat yapan firmalarda çalışanların yenilikçilik düzeyi daha yüksektir. Levene testi sonucunda (F = 0,398; p = 0,528) varyansların eşit olduğu tespit edilmiştir. T-testi sonucuna göre (t = 2,019; p = 0,044), %5 anlamlılık düzeyinde ihracat yapan ve yapmayan firmalar arasında yenilikçilik düzeyi açısından anlamlı bir fark olduğu bulunmuştur. Ortalama fark 0,15720 olarak hesaplanmıştır. Bu sonuç, H5d hipotezini desteklemekte ve ihracat yapan firmalarda çalışanların yenilikçilik düzeyinin daha yüksek olduğunu göstermektedir.

Yapılan analiz sonucunda, teknoloji ilgi düzeyi (H5b) ve yenilikçilik düzeyi (H5d) açısından ihracat yapan ve yapmayan firmalarda çalışan yenilikçi sınıf arasında anlamlı farklılıklar bulunmuştur. İhracat yapan firmalarda çalışanlar teknolojiye daha fazla ilgi duymakta ve yenilikçilik düzeyleri daha yüksek görünmektedir. Ancak, tolerans/hoşgörü düzeyi (H5a) ve girişimcilik potansiyeli (H5c) açısından ihracat yapma durumu ile istatistiksel olarak anlamlı bir fark tespit edilmemiştir.

Elde edilen bulgular, çalışma alanı, firma türü, yaş, cinsiyet ve ihracat durumu gibi değişkenlerin bireylerin girişimcilik, yenilikçilik, teknoloji ilgisi ve hoşgörü düzeylerini farklı şekillerde etkilediğini ortaya koymaktadır. Özellikle mekânsal farklılıkların (OSB-TGB) yalnızca fiziksel değil, aynı zamanda çalışanların bireysel psikolojik eğilimlerini şekillendiren güçlü birer unsur olduğu anlaşılmaktadır.

Tablo 10: Değişkenlere göre OSB ve TGB Kıyaslaması Özeti

Değişken	OSB'de Ar-Ge Çalışanları	TGB Ar-Ge Çalışanları
Girişimcilik Potansiyeli	Düşük	Yüksek
Yenilikçilik Düzeyi	Yüksek	Görece düşük
Teknolojiye İlgi	Yüksek	Görece düşük
Tolerans / Hoşgörü	Yüksek (Geleneksel-sosyal üretim kültürü)	Düşük (Bireyci-rekabetçi yapı)



Grafik 2: Çalışma Alanına Göre Değişkenlerin Durumu

OSB çalışanlarının hoşgörü düzeyinin, TGB çalışanlarına kıyasla istatistiksel olarak anlamlı biçimde daha yüksek olduğu tespit edilmiştir. Bu bulgu, OSB'lerdeki üretim temelli çalışma kültürünün, daha geleneksel ve yerleşik sosyal ilişkiler içinde gelişen bir anlayışa sahip olduğunu düşündürmektedir. TGB'lerde ise daha rekabetçi ve bireyci bir yapı olabileceği değerlendirilmektedir. Teknolojiye olan ilgi bakımından da OSB çalışanlarının, TGB çalışanlarına göre daha yüksek bir ortalamaya sahip olduğu saptanmıştır. Bu sonuç, OSB'lerde faaliyet gösteren firmaların teknik üretim süreçlerine olan doğrudan bağlılığının, teknolojiye olan ilgiyi tetikleyici bir unsur olabileceğini ortaya koymaktadır. Öte yandan, TGB'lerde teknolojik gelişim daha çok soyut araştırma ve yazılım tabanlı çalışmalara dayandığı için bireysel teknoloji ilgisi daha düşük düzeyde seyredebilir. TGB çalışanlarının girişimcilik potansiyelinin OSB çalışanlarına göre anlamlı derecede daha yüksek olduğu belirlenmiştir. TGB'ler, yenilikçi fikirlerin ticarileştirilmesi ve yeni girişimlerin doğuşuna olanak tanıyan bir ekosistem sağladığından, bu alanlarda çalışan bireylerin girişimcilik eğilimlerinin daha fazla geliştiği anlaşılmaktadır. OSB'lerde ise daha çok kurumsallaşmış yapılar ve üretim odaklı operasyonlar hâkim olduğundan bireysel girişimcilik motivasyonunun sınırlı kalabileceği öngörülmektedir. Yenilikçilik düzeyi açısından OSB çalışanlarının TGB çalışanlarına göre daha yüksek düzeyde performans gösterdiği bulgulanmıştır. Bu durum, OSB'lerdeki yenilikçilik anlayışının daha çok ürün ve süreç inovasyonuna dayalı pratik çıktılarla ölçülebilir bir hâl aldığını; TGB'lerde ise inovasyonun daha soyut ve uzun vadeli çıktılara dayalı olması nedeniyle algılanan yenilikçilik düzeyinin daha düşük olabileceğini düşündürmektedir. Bu bulgular çerçevesinde, OSB'lerin bireylerin hoşgörü, teknoloji ilgisi ve yenilikçilik kapasitesi açısından daha elverişli bir ortam sunduğu, TGB'lerin ise bireylerin girişimcilik potansiyelini destekleyici yapısıyla öne çıktığı söylenebilir. Bu sonuçlar, mekânsal türlerin yalnızca fiziksel farklılıkları değil, aynı zamanda çalışanların psikolojik eğilim ve davranışlarını da şekillendirdiğini göstermektedir.

Elde edilen bulgular, girişimcilik potansiyeli ve yenilikçilik düzeyinin yalnızca bireysel yetkinliklerle değil; aynı zamanda çalışılan kurumun yapısı, faaliyet gösterilen mekânsal alan ve firmanın küresel entegrasyon düzeyi gibi kurumsal faktörlerle de anlamlı şekilde etkileşim içerisinde olduğunu ortaya koymaktadır. Bu çerçevede; TGB çalışanlarının girişimcilik eğilimlerinin daha yüksek olması, OSB çalışanlarının ise teknolojiye ilgi ve yenilikçilik düzeylerinde öne çıkması, çalışma ortamının psikososyal etkilerini vurgulamaktadır. Ayrıca, cinsiyet değişkeni bağlamında ortaya çıkan çift yönlü etki - erkeklerin daha yüksek girişimcilik potansiyeline, kadınların ise daha yüksek yenilikçilik düzeyine sahip olması - toplumsal cinsiyetin iş yaşamındaki rolünü yeniden değerlendirmeyi gerekli kılmaktadır. Yaş ve ihracat durumu gibi faktörlerin etkileri ise daha seçici düzeyde gözlemlenmiş; özellikle genç bireylerin teknolojiye olan ilgisinin yüksek olması ve ihracat yapan firmalarda yenilikçilik düzeyinin anlamlı biçimde artması, teknolojiye erişim ve uluslararası rekabetin bireysel tutumlar üzerindeki dönüştürücü etkisini göstermektedir. Bu çok katmanlı yapının anlaşılması, sadece girişimcilik ve yenilikçilik süreçlerinin daha iyi yönetilmesine değil, aynı zamanda politika geliştiricilere, kurum yöneticilerine ve insan kaynakları stratejistlerine özgün uygulama önerileri sunulmasına da zemin hazırlamaktadır. Bir sonraki bölümde, elde edilen bu bulgular doğrultusunda geliştirilen politika ve uygulama önerilerine yer verilmiştir.

Çalışmanın bulguları ışığında yapılan analizler, TGB'lerin mekânsal avantajlarının çalışanların teknoloji ilgisi, girişimcilik potansiyeli ve yenilikçilik düzeyleri gibi bireysel yetkinliklerine anlamlı biçimde yansıdığını ortaya koymaktadır. Özellikle bağımsız örneklem t-testi sonuçları, TGB'lerde çalışan Ar-Ge personelinin girişimcilik potansiyeli ve yenilikçilik düzeylerinin OSB çalışanlarına kıyasla istatistiksel olarak anlamlı düzeyde daha yüksek olduğunu göstermektedir ($p < 0,05$). Bu durum, TGB'lerdeki çalışanların daha esnek, yaratıcı ve üniversite-sanayi iş birliklerine açık bir ortamda çalıştığını ve bu koşulların girişimcilik eğilimlerini olumlu yönde etkilediğini düşündürmektedir.

Ayrıca, TGB'lerin sosyal ve kültürel olanaklar açısından daha zengin olmaları, çalışanların motivasyon düzeylerini ve psikolojik iyilik hâllerini artırmakta; bu da yenilikçi fikir üretimini destekleyen bir zemin oluşturmaktadır. Üniversite kampüsleriyle yakın temas içinde bulunmak, çalışanlara hem akademik bilgiye hem de çeşitli seminer, çalıştay ve ağ kurma etkinliklerine erişim imkânı sunmakta; bu tür fırsatlar ise bireylerin girişimcilik niyetlerini güçlendirmekte ve yenilikçi düşünme biçimlerini teşvik etmektedir. Buna karşılık, OSB çalışanlarının teknoloji ilgisi düzeyinin daha yüksek çıkması, OSB'lerin üretimle daha sıkı entegre olmuş yapısından kaynaklanabilir. Uygulamalı teknolojilere yakın çalışmanın getirdiği pratik deneyim, teknolojiye olan ilgiyi artırırken, aynı zamanda çalışanların teknolojik uygulamaları doğrudan gözlemleyip kullanmalarına da olanak tanımaktadır. Ancak bu durum, yüksek teknoloji üretimiyle birlikte gelen yenilikçiliği ve girişimciliği doğrudan destekleyen bir ortamın varlığını garanti etmemektedir. Bu noktada, OSB içinde yer alan TGB'lerin de OSB'nin yapısal özelliklerinden kaynaklanan benzer sıkıntılarla karşı karşıya kaldığı görülmektedir. Üniversite ve sosyal ağlara erişim açısından sınırlı olan bu tür TGB'ler, mekânsal avantajların sunduğu potansiyelden tam anlamıyla faydalanamamakta; bu da girişimcilik ve yenilikçilik düzeylerinin gelişimini kısıtlayabilmektedir.

Sonuç olarak, TGB'lerin şehir merkezlerine yakın konumlanmasının çalışanlar üzerindeki etkisi çok boyutlu olarak ele alınmalıdır. Sadece fiziksel erişim kolaylığı değil, aynı zamanda sosyal sermayeye, kültürel etkinliklere ve akademik bilgiye yakınlık; girişimcilik potansiyeli ve yenilikçilik düzeylerinde anlamlı artışlara katkı sağlamaktadır. Bu bağlamda, mekânsal konumun, Ar-Ge çalışanlarının bireysel kapasiteleri üzerindeki etkilerinin derinlemesine anlaşılması, bölgesel kalkınma politikalarının daha isabetli bir biçimde tasarlanmasına olanak tanıyacaktır. Ayrıca, OSB'lerde de TGB benzeri sosyal ve akademik destek mekanizmalarının oluşturulması, bu bölgelerde çalışanların girişimcilik ve yenilikçilik potansiyelinin artırılmasına katkı sağlayabilir.

5. Sonuç ve Tartışma

OSB ve TGB'lerin mekânsal dinamikleri, yenilikçi sınıfın ihtiyaç ve beklentilerine uygun şekilde düzenlenmelidir. Bu bölgelerdeki fiziksel yerleşim, altyapı özellikleri, sosyal imkanlar ve iş birliği olanakları, çalışanların verimliliği ve iş memnuniyeti üzerinde doğrudan etkilidir. OSB'ler daha çok üretim odaklı süreçlere yoğunlaşırken, TGB'ler esnek ve yaratıcı iş ortamları sunarak yenilikçi sınıfa daha uygun koşullar sağlamaktadır.

Bu çalışmada yenilikçi sınıfın girişimcilik eğilimlerini etkileyen faktörler analiz edilmiştir. Elde edilen bulgulara göre:

- Tolerans/hoşgörü düzeyi cinsiyete göre anlamlı bir farklılık göstermemiştir. Bu durum, cinsiyetin tolerans/hoşgörü üzerinde belirleyici bir faktör olmadığını ortaya koymaktadır.
- Teknoloji ilgi düzeyi de cinsiyete göre anlamlı bir farklılık göstermemiştir, dolayısıyla teknoloji ilgisi konusunda cinsiyetler arasında belirgin bir fark yoktur.
- Girişimcilik potansiyeli açısından firmanın türü önemli bir farklılık yaratmıştır. Özellikle Teknoparklarda çalışanlar, AR-GE Merkezlerinde çalışanlara kıyasla daha yüksek girişimcilik potansiyeline sahiptir ($p < 0,05$). Bu bulgu, yenilikçi ekosistemlerde çalışanların daha fazla girişimcilik eğilimi gösterdiğini desteklemektedir.
- Yenilikçilik düzeyi de firmanın türüne göre anlamlı bir farklılık göstermiştir. Teknopark çalışanları, Tasarım Merkezlerinde çalışanlara kıyasla daha yüksek yenilikçilik düzeyine sahiptir ($p<0,05$). Bu sonuç, Teknoparkların yenilikçi fikirlerin geliştirilmesinde daha uygun bir ortam sunduğunu göstermektedir.

Bu sonuçlar, Türkiye'deki OSB ve TGB'lerde çalışan Ar-Ge personelinin girişimcilik eğilimleri üzerinde firmanın türü ve çalışma ortamının etkili olduğunu göstermektedir. Bu bağlamda, Teknoparklar gibi yenilikçi ekosistemlerin desteklenmesi ve genişletilmesi, girişimcilik potansiyelinin artırılması açısından önem arz etmektedir.

Türkiye'deki OSB ve TGB'lerin Ar-Ge faaliyetlerine sundukları katkılar arasındaki farklılıklar, bu bölgelerin planlanması ve yönetiminde yenilikçi sınıfın ihtiyaçlarının dikkate alınmasının önemini ortaya koymaktadır. Yenilikçi sınıfın en güncel teknolojileri kullanarak verimli çalışabilmesi için gerekli altyapının sağlanması, bu bölgelerdeki Ar-Ge faaliyetlerinin etkinliğini artıracaktır. Ayrıca, farklı disiplinlerden gelen profesyonellerin iş birliği yapabileceği ortamlar oluşturulmalı, sosyal ve kültürel ihtiyaçları karşılayacak mekanlar ve etkinlikler sunulmalıdır.

Çalışma alanlarının tasarımında yaratıcı düşünme ve problem çözme yeteneklerini destekleyen düzenlemeler yapılmalı; açık ofis planları, esnek oturma düzenlemeleri ve yaratıcı alanlar gibi unsurlar ön planda tutulmalıdır. Böylece, OSB ve TGB'ler daha çekici ve yenilikçi hale getirilebilir, bu da Türkiye'nin ekonomik ve teknolojik gelişimine önemli katkılar sağlayacaktır. Yenilikçi sınıfın mekân tercihlerini etkileyen faktörler göz önünde bulundurularak yapılan düzenlemeler, bölgesel kalkınma ve ulusal yenilikçilik stratejileri açısından büyük önem taşımaktadır.

Bu çalışma, OSB ve TGB'lerin yenilikçi sınıf üzerindeki etkilerini karşılaştırarak, kümelenme teorisi, Triple Helix modeli ve RIS çerçevesinde önemli katkılar sunmaktadır. Bulgular, TGB'lerin üniversite-sanayi-devlet işbirliğini daha etkin bir şekilde teşvik ettiğini ve bu sayede yenilikçi faaliyetleri artırdığını göstermektedir. OSB'ler ise daha çok üretim odaklı olup, yenilikçi faaliyetleri sınırlı düzeyde desteklemektedir. Bu sonuçlar, TGB'lerin Triple Helix modeli çerçevesinde daha etkin bir yenilik ekosistemi oluşturduğunu ve RIS kapsamında bölgesel yenilik kapasitesine daha fazla katkı sağladığını ortaya koymaktadır.

6. Politika ve Uygulama Önerileri

Bu çalışmanın bulguları, girişimcilik ve yenilikçilik eğilimlerinin bireysel, mekânsal ve kurumsal faktörlere bağlı olarak önemli ölçüde farklılık gösterdiğini ortaya koymaktadır. Dolayısıyla, kalkınma politikalarının yalnızca bireylerin yetkinliklerini artırmaya odaklanması yetersiz kalmakta; aynı zamanda kurumsal yapıları ve mekânsal bağlamları iyileştirici bütüncül stratejilere ihtiyaç duyulmaktadır.

Girişimcilik Potansiyelini Artırmaya Yönelik Politikalar

- TGB'lerde tespit edilen yüksek girişimcilik potansiyeli dikkate alındığında, bu alanlarda girişimcilik eğitimleri, mentorluk programları ve risk sermayesi desteklerinin artırılması kritik önem taşımaktadır. Özellikle üniversitelerle kurulacak iş birlikleri sayesinde erken aşama girişimcilik programları ve öğrenci odaklı girişimcilik fonlarının yaygınlaştırılması, genç bireylerin bu potansiyelden faydalanmalarını kolaylaştıracaktır.
- AR-GE merkezlerinde gözlemlenen düşük girişimcilik potansiyeli, mevcut yönetim yapılarının gözden geçirilmesini gerektirmektedir. Bu bağlamda, proje bazlı esnek yönetim modelleri, performansa dayalı ödüllendirme sistemleri ve ticarileşmeye odaklı performans göstergelerinin benimsenmesi önerilmektedir.

Yenilikçilik Düzeyini Artırmaya Yönelik Politikalar

- OSB'lerde tespit edilen yüksek yenilikçilik düzeyinin korunması ve daha ileriye taşınması amacıyla sanayi-üniversite iş birliklerinin güçlendirilmesi, uygulamalı araştırma fonlarının artırılması ve sektörel kümelenme stratejilerinin yaygınlaştırılması önem arz etmektedir.
- Kadın çalışanların yenilikçilik süreçlerindeki güçlü katkısı dikkate alınarak, STEM (fen, teknoloji, mühendislik ve matematik) alanlarında kadın istihdamını artırmaya yönelik pozitif ayrımcılık politikaları ve kariyer gelişimini destekleyen modellerin geliştirilmesi gerekmektedir.
- TGB'lerde yenilikçilik düzeyinin görece düşük olması, performans bazlı destek politikalarının uygulanması ve yapısal değerlendirme mekanizmalarının kurulması gerekliliğini ortaya koymaktadır. Bu sayede TGB'lerde yenilikçilik kapasitesinin artırılması mümkün olacaktır.

Mekânsal Farklılıklara Duyarlı Uygulamalar

- Mekânsal farklılıkların girişimcilik ve yenilikçilik eğilimleri üzerindeki etkisi göz önünde bulundurularak, bölgelere özgü stratejiler geliştirilmelidir. Örneğin, OSB'lerde tespit edilen yüksek hoşgörü düzeyi, teknoloji ilgisi ve dijital dönüşüm kapasitesi doğrultusunda yapay zekâ destekli üretim sistemleri, otomasyon çözümleri ve Endüstri 4.0 uygulamalarını teşvik eden politikaların benimsenmesi önemlidir. TGB'lerde ise yalnızca girişimcilik potansiyeli değil, aynı zamanda yenilikçilik ve teknoloji adaptasyonunu artırmaya yönelik çok aktörlü destek mekanizmalarının (örneğin inovasyon koçluğu, tasarım odaklı atölyeler vb.) uygulanması önerilmektedir.

İhracat Yönelimi Olan Firmalar İçin Stratejik Gelişim Alanları

- İhracat yapan firmalarda gözlemlenen yüksek teknoloji ilgisi ve yenilikçilik düzeyi, bu firmaların iyi uygulama örnekleri olarak belgelenip sistematik şekilde yaygınlaştırılması gerektiğine işaret etmektedir. Bu tür firmalar, girişimcilik ve yenilikçilik politikalarının saha temelli uygulamaları için referans noktaları oluşturabilir.
- İhracatçı firmaların biriktirdiği bilgi ve deneyim, ihracat yapmayan firmalar için değerli bir öğrenme kaynağıdır. Bu kapsamda, sektörel eşleştirme mekanizmaları ve ortak inovasyon platformları aracılığıyla bilgi transferi sağlanmalı; ayrıca mentorluk programları yoluyla ulusal inovasyon kapasitesi artırılmalıdır.

Kaynakça

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The Powerful Locomotive of Growth: Passion. The Role of Entrepreneurial Passion and Political Skill in Business Growth

Zişan Duygu Alioğulları*

Abstract

Purpose: While the establishment of enterprises is of critical importance for entrepreneurs, the subsequent growth of these enterprises is also an important and complex process. At this point, the concept of passion, a dominant factor in the entrepreneur's decision to grow, has emerged. Individuals with political skills, are able to influence others and promote themselves effectively in their social environment by displaying strategies and behaviors appropriate to the situation. In this way, they do not have difficulty in finding funding and support, they contribute to growth by attracting qualified investors to their businesses, and they can eliminate growth barriers to their businesses with their existing skills.

Methodology: Within the scope of the research, data were collected through a survey of entrepreneurs in Erzurum. Data collected from 403 entrepreneurs were tested by correlation and structural equation modeling (SEM) analysis.

Findings: As a result of the research, it was found that entrepreneurial passion has a positive effect on the entrepreneur's growth intention, and the entrepreneur's political skill has a mediating role in this effect. According to this study, it was determined that passion, which enables the entrepreneur to exhibit perseverance in the face of challenges, has a positive effect on entrepreneurial growth intention. Politically skillful entrepreneurs who are skillful in dealing with environmental uncertainties, influencing others, and eliminating the factors that prevent the growth of their businesses are more effective in transforming their passion into growth intention.

Originality: In the literature review, no other study was encountered in which the variables in the research model were analyzed together. In the direction of the findings, many suggestions have been made for managers, investors, educational and public institutions, and future researchers, and it is evident that the contribution of the research to the literature is significant. In the present study, this problem, which is a major national problem, has been addressed and a comprehensive analysis has been made regarding its solution.

Keywords: Entrepreneurial Passion, Political Skill, Entrepreneurial Growth Intention.

JEL Codes: L20, L26, M10.

Büyümenin Güçlü Lokomotifi: Tutku. Girişimcilik Tutkusunun İşletme Büyümesinde Politik Becerinin Rolü

Öz

Amaç: Girişimlerin kurulması girişimciler için kritik öneme sahip olmakla birlikte, bu girişimlerin büyütülmesi de önemli ve karmaşık bir süreçtir. Tam da bu noktada, girişimcinin büyümeye karar vermesinde baskın bir unsur olan tutku kavramı ortaya çıkmıştır. Politik beceriye sahip bireyler, duruma uygun stratejiler ve davranışlar sergileyerek başkalarını etkileyebilir ve sosyal çevrelerinde kendilerini etkili bir şekilde tanıtabilirler. Bu sayede, fon ve destek bulma konusunda zorluk yaşamazlar, işletmelerine nitelikli yatırımcıları çekerek büyümeye katkı sağlarlar ve mevcut yetenekleriyle işletmelerinin önündeki büyüme engellerini ortadan kaldırabilirler.

Metodoloji: Araştırma kapsamında, Erzurum'da ki girişimciler üzerinde anket yoluyla veriler toplanmıştır. 403 girişimciden toplanan veriler, korelasyon ve yapısal eşitlik modellemesi (YEM) analizi ile test edilmiştir.

Bulgular: Araştırma sonucunda, girişimcilik tutkusunun, girişimcinin büyüme niyeti üzerinde olumlu etki oluşturduğu ve bu etkide girişimcinin politik becerisinin aracı etkisi olduğu görülmüştür. Bu çalışmaya göre; girişimcinin zorluklara karşı dayanıklılık göstermesini sağlayan tutkunun, işletme büyüme niyeti üzerinde olumlu etkisi olduğu tespit edilmiştir. Çevresel belirsizliklerle başa çıkmada, başkalarını etkileme ve işletmelerinin büyümesi engelleyen faktörleri ortadan kaldırmada yetenekli olan politik becerili girişimcilerin, tutkularını büyüme niyetine dönüştürmede daha etkili oldukları görülmüştür.

Özgünlük: Yapılan literatür taramasında araştırma modelindeki değişkenlerin bir arada incelendiği başka bir çalışmaya rastlanmamıştır. Elde edilen bulgular ışığında yöneticilere, yatırımcılara, eğitim ve kamu kurumları ile gelecek araştırmacılara yönelik pek çok öneri getirilmiş olup araştırmanın yazına katkısının önemli olduğu açıktır. Çalışmayla ulusal bazda büyük olan bu sorun ele alınmış olup çözümüne yönelik kapsamlı bir analiz yapılmıştır.

Anahtar Kelimeler: Girişimcilik Tutkusu, Politik Beceri, Girişimcilik Büyüme Niyeti.

JEL Codes: L20, L26, M10.

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1. Introduction

Enterprise-oriented businesses serve as the driving and pioneering forces behind national economies. It is essential for enterprises, regarded as economic pioneers, to survive, grow, and develop. Thus, it is crucial for the state to support, encourage, and increase the number of rapidly growing entrepreneurial businesses. Entrepreneurial businesses positively impact not only to their own interests but also the development of the economy at the local, regional, and national levels, and the creation of new employment, opportunities, and wealth (Costin, 2012). Identifying the factors that contribute to the development, progress, or growth of entrepreneurial businesses and addressing existing weaknesses are of great importance for the country's economy and development.

Motivation that mobilizes individuals is an essential factor in the formation of growth intentions of entrepreneurial enterprises. Entrepreneurial enterprises must sustain their initial motivation to ensure continued success in their areas. Studies have demonstrated that entrepreneurial businesses are generally more interested in survival than growth (Welsch et al., 2013). Consequently, many studies have been conducted to explore what motivates entrepreneurs in the formation of growth intentions (Cardon et al., 2017; Gielnik et al., 2017). In these studies, the concept of entrepreneurial passion has emerged as a significant factor. Entrepreneurial passion, which encompasses the entrepreneur's ability to invent new ideas and products, to have the courage and vigor for new ideas and enterprises, and the ability to bring people together, plays a key role not only in the start-up phase of businesses but also in the growth and progression phases of businesses. As a result, passion can provide the entrepreneur with significant energy to overcome economic and psychological challenges in the entrepreneurial cycle to realize growth.

Furthermore, studies have demonstrated that personality (Young & Kim, 2015; Bozkurt et al., 2012; Zhao & Seibert, 2006), talent, and skill play an important role in the success and growth of entrepreneurial businesses (Yaman & Batı, 2020; Tocher et al., 2012). The growth phase in the entrepreneurial cycle is laden with uncertainty (Rujirawanich et al., 2011). The contributions of political skill to the individual, such as seeing the opportunities in their environment well, establishing good interpersonal relationships, and overcoming conflicts with stakeholders skillfully, lead businesses to want to grow. In summary, political skill has been identified as a key factor that positively influences the identification and evaluation of opportunities, the growth intention of the enterprise, and the success of the business, i.e. company performance, high growth intention, investment capacity, largely depends on the political skills of entrepreneurs.

According to the Creating the Human Advantage Survey 2023 report conducted by the World Federation of People Management Associations (WFPMA, 2023) with 6,900 participants with different seniority levels from 102 sectors around the world with the participation of 150 HR managers from Türkiye; it has been observed that the third biggest business-related challenge experienced by Türkiye with a rate of 39% is Innovative (Entrepreneurial)/Digital change and transformation (https://www.peryon.org.tr). The present study aims to provide a comprehensive analysis and recommendations for the solution of this problem by addressing this problem on a national basis. In the study conducted by Okumuş and Bakan on entrepreneurs registered to Kahramanmaraş Chamber of Tradesmen and Craftsmen in 2023, it was stated that 27% of the entrepreneurs did not want to expand their businesses. In the context of this information, the problem of the research is based on the questions 'Why do some entrepreneurs grow their businesses while others do not? What are the factors that motivate people to grow their businesses?' and it is aimed to fill a significant gap in the literature.

In this study, it is analyzed how politically skilled individuals with entrepreneurial passion are and whether political skill is an igniting factor in entrepreneurs' intention to grow their businesses. In the literature review, no study was found that examined the effect of entrepreneurial passion or political skill variables on the effect of business growth intention. The study fills this gap in the literature and analyses the effect of passion and political skill variables on growth intentions.

The research is of great benefit to the national economy and entrepreneurs with its contributions and suggestions. In this respect, research both fulfills an important need in literature and makes a valuable contribution to the literature by offering an authentic perspective.

1. Conceptual Framework

1.1. Entrepreneurial Passion

In the literature, passion has been accepted as the antecedent of entrepreneurial performance and has taken its place in studies (Baum et al., 2001; Vallerand et al., 2003; Vallerand et al., 2010; Cardon and Kirk., 2013) as the most fundamental element of entrepreneurship. In the dictionary, the concept of passion is defined as the desire of individuals to direct all their time and energy to activities that they love and find important (Vallerand et al., 2003: 756; Frijda et al., 1991: 217). On the other hand, entrepreneurial passion is defined as the entrepreneur's conscious experience of entrepreneurial activities in this process by assuming roles that are meaningful to his/her identity and experiencing intense positive emotions (Cardon et al., 2009: 517-519). Stepherd and Patzelt (2018, 204-206) describe entrepreneurial passion as entrepreneurs constantly thinking about new business opportunities and business issues even while interacting with their environment and spending time with their families in their free time.

With the energy generated by passion, individuals feel motivated to devote intensive time to their activities (Yitshaki & Kropp, 2016: 208). The concept of passion is different from the concept of motivation. Whereas motivation involves a number of psychological phases necessary for individuals to make an effort, passion is when individuals do the job they are fond of as a part of their identity. Passion is a driving factor that feeds and strengthens entrepreneurial motivation (Cardon et al., 2013: 25-30).

When the studies were reviewed, it was observed that entrepreneurial passion facilitates goal setting and commitment to these goals (Winand, Bell & Zeimers, 2023), which increases entrepreneurial success (Gielnik et al., 2017; Cardon et al., 2017; Timmons, 2000). Ma et al. (2017) conducted a study on 154 entrepreneurs and found that entrepreneurial passion creates a climate of innovation in organizations and this process directly and indirectly increases the performance of entrepreneurs. It was seen that entrepreneurial passion has a positive relationship with the concepts of vision and innovation and positively affects the growth of the enterprise through these variables (Gülbahar,2019; Luu & Nguyen, 2021).

The research conducted by Stroe et al. (2018) involving 50 entrepreneurs revealed that entrepreneurial passion enhances decision-making in times of uncertainty and stress, while also fostering greater patience and flexibility in these situations (Cardon & Kirk, 2013). Chen et al. (2022) stated that entrepreneurial passion has a positive effect on the well-being and motivation levels of entrepreneurs, and Breugst et al. (2012) noted that it positively increases the commitment of employees. In many studies, it has also been demonstrated that entrepreneurial passion acts as a supportive factor in developing and advancing entrepreneurs' businesses (Gielnik et al., 2017; Elci, 2013).

In their study on 73 entrepreneurial teams from the USA and Portugal, Santos and Cardon (2019) found that entrepreneurial passion positively affects team performance in inventing and developing new enterprises. Entrepreneurial passion plays a leading role in uncovering new opportunities, establishing new businesses, and developing new enterprise activities (Murnieks et al., 2014; Vallerand et al. 2015). Therefore, entrepreneurial passion consists of 3 sub-dimensions: invention, which is the invention of entrepreneurship, establishment, which is the re-establishment of businesses and activities, and development, which is the development of all businesses (Cardon & Kirk, 2013: 1030; Cardon et al., 2009).

As a result, it was seen that passion is a characteristic found in successful entrepreneurs and encourages entrepreneurial behavior. Passion is a driving force for the entrepreneur to be resilient in the face of difficulties, to achieve his/her goal without losing his/her determination, and to be determined in his/her behavior (Cardon & Kirk, 2013).

While doing all these, it exhibits the behavior of inventing new ways to grow the business, searching for new ideas, evaluating these ideas, and establishing new businesses (Murnieks et al., 2014; Vallerand et al. 2003).

In the literature review, it was observed that entrepreneurs who intend to grow their enterprises have a high passion for their businesses. Biraglia and Kadile's 2017 study on private-sector manufacturers in the United States revealed that entrepreneurial passion has a positive effect on creativity and intention to grow the enterprise. Baum and Locke's (2004) study on 229 entrepreneurs and 106 employees showed that entrepreneurial passion has a positive effect on enterprise growth and that the entrepreneur's sense of vision and self-efficacy play a mediating role in this research. In the study conducted by Anjum et al. (2021) on business students at a university in Pakistan, Akinboye (2020) on 528 SME entrepreneurs in Zealand and Australia, Drnovsek et al. (2016) on 122 high R&D entrepreneurs, it was found that entrepreneurial passion increases entrepreneurial growth intention. Furthermore, Dhakal et al. (2022), in a study of 99 women entrepreneurs, found that entrepreneurial leader identity has a positive effect on enterprise growth intention and passion. In the light of the above studies, the first hypothesis (H1) of the study was developed:

H1: Entrepreneurial passion has a significant positive effect on entrepreneurial growth intention.

H1a Entrepreneurial passion sub-dimensions have a significant positive effect on entrepreneurial growth intention sub-dimensions.

Being persistent and passionate about the enterprise will help to gain experience and environment to achieve success (Heupel et al., 2024; Vallerand, 2015) and to appear sincere and genuine. For individuals with high entrepreneurial passion, their identity is shaped by their passion (Murnieks et al., 2014). Therefore, entrepreneurial passion seems to play an important role in an individual's abilities and skills. A high feeling of passion has a positive effect on the likelihood of having and acquiring political skills such as positive image-building, networking, sincerity, and interpersonal bonding. As a result of the studies mentioned above, the second hypothesis of the study (H2) was developed:

H2: Entrepreneurial passion has a significant positive effect on political skills.

H2a: Entrepreneurial passion sub-dimensions have a significant positive effect on political skill sub-dimensions.

1.2. Political Skill

Ferris et al. (2010: 7; 2005: 127) characterized political skill as the ability to perceive and interpret others and to use this understanding strategically to achieve individual and organizational goals. Thus, political skill is defined as the capacity to effectively understand others in the workplace and to use all the information gained from the environment to improve personal and organizational goals (Ferris et al., 2007: 291). Politically skilled people leave a sincere and sincere impression on the other side while introducing themselves to their environment. With this sincere communication, they are able to coordinate all the information and resources around them (Marvel et al., 2020). Political skill consists of four sub-dimensions: social alertness, interpersonal influence, network ability, and sincerity (Ferris et al., 2005). It is crucial that politically skilled managers and leaders who are socially alert (e.g.: I have good intuition and insight on how to present myself to others), have the power to influence others, have strong networks, and are perceived as sincere while doing all of these are present in organizations.

In the literature review, it has been observed that the performance of organizations managed by politically skilled managers is high. Politically skilled managers are successful in recognizing environmental advantages over competitors (Alvarez & Busenitz, 2001), dealing with uncertainties and risks, and creating new solutions (McAllister, Ellen, & Ferris, 2018). Thus, politically skilled managers are able to respond immediately to environmental changes, adjust their strategies accordingly, and see opportunities in the current environment better than anyone else (Zhang et al., 2023; McAllister et al., 2018; Nikolaou et al., 2007).

Politically skilled managers are those who can persuade others through effective negotiation about the use of possible opportunities and potentials (Grosser et al., 2018). This increases the success of the organization and the trust in the organization (Zhang et al., 2022; Ferris et al., 2007; Ferris et al., 2005).

Research has shown that politically skilled managers build stronger relationships with suppliers, customers, venture capitalists, and potential business partners in order to achieve their goals. Politically skilled managers are also successful in maintaining these relationships with well-connected and well-informed people. In addition, managers with this skill can easily overcome conflicts in their relationships (Tocher et al., 2012). Politically skilled managers are skilled in creating a positive image by skillfully introducing themselves, their skills, and their achievements to their environment (McAllister et al., 2018; Baron & Tang, 2009). Therefore, entrepreneurs with high political skills are more successful in business activities than entrepreneurs with low political skills and social competence is a key component of social competence (Tocher et al., 2012).

Political skill is known to have a negative impact on the feelings and thoughts of failure in entrepreneurs. Therefore, if entrepreneurs have this skill, they will want to grow, develop, and progress. According to the study conducted by Yaman and Batı (2020), it was argued that the political skills of women entrepreneurs positively affect the growth intentions of their enterprises. In the study, it was observed that women entrepreneurs with political skills who have the ability to network, and influence have higher growth intention levels.

Tocher et al. (2012) reported that political skill has a positive effect on new enterprise creation. In the study conducted on American entrepreneurs, it was observed that political skill provides entrepreneurs with social competence, which positively affects entrepreneurial performance. In the study, political skill was also found to increase the financial performance of the company.

Hallen et al. (2020) observed that politically skilled entrepreneurs are aware of the opportunities around them, take initiatives towards these opportunities, gather the resources at their disposal to achieve goals and objectives and negotiate them with stakeholders, communicate and use their extensive social entrepreneurial networks. Zhang et al. (2023), in a study of 91 academic entrepreneurs, found that entrepreneurs' political skills positively affect their innovation behavior.

Politically skilled individuals exhibit the behaviors of understanding people in the workplace, showing behaviors to advance their personal or organizational goals, and persuading others of their views. Studies have shown that individual experience positively affects entrepreneurial growth intention. In addition, there are many studies demonstrating the high role of emotions in the entrepreneurial process (Whittle et al., 2021; Doern & Goss, 2014; Padilla-Meléndez et al., 2014; Podoynitsyna et al., 2012). As a result, no matter how good the conditions of the business are, the decision to grow is an individual decision that should be made by the entrepreneur themselves, and it is determined that political skill, which is an individual skill, helps and facilitates entrepreneurial growth intention.

Davidsson (1991) detected in his studies that the opportunities they perceive, their need for success, and their abilities motivate them in the formation of the intention to grow their businesses in entrepreneurs. Hsu et al. (2017) found that the entrepreneur's capability and motivation have a positive effect on the processes of starting a business, decision-making for growth, and realizing growth in the entrepreneurial cycle. Based on the studies conducted, the third hypothesis (H3) of the research was developed:

H3: Political skill has a significant positive effect on entrepreneurial growth intention.

H3a: Political skill sub-dimensions have a significant positive effect on entrepreneurial growth intention sub-dimensions.

1.3. Entrepreneurial Growth Intention

Growing an enterprise is as challenging as starting one. Entrepreneurs should engage in activities related to the growth and development of the enterprise after their initial establishment. In a study conducted by Okumuş and Bakan in 2023 on entrepreneurs registered in the Kahramanmaraş Chamber of Tradesmen and Craftsmen, it was found that 27% of entrepreneurs did not wish to expand their businesses (Okumuş and Bakan, 2023). Dutta and Thornhill (2014) stated that an entrepreneur cannot go directly to the growth stage after the start-up stage and that this process does not proceed in a linear plane. As a result of the research mentioned above, it has been observed that not all entrepreneurs have the intention to grow their business after the start-up phase. In addition, it has been found as a result of studies that growth intention occurs before actual growth and that this intention should be present in entrepreneurs (Puente et al., 2017; Neneh & Vanzyl, 2014).

Entrepreneurial growth intention is defined as an entrepreneur's willingness to increase and expand business potential in the face of opportunities (Douglas, 2013: 636). Growth intention is an individual decision based on the entrepreneur's perceived opportunities, skills, and the entrepreneur's willingness to do expand. Therefore, growth intention combines what is desirable and what is possible given the available opportunities (Terjesen and Szerb, 2008).

Knowing the factors affecting entrepreneurs' growth intentions assists in understanding how growth is achieved (Dutta and Thornhill, 2014). In the literature review, it has been observed that the identity of the entrepreneur has a positive effect on the growth intention of the business (Dhakal et al., 2022; Vallerand et al. 2003). It has been observed that entrepreneurs with high ambition for success and innovation drive intend to grow their enterprises more than their competitors. Levie and Autio (2013) found that entrepreneurs' experiences of personal and financial failure in the entrepreneurial process triggered higher growth expectations in subsequent enterprises. Moreover, it was found that the perception of self-efficacy that they felt about their ability to successfully fulfill a certain task had a positive effect on their growth intentions. In essence, the entrepreneur's level of self-efficacy and achievement needs positively affect the entrepreneur's intention to grow the enterprise. Research has shown that for employees' entrepreneurial passion to lead to growth intention, there must be a driving force or mediating variable. Dhakal et al. (2022) in a study of 99 women entrepreneurs found that entrepreneurial passion has no direct effect on entrepreneurial growth intention; entrepreneurial leader identity does not have a positive effect on growth intention and passion.

In their study on 195 entrepreneurs operating in different sectors in Vietnam, Luu and Nguyen (2021) revealed that entrepreneurial passion is positively related to the concepts of vision and innovation, thus contributing to the growth intention of the enterprise through these variables. Riar et al. (2023) concluded that entrepreneurial alertness plays a partial mediating role in the effect of entrepreneurial passion on entrepreneurial growth intention.

In the context of this information, the fourth hypothesis of the study (H4) has been developed, and no research has been encountered in which the mediating role of political skill in the effect of entrepreneurial passion on entrepreneurial growth intention has been tested.

H4: Political skill mediates the relationship between entrepreneurial passion and entrepreneurial growth intention.

H4a: In the relationship between the sub-dimensions of entrepreneurial passion and the sub-dimensions of entrepreneurial growth intention, the sub-dimensions of political skill have a mediating relationship.

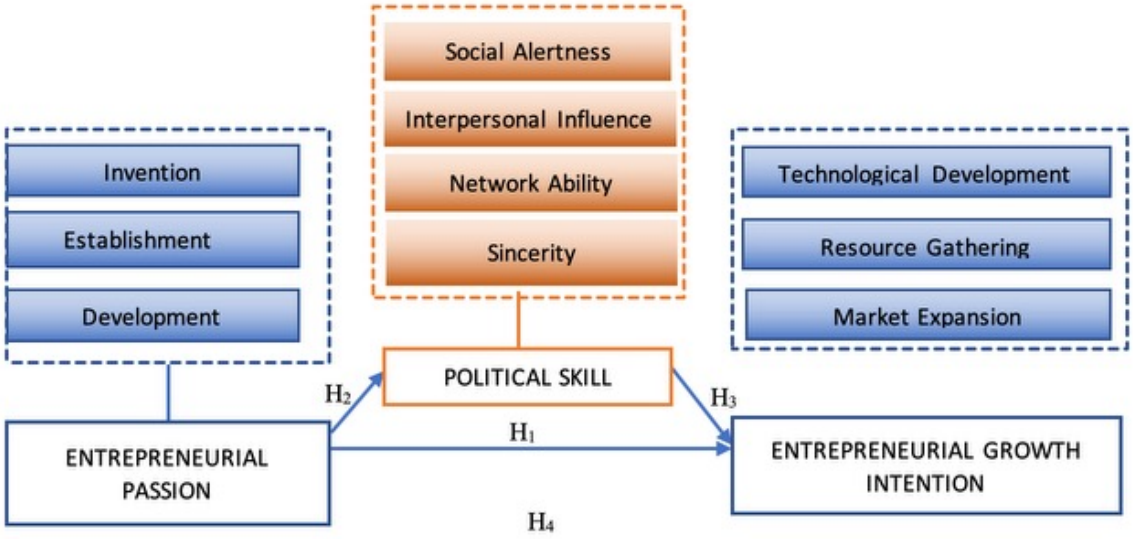

Figure 1. Research Model

The research model determined in line with the hypotheses developed is presented in Figure 1.

2. Research Methodology

2.1. Purpose of the Research and Sampling

The purpose of the study is to elucidate the mediating role of political skill in the influence of entrepreneurial passion on entrepreneurial growth intention. Given the challenges entrepreneurs face when starting and growing new enterprises, political skill plays a critical role in mobilizing and motivating entrepreneurial growth intention.

The sample of the research consists of entrepreneurs affiliated with the Erzurum Chamber of Commerce and Industry. In order to obtain a diverse and balanced sample, participants were selected by random and convenient sampling. Erzurum Chamber of Commerce and Industry has 5340 members in line with the information obtained from the managers in the registry unit. 2050 of these members have received entrepreneurship support from KOSGEB. Within the scope of the research, 407 questionnaires were distributed to 407 entrepreneurs, and a total of 403 questionnaires were evaluated after removing extreme values and missing questionnaires.

2.2. Scales and Statistical Techniques Used in Data Analysis

In the research, a 5-point Likert-type questionnaire technique was applied utilizing a convenience sampling method. The questionnaire consists of two parts in total, with the first part gathering demographic information about the respondents, and the second part including questions regarding entrepreneurial passion, political skills, and entrepreneurial growth intention. The data were obtained from the participants through a questionnaire in February 2023. Regarding the research, the necessary ethics committee permission was obtained from Erzurum Technical University Scientific Research and Publication Ethics Committee with meeting number 11 dated 11/17/2022.

The data were analyzed using SPSS 27.0 and AMOS 24 programs, validity and reliability analyses of the scales were performed, and missing data and outliers were removed. In the study, the data were found to be normally distributed and within the reference limits (Tabachnic & Fidell, 2013). Confirmatory Factor Analysis (CFA) and discriminant validity analysis were conducted to examine the item loadings of the scales. In addition, Bartlett's Sphericity values were significant (p<.001), indicating that the correlation relationships between the items were suitable for factor analysis (Gürbüz & Şahin, 2015). Pearson correlation test and structural equation analysis were conducted to determine the effect of the relationship between variables on other variables. In the structural equation analysis, the Maximum Likelihood method (α=0.05) was used to estimate the model parameters, and simulation with the bootstrapping method (at least 2000 resampling for 95% G.A.) was used for the significance of the existing effects.

Entrepreneurial Passion; This scale developed by Cardon et al. (2013) consists of 3 dimensions and 13 items. In the analysis, CFA was statistically significant as the factor loadings (>0,50; p<0,05) and Chi-Square values (x2/df; 2,46) of all items were acceptable. The modification process was applied to improve the model fit values. The scale was found to have good fit values (GFI: ,923; CFI: ,963; SRMR: ,0743; RMSEA: ,0761), similar to those in the literature.

Entrepreneurial Growth Intention; This scale developed by Kozan et al. (2006) used a 3-dimensional entrepreneurial growth intention scale including technological developments (6 items), resource gathering (5 items), and market expansion (4 items) dimensions. In the analysis, CFA was statistically significant as the factor loadings (>0,50; p<0,05) and Chi-Square values (x2/df; 2,48) of all items were acceptable. The modification process was applied to improve the model fit values. The scale was found to have 3-dimensional and good fit values (GFI: ,911; CFI: ,960; SRMR; ,0773; RMSEA; ,0721) similar to those in the literature.

Political Skill; The scale developed by Ferris et al. (2005) consists of 4 dimensions and 18 items. In the analysis, CFA was statistically significant as the factor loadings (>0,50; p<0,05) and Chi-Square values (x2/df: 2,56) of all items were acceptable. The modification process was applied to improve the model fit values. The scale was found to have 4 dimensions and good fit values (GFI: ,909; CFI: ,961; SRMR: ,0641; RMSEA: ,0692) similar to those in the literature.

3. Research Findings

When the sample of the research is analyzed demographically, 64% of the participants are male, 70% are married, 41% are bachelor's degree graduates, 20% are associate degree graduates, 33,7% are 41-50 years old, and 27% are 51-60 years old. The majority of the participants are male individuals over the age of 40 with a bachelor's degree. When we look at the years of company activity, it is seen that 40,7% of them have been in business for more than 15 years and 3% for less than 1 year. 90% of the participants stated that they intend to expand their companies.

Validity and reliability, combined reliability, Average Variance Explained (AVE), and Combined Reliability (CR) values were also calculated in the research.

Table 1. Mean, Correlation, Reliability, and Discriminant Validity Values of Variables

Variables	M	S.D.	1	2	3	4	5	6	7	8	9	10
1. Invention	4,05	,93	**(,879)**									
2. Establishment	4,17	,96	,665**	**(,894)**								
3. Development	4,07	,89	,691**	,677**	**(,886)**							
4. Technological Development	3,83	,76	,095	,022	,076	**(,707)**						
5. Resource Gathering	3,77	,92	,082	-,012	,037	,677**	**(,754)**					
6. Market Expansion	3,98	,85	,059	-,010	,021	,689**	,600**	**(,860)**				
7. Network Ability	3,82	,95	,600**	,730**	,733**	,114*	,106*	,052	**(,817)**			
8. Sincerity	4,25	,92	,689**	,639**	-,603**	-,059	-,121*	-,049	,727**	**(,908)**		
9. Social Alertness	3,98	,89	-,604**	,630**	-,653**	,105*	,118*	,078	,726**	,766**	**(,679)**	
10. Interpersonal Influence	4,06	,92	-,609**	,641**	,670**	,056	-,010	,026	,775**	,649**	,651**	**(,864)**
Reliability Coefficient (Cronbach α)			***,911***	***,879***	***,876***	***,809***	***,811***	***,909***	***,869***	***,831***	***,855***	***,812***
Combined Reliability (CR)			***,931***	***,953***	***,936***	***,835***	***,868***	***,919***	***,923***	***,934***	***,913***	***,922***
Average Variance Explained (AVE)			***,774***	***,801***	***,785***	***,501***	***,569***	***,740***	***,669***	***,825***	***,679***	***,747***

****p<0,001 **p<0,01 *p<0,05.*

Note: The values shown in parentheses are square root values of the AVE calculated for the scale.

The analysis revealed the mean entrepreneurial passion (mean= 4,09), the mean entrepreneurial growth intention (mean= 3,86), and the mean political skill level (mean= 4,03). Entrepreneurs were found to have high levels of political skill, passion, and growth intention; however, the reliability values (α) of all scales were found to be of high reliability (>0,7).

According to Table 1, there is a significant and positive relationship between the inventing sub-dimension of entrepreneurial passion and the networking ability (r=,600**) and sincerity (r=,689**) sub-dimensions of political skill, and a negative relationship between the social alertness (r= -,604**) and interpersonal influence (r= -,609**) sub-dimensions. There is a positive relationship between the Establishment sub-dimension and the network ability (r=,730**), sincerity (r=,639**), social alertness (r= ,630**), and interpersonal influence (r= ,641**) sub-dimensions. There is a negative relationship between the development sub-dimension and sincerity (r= -,603**), social alertness (r= -,653**), and positive relationship between the development sub-dimension and interpersonal influence (r= ,670**), the network ability (r= ,733**) sub-dimensions. There is a positive relationship between the technological development sub-dimension of entrepreneurial growth intention and network ability (r=,114*), and social alertness (r= ,105*) sub-dimensions. There is a positive relationship between the resource gathering sub-dimension of entrepreneurial growth intention and the networking ability (r=,106*) and social alertness (r= ,118*) sub-dimensions, and a negative relationship with the sincerity dimension (r= -,121*).

Since the AVE and CR values of the variables are higher than the correlation value, convergence and divergence validities are ensured. Since the variables were within the normal distribution limits, regression analysis was performed using the Maximum likelihood method for model parameter estimation in structural equation analysis.

As a result of the analysis, since x2: 2473.11 and x2/df (2.623) were obtained, it was seen that the mediating role of political skill in the effect of entrepreneurial passion on entrepreneurial growth intention was significant (p<0.05). Hypothesis H4 was supported. The fit values of the model are within acceptable limits (GFI: ,927; CFI: ,964; SRMR: ,0702; RMSEA: ,0755). In the research model in which the mediating role of political skill (PS) in the effect of entrepreneurial passion (EP) on entrepreneurial growth intention (EGI) is valid, the mediating effects of sub-dimensions were also examined. Hypothesis H4a was supported.

The effect of the variable of inventing, one of the sub-dimensions of EP on the variables of network ability (β=1,124; p<0,05), sincerity (β=,222; p<0,05), interpersonal influence (β=,262; p<0,05), one of the sub-dimensions of PS was found to be positive and significant. In addition, the effect of the variable of inventing on the variables of technological development (β=,493; p<0,05) and resource gathering (β=,216; p<0,05), which are the sub-dimensions of EGI was determined to be positive and significant.

The effect of the establishing variable, one of the sub-dimensions of EP, on the network ability (β= ,682; p<0,05), intimacy (β= ,900; p<0,05), social alertness (β=,988; p<0,05), and interpersonal influence (β= ,952; p<0.05) variables of PS was found positive and significant. Additionally, the effect of the variable of establishment on the variables of technological development (β=,726; p<0,05), resource gathering (β=1,142; p<0,05), market expansion (β=,845; p<0,05), which are sub-dimensions of EGI was detected to be positive and significant.

The effect of the development variable, one of the sub-dimensions of EP, on the network ability (β=,758; p<0,05) and interpersonal influence (β=,221; p<0,05) variables, one of the sub-dimensions of PS, was found to be positive and significant. In addition, the effect of market expansion (β=,680; p<0,05), one of the sub-dimensions of EGI, was again found to be positive and significant.

According to the findings, hypothesis H1 was supported. The effect of entrepreneurial passion sub-dimensions on entrepreneurial growth intention sub-dimensions was examined and significant (p<0.05) effects were indicated. Within the scope of hypothesis H1a, 6 effects out of 9 direct effects tested were found to be significant and, in this respect, the hypothesis was largely supported. According to the research results, hypothesis H2 was supported. The effect of entrepreneurial passion sub-dimensions on political skill sub-dimensions was examined and significant (p<0.05) effects were indicated. Within the scope of hypothesis H2a, 9 effects were found to be significant out of 12 direct effects tested and, in this respect, the hypothesis was largely supported.

The effect of the network ability variable, one of the sub-dimensions of PS, on the technological development (β=,364; p<0,05) and resource gathering (β=,294; p<0,05) variables of EGI was found positive and significant. The effect of the sincerity variable, one of the sub-dimensions of PS, on the technological development variable (β=,372; p<0,05) and the resource gathering variable (β=,586; p<0,05) was determined to be positive and significant. The effect of social alertness, one of the sub-dimensions of PS, on technological development (β=1,859; p<0,05), resource gathering (β=1,361; p<0,05), market expansion (β=1,192; p<0,05) variables were found both positive and significant.

Accordingly, hypothesis H3 was supported. The effects of political skill sub-dimensions on entrepreneurship growth intention sub-dimensions were examined and significant (p<0,05) effects were indicated. Within the scope of hypothesis H3a, 7 effects were found to be significant out of 12 direct effects tested and, in this respect, the hypothesis was largely supported.

Bootsrap method (n=5000) was used to test the mediating roles of the sub-dimensions of PS in the effect of EP on the sub-dimensions of EGI. Of the 36 mediation hypotheses tested within the scope of the H4a hypothesis, 17 mediation hypotheses were found to be significant (p<0,05 and in this respect, the hypothesis was largely supported.

Table 2. Significance Test of Mediator Hypotheses in the Model

	Coefficient	Min	Max	P	Hypothesis
IE → NA → TD	**,325**	**0,026**	**,733**	**,014***	**Accepted**
IE → NA → RG	**,284**	**,099**	**,537**	**,025***	**Accepted**
IE → NA → ME	,051	-,095	,800	,570	Rejected
IE → SI → TD	**,091**	**,0013**	**,363**	**,045***	**Accepted**
IE → SI → RG	**,240**	**,019**	**,389**	**,049***	**Accepted**
IE → SI → ME	,0911	,004	,245	,127	Rejected
IE → SA → TD	- ,156	-1,507	,178	,617	Rejected
IE → SA → RG	-,181	-2,064	,195	,567	Rejected
IE → SA → ME	-,190	-1,719	,221	,613	Rejected
IE → II → TD	,052	,019	,177	,433	Rejected
IE → II → RG	,018	,009	,0301	,779	Rejected
IE → II → ME	**,101**	**,045**	**,207**	**,046***	**Accepted**
ES → NA → TD	**,220**	**,165**	**,392**	**,012***	**Accepted**
ES → NA → RG	**,192**	**,062**	**,972**	**,039***	**Accepted**
ES → NA → ME	,035	-,070	,287	,585	Rejected
ES → SI → TD	**,296**	**,007**	**,517**	**,038***	**Accepted**
ES → SI → RG	**,506**	**,306**	**,772**	**,024***	**Accepted**
ES → SI → ME	**,192**	**,084**	**,371**	**,041***	**Accepted**
ES → SA → TD	**1,619**	**,648**	**2,171**	**,001****	**Accepted**
ES → SA → RG	**1,686**	**,740**	**2,697**	**,005***	**Accepted**
ES → SA → ME	**1,197**	**,815**	**2,428**	**,004***	**Accepted**
ES → II → TD	**,212**	**,445**	**,843**	**,021***	**Accepted**
ES → II → RG	,074	0,06	,540	,928	Rejected
ES → II → ME	**,393**	**,665**	**,913**	**,018***	**Accepted**
DV → NA → TD	**,279**	**,268**	**1,808**	**,018***	**Accepted**
DV → NA → RG	**,244**	**,105**	**1,870**	**,018***	**Accepted**
DV → NA → ME	,044	,011	,541	,473	Rejected
DV → SI → TD	-,043	-,375	,055	,355	Rejected
DV → SI→ RG	-,074	-,495	,107	,415	Rejected
DV → SI → ME	-,028	-,363	,044	,399	Rejected
DV → SA → TD	-,567	-2,209	1,357	,413	Re
DV → SA → RG	-,658	-2,446	1,535	,399	Rejected
DV → SA → ME	-,690	-1,236	1,530	,382	Rejected
DV → II → TD	,056	-,068	5,322	,366	Rejected
DV → II → RG	-,020	-,742	,183	,597	Rejected
DV → II → ME	,104	-,040	5,493	,216	Rejected

***p<0,001 **p<0,01 *p<0,05.
IE: Invention, ES: Establishment, DV: Development, SA: Social Alertness, II: Interpersonal Influence, NA: Network Ability, SI: Sincerity, TD: Technological Development, RG: Resource Gathering, ME: Market Expansion

Holmbeck (1997) defined the non-significance of the relationship between the dependent and independent variables in the model where the direct path is added to the analysis as "full mediation". However, if the relationship between the variables is significant, but there is a decrease in the amount of the standardized value for this path, then "partial mediation" is the case.

According to Table 2, the indirect effect of IE on TD through the NA variable (β=,325; p<0,05) was found to be positive and significant. Accordingly, there is a positive partial mediation effect of network ability on the effect of the invention variable on technological development. The indirect effect of IE on RG through the NA variable (β=,284; p<0,05) was found to be positive and significant. The statistical significance of the indirect effects was tested with bootstrap analyses performed at a 95% confidence level. It was observed that the relationship in question was significant since the lower (LL) and upper (UL) limits of the bootstrap confidence intervals obtained in the path models did not include the zero value.

Accordingly, there is a positive full mediation effect of network ability on the effect of invention variables on resource gathering. The indirect effect of IE on TD through the SI variable (β=,091; p<0,05) was found to be positive and significant. Accordingly, there is a positive full mediation effect of the sincerity variable on the effect of the invention variable on the technological development variable. The indirect effect of IE on RG through the SI variable (β=,240; p<0,05) was found to be positive and significant. Accordingly, there is a positive full mediation effect of the sincerity variable on the effect of the invention variable on the resource gathering variable. The indirect effect of IE on ME through the II variable (β=,101; p<0,05) was found to be positive and significant. Accordingly, there is a positive full mediation effect of the interpersonal influence variable on the effect of the invention variable on the market expansion variable.

The indirect effect of ES on TD through the NA variable (β=,220; p<0,05) was found to be positive and significant. Accordingly, there is a positive partial mediation effect of the network ability variable on the effect of the establishment variable on the resource gathering variable. The indirect effect of ES on RG through the NA variable (β=,192; p<0,05) was found to be positive and significant. Accordingly, there is a positive partial mediation effect of the sincerity variable on the effect of the establishment variable on the technological development variable. The indirect effect of ES on TD through the SI variable (β=,296; p<0,05) was found to be positive and significant. Accordingly, there is a positive partial mediation effect of the sincerity variable on the effect of the establishment variable on the technological development variable.

The indirect effect of ES on RG through the SI variable (β=,506; p<0,05) was found to be positive and significant. Accordingly, there is a positive partial mediation effect of the sincerity variable on the effect of the establishment variable on the resource gathering variable. The indirect effect of ES on ME through the SI variable (β=,192; p<0,05) was determined to be positive and significant. Accordingly, there is a positive partial mediation effect of the sincerity variable on the effect of the establishment variable on the market expansion variable. The indirect effect of ES on TD through the SA variable (β= 1,619; p<0,05) was detected to be positive and significant. Based on this, it is determined that the social alertness variable has a positive partial mediation effect on the effect of the establishment variable on the technological development variable.

The indirect effect of ES on RG through the SA variable (β= 1,686; p<0,05) was found to be positive and significant. Accordingly, the social alertness variable is a positive partial mediator in the effect of the establishment variable on the resource gathering variable. The indirect effect of ES on ME through the SA variable (β=1,197; p<0,05) was found to be positive and significant. In this respect, there is a positive partial mediation effect of the market expansion variable on the effect of the establishment variable on the social alertness variable. The indirect effect of ES on TD through the II variable (β=,212; p<0,05) was also found to be positive and significant. This indicates that there is a positive partial mediation effect of the technological development variable on the effect of the establishment variable on the interpersonal influence variable. The indirect effect of ES on ME through the II variable (β=,393; p<0,05) was found to be positive and significant. In this regard, there is a positive partial mediation effect of the market expansion variable on the effect of the establishment variable on the interpersonal influence variable.

The indirect effect of DV on TD through the NA variable (β=,279; p<0,05) was detected to be positive and significant. In this respect, the network ability variable has a positive full mediation effect on the effect of the development variable on the technological development variable. The indirect effect of DV on RG through the NA variable (β=,244; p<0,05) was detected to be positive and significant. Accordingly, there is a positive full mediation effect of the network ability variable on the effect of the development variable on the resource gathering variable.

3. Results and Discussion

It is evident that the number of entrepreneurial enterprises in a country is critical to the development of its economy. It is not enough to only establish enterprises, but to also grow and develop these enterprises in a sustainable manner. Ostgaard and Birley (1996) argue that entrepreneurship should not only be limited to the start-up phase but the growth and development processes of enterprises should also be emphasized at the completion of the entrepreneurial cycle. Therefore, the factors affecting the growth processes of entrepreneurial enterprises need to be comprehensively known.

The individual characteristics (such as self-confidence, honesty, commercial ethics, risk-taking, innovative, creative, and social skills) that enable the formation and growth of entrepreneurial activities have been investigated by many researchers (Bozkurt et al., 2012). It has been observed that there is a limited number of studies examining the impact of political skill, which is an individual skill that can be learned later on entrepreneurs' growth intentions. Entrepreneurs with strong and effective social networks gain access to potential customers, partners, and investors and gain valuable knowledge and experience by interacting with them. Political skill is a capability that has the potential to offer entrepreneurs these advantages. Therefore, entrepreneurs' political skill plays a supportive role in operationalizing their growth intentions.

It is important to transform the motivational energy in entrepreneurs into passion. Entrepreneurial passion stands out as a key dynamic in entrepreneurs' growth decision-making (Murnieks et al., 2018). Stepherd and Patzelt (2018, 204-206) define entrepreneurial passion as entrepreneurs constantly thinking about new business opportunities and business issues, even in their free time, even while spending time with their family and friends. However, in order for this passion to translate into growth intentions, it is important to have individual strategic competencies such as political skills. Ultimately, the intention to grow the business is an individual decision and is directly influenced by the skills and abilities of the entrepreneur (Cortes and Herrmann, 2021). Politically skilled individuals are flexible and adaptive in dealing with environmental uncertainties and use their ability to influence others effectively (Ferris et al., 2005). Therefore, entrepreneurs will need good networking and interpersonal skills to deal with uncertainties in the external world in order to realize their growth intentions.

In this research, it is hypothesized that entrepreneurs' political skills and passion have a positive effect on the formation of growth intention. In the literature review, it has been observed that most of the studies on the growth intention of the enterprise are on the examination of the relationship between company characteristics and growth. There is no study investigating the relationship between the variables in the research model, and it is clear that the results obtained will make a significant contribution to the literature. In line with the findings obtained in the research, a perspective model is presented for entrepreneurs and future researchers to grow their businesses. This situation adds authenticity to the research.

As a result of the research analysis, the first hypothesis of the study, that entrepreneurial passion has a significant positive effect on entrepreneurial growth intention (EGI), was supported. The result obtained is consistent with previous studies (Dhakal et al., 2022; Anjum et al., 2021; Akinboye, 2020; Biraglia & Kadile, 2017; Drnovsek et al., 2016; Baum & Locke, 2004). Moreover, among the sub-dimensions of entrepreneurial passion, the effect of the invention variable on the technological development and resource gathering variables and the effect of the development variable on the market expansion variable was found to be positive and significant. Lastly, the effect of the establishment sub-dimension on the variables of technological development, resource gathering, and market expansion, which are among the sub-dimensions of GBN, was found to be positive and significant.

Entrepreneurial passion acts as a factor that encourages and supports entrepreneurs to overcome obstacles to business growth.

The challenging goals that entrepreneurs set for themselves to deal with environmental uncertainties may be a source of motivation in the short term, but they do not lead to growth. Therefore, entrepreneurial passion is considered to be important for business growth.

The second hypothesis of the study, that entrepreneurial passion has a significant positive effect on political skill, was supported. The result obtained is consistent with previous studies (Heupel et al., 2024; Vallerand, 2015; Murnieks et al., 2014). The effect of invention and establishment, which are the sub-dimensions of entrepreneurial passion, on the variables of network ability, sincerity, and interpersonal influence, which are the sub-dimensions of political skill, was found to be positive and significant. In addition, the effect of development sub-dimensions on the variables of networking ability and interpersonal influence, which are sub-dimensions of political skill, was determined to be positive and significant.

Political skill refers to the ability to positively influence the behavior of others for one's own benefit. Moreover, individuals passionate about entrepreneurship can aim to acquire political skills, which include skills such as mitigating the negative effects of interpersonal conflicts on business, fostering a positive image and network, demonstrating sincerity, and establishing good relations with stakeholders.

The third hypothesis of the study, that political skill has a significant positive effect on entrepreneurial growth intention, was supported. The result obtained is consistent with previous studies (Davidsson, 1991; Hsu et al., 2017). The effect of network ability and sincerity variables, which are sub-dimensions of political skill, on technological development and resource gathering variables, which are sub-dimensions of GBN, was found to be positive and significant. The effect of the social alertness variable on technological development, resource gathering, and market expansion variables was detected to be positive and significant.

It is known that individuals with political skills have an advantage in finding financing and support as a result of promoting themselves effectively in their social circles, and they also contribute to the growth of businesses by bringing together competent investors within the business. In addition, individuals with political skills not only take strategic steps in the growth process such as procurement of equipment and resources, market expansion, and creating a new brand or image, but also create a strong network that can eliminate all negativities and obstacles. In this process, these entrepreneurs will appear sincere and genuine, providing a competitive advantage in the growth of their businesses.

The fourth and final hypothesis of the study, that political skill mediates the relationship between entrepreneurial passion and entrepreneurial growth intention, was supported. The 17 mediation hypotheses between the sub-dimensions of the variables supported within the scope of the research are given in Table 2. In the literature review, it was observed that there was no study in this direction that included all of the variables. Passion in entrepreneurs was found to have a positive effect on effective negotiation with stakeholders and individuals who contribute to entrepreneurial business growth. It is known that politically skilled entrepreneurs do not have difficulties in obtaining financial support and funding by effectively introducing themselves to their social environment, and also make a significant contribution to growth by incorporating qualified investors into the business. It is evident that political skill is a positive factor in triggering entrepreneurial passion to trigger the growth of entrepreneurial business.

It is obvious that entrepreneurs' growth intentions will gain positive momentum if they are strengthened with political skills. The research offers many contributions to managers, entrepreneurs, government, and private organizations with its recommendations and the gaps it fills in the literature.

At this point, research makes an important contribution in terms of shaping the future, achieving higher enterprise performance, and providing guidance to both government agencies and researchers. Some recommendations are offered to development agencies, public institutions, organizations, investors, and organizational managers:

- The study underlines that political skill plays an important role in the emergence of entrepreneurship and that this skill should be provided to entrepreneurs. Organizations such as KOSGEB, MUSIAD, KUDAKA, DAP, chambers of commerce, and industry can look at whether entrepreneurs have political skills when providing them with investments. These organizations can create an appropriate platform to offer political skills training for entrepreneurs. Thus, entrepreneurs can be provided with the necessary competencies to support their growth intentions and improve their enterprise performance.
- While angel investors and venture capitalists provide financial investments to entrepreneurs, they can assess whether they have political skills. It is recommended to measure entrepreneurs' growth intentions and political skills in order to make more informed investment decisions. This recommendation will enable angel investors and VCs to make more informed and strategic investments.
- Within the framework of entrepreneurship programs carried out by research and incubation centers established within universities, it is recommended to develop the political skills of entrepreneurs and to establish training programs in this direction. In particular, political skills and entrepreneurial passion can be among the important topics that can be addressed in entrepreneurship courses at universities. In remote education centers at universities, training on topics that include research variables for entrepreneurs can be created.
- Moreover, remote learning and online courses can be considered effective tools for entrepreneurs to strengthen their political skills. These methods would provide entrepreneurs with a flexible learning process, allowing them to acquire the necessary skills without the limitations of time and space. Such training can assist entrepreneurs in navigating the hurdles encountered in the business world more effectively. The research results demonstrate that entrepreneurs should pay attention to these variables. Entrepreneurs should realize that they need to give importance to these variables in order to be more effective in the business world and to cope with the challenges they face more successfully.
- In the literature study conducted within the scope of the research, it was observed that women entrepreneurs deliberately choose slow growth in their businesses (Catalyst, 2019; Güler & Gaipova, 2023). The finding that women suppress their intention to grow their businesses in order to balance their desire to grow their businesses with their private lives has been observed in studies conducted in the literature. Gaining political skills, especially for women employees, will enable them to manage their work faster and use their time and energy more efficiently. While this situation will increase productivity for businesses at the micro level, at the macro level, it will have positive consequences for the country's economy and welfare.
- One of the important factors affecting entrepreneurship is advisory and support services. In this regard, awards and financial support can be provided by governments or various organizations to help entrepreneurs overcome the challenges they face and grow their businesses successfully. Such programs can contribute to the entrepreneurship ecosystem by increasing the economic independence of entrepreneurs.
- Furthermore, mentoring programs can also be an important support mechanism in this process. Mentoring by experienced entrepreneurs or business professionals can help entrepreneurs build and develop passion, political skills, and the will to grow their business.

Research Limitations and Suggestions for Future Researchers

- The fact that the study was limited to a specific region limits the general validity of the results obtained. Therefore, future researchers are advised to conduct similar studies in different provinces and various geographical regions.
- Maximizing enterprise growth is the main goal of every entrepreneur. Although political skill has a significant impact on entrepreneurs' development, it alone may not be sufficient to achieve this goal. Accordingly, it is suggested to examine the impact of other positive skills from the literature on entrepreneurs' growth intentions. Such examinations will contribute to determining the skill sets that entrepreneurs should possess.
- Qualitative methods can reveal in more detail how entrepreneurs develop their political skills and the impact of these skills on entrepreneurs' growth intentions. Future researchers are advised to conduct qualitative research.
- Due to the time constraints of the researcher, the effects of demographic variables could not be fully analyzed. Accordingly, it is suggested that future research should measure the effects of demographic factors such as age, gender, and education level in the research model. In addition, it is also recommended to examine company information such as year of operation, number of employees, sector of operation, etc. Such examinations will contribute to a better understanding of the relationships between variables.
- Many factors such as entrepreneurs' values, attitudes, motivational characteristics, the influence of the leader in the organization, and leadership styles are important variables that affect the growth of entrepreneurial businesses, passion, and political skill. Studies addressing the role of these factors in entrepreneurial growth are also recommended.
- Cross-sectional method was used in this study. Future researchers are recommended to conduct different studies with the research variables using the longitudinal method.

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GREEN PRODUCTION AND ECOLOGICAL FOOTPRINT: EVALUATION OF SUSTAINABILITY PERFORMANCE WITH MULTI-CRITERIA DECISION-MAKING METHODS

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Abstract
Purpose: This study seeks to provide a comprehensive assessment of national sustainability performance by integrating green production strategies into the broader discourse of production management. In response to the growing ecological crisis, it addresses a notable gap in the literature concerning the use of advanced multi-criteria decision-making (MCDM) methods to evaluate the interplay between ecological footprint, biocapacity, and ecological deficit.
Methodology: A hybrid methodological framework is employed, combining the TOPSIS technique with time-series analysis, regional and income-based stratifications, and K-Means clustering. This integrative approach allows for a multi-dimensional, data-driven evaluation of sustainability performance across diverse economic contexts, facilitating both temporal and spatial comparisons among countries.
Findings: The empirical findings underscore that high-income nations tend to exhibit disproportionately large ecological footprints and deficits, whereas lower-income countries, despite lower consumption levels, suffer from significant biocapacity constraints. Moreover, a strong positive correlation is observed between GDP growth and ecological degradation, particularly in industrialized economies. Nonetheless, several countries have demonstrated the capacity to decouple economic expansion from environmental deterioration through the implementation of robust green policies.
Originality: This research makes a novel contribution by operationalizing an interdisciplinary analytical framework that bridges production management and environmental sustainability. By synthesizing MCDM techniques with unsupervised learning algorithms, it offers new insights into the role of green production strategies in mitigating ecological disparities, ultimately emphasizing the urgency of aligning economic development with planetary boundaries.

Keywords: Sustainability, Ecological Footprint, Biocapacity, Multi-Criteria Decision Making, Global Sustainability, Green Production, Production Management

JEL Codes: Q01, Q56, M11, C44, L23

Yeşil Üretim ve Ekolojik Ayak İzi: Çok Kriterli Karar Verme Yöntemleriyle Sürdürülebilirlik Performansının Değerlendirilmesi

Özet
Amaç: Bu çalışma, yeşil üretim stratejilerini üretim yönetimi perspektifiyle ilişkilendirerek ülkelerin sürdürülebilirlik performanslarını çok boyutlu bir yaklaşımla değerlendirmeyi amaçlamaktadır. Ekolojik ayak izi, biyokapasite ve ekolojik açık gibi temel çevresel göstergelere dayalı olarak yapılan değerlendirme ile, mevcut literatürdeki çok kriterli karar verme yöntemleriyle yapılan kapsamlı analizlerin eksikliğine çözüm sunulması hedeflenmektedir.
Yöntem: Çalışmada hibrit bir metodolojik çerçeve benimsenmiş ve TOPSIS yöntemi, zaman serisi analizi, bölgesel ve gelir düzeyine dayalı karşılaştırmalar ile K-Means kümeleme analizi birlikte uygulanmıştır. Bu çok katmanlı analiz modeli, ülkelerin sürdürülebilirlik performanslarının mekânsal ve zamansal açıdan kapsamlı bir şekilde karşılaştırılmasına olanak sağlamaktadır.
Bulgular: Elde edilen bulgular, yüksek gelirli ülkelerin genellikle daha yüksek ekolojik ayak izi ve ekolojik açık değerlerine sahip olduğunu, düşük gelirli ülkelerin ise daha sınırlı ayak izine rağmen ciddi biyokapasite kısıtları yaşadığını ortaya koymaktadır. Ayrıca, GSYİH büyümesi ile ekolojik açık arasındaki anlamlı pozitif ilişki, sanayileşmiş ülkelerin çevresel baskıyı artırma eğilimini teyit etmektedir. Bununla birlikte, bazı ülkeler etkin çevre politikaları ve sürdürülebilirlik stratejileriyle bu olumsuz etkileri başarıyla sınırlandırmıştır.
Özgünlük: Bu çalışma, üretim yönetimi ve çevresel sürdürülebilirlik alanlarını disiplinlerarası bir yöntemle bir araya getirerek literatüre özgün bir katkı sunmaktadır. Çok kriterli karar verme tekniklerinin denetimsiz öğrenme algoritmalarıyla entegrasyonu sayesinde, yeşil üretim stratejilerinin ekolojik eşitsizliklerin azaltılmasındaki işlevselliği ve politika yapım sürecindeki rolü yeni bir bakış açısıyla ortaya konmuştur. Bu çerçevede, ekonomik kalkınmanın çevresel sınırlarla uyumlu hale getirilmesi gerekliliği vurgulanmaktadır.
Anahtar Kelimeler: Sürdürülebilirlik, Ekolojik Ayak İzi, Biyokapasite, Çok Kriterli Karar Verme, Küresel Sürdürülebilirlik, Yeşil Üretim, Üretim Yönetimi
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1. Introduction

The sustainability problem is now a significant concern in the context of the global economy and environmental policy (Feng, Shafiei, Ng, Ren, & Jiang, 2024). Industrialization, economic development, and the rise in the population have raised the use of natural resources and carbon dioxide emissions and have turned into a significant ecological imbalance threat (Ozcan, Tzeremes, & Tzeremes, 2020). The manufacturing sector, particularly in industrialized nations, contributes to the imbalance between ecological footprint and biocapacity (Saqib & Shahzad, 2024). In such a context, it is necessary to be aware of the degree to which the environmental performance of nations is in line with global sustainability goals and the degree to which the ecological balance is influenced by economic growth. However, it is revealed in the literature that few studies assess sustainability performance using multi-criteria decision-making methods. Apart from studies focusing on a specific indicator in evaluating the ecological performance of countries, there is a pressing need for multidimensional and holistic analysis.

The current study aims to assess the sustainability performance of countries with the help of key indicators such as ecological footprint, biocapacity, ecological deficit, and global hectares demand. To achieve this, the study categorizes countries with the help of the TOPSIS approach, examines ecological indicator changes with the help of the time-series analysis, examines regional and income-based discrepancies, and classifies countries with similar sustainability traits with the help of K-Means clustering analysis. The studies help to fill the literature and clarify the effectiveness of sustainable development policy. The present work also attempts to investigate cross-country variations in the sustainable development process by analyzing how sustainability policy differs in various nations with varying income levels and geographical compositions. Based on the stated objectives and the gaps identified in the existing literature, this study is guided by three central research questions: (1) How do ecological sustainability indicators such as ecological footprint, biocapacity, and ecological deficit differ among countries with varying income levels and regional characteristics? (2) What patterns and trends emerge in these ecological indicators over the 2019–2022 period, and how do they reflect the global sustainability trajectory? (3) To what extent can multi-criteria decision-making techniques—particularly the entropy-weighted TOPSIS method—and K-Means clustering analysis be utilized to systematically classify countries according to their sustainability performance? Addressing these questions aims to provide a data-driven foundation for evaluating national sustainability efforts and informing future policy directions.

Ecological sustainability policies' success worldwide depends mainly on the capacity to balance natural resource use and economic development. Though some nations' economic growth is linked to sustainable development models, others' environmental pressures are exacerbated by limited resource use (Hariram, Mekha, Suganthan, & Sudhakar, 2023). Thus, an integrated evaluation of ecological and economic indicators is vital for future sustainable development policymaking. The present work will attempt to determine the long-term effects of the sustainability policy in various nations and offer recommendations for creating more integrated decision-support systems.

An overall evaluation of the ecological performance of countries with different income levels and regional characteristics is given in the paper. This emphasizes how economic growth affects ecological deficits, regional disparities, and the clustering of countries with comparable environmental traits. The study highlights the necessity of reevaluating sustainable development plans and offers insightful information about the future course of sustainability policy.

2. LITERATURE REVIEW

Supply chain management and sustainable production have become increasingly important in today's research and business practices. Most production management and sustainability studies have focused on lowering the carbon footprint, reducing the ecological deficit, and improving resource utilization efficiency (Gallego-Álvarez, Segura & Martínez-Ferrero, 2015).

Key Studies and Findings

Numerous strategies for managing logistics and sustainable production have been put forth due to the scholarly literature's analysis. The following primary thematic categories have been used to group these studies:

No	Researcher(s)	Year	Title	Key Findings	Methodology Used
1	Arsu, T. & Ayçin, E.	2021	Evaluation of OECD Countries with Multi-Criteria Decision-Making Methods in terms of Economic, Social and Environmental Aspects	Assessed OECD countries in terms of economic, social, and environmental aspects; highlighted the need for balanced sustainable development.	TOPSIS (MCDM)
2	Wackernagel, M., Monfreda, C., Schulz, N. B., Erb, K.-H., Haberl, H., & Krausmann, F.	2004	Calculating national and global ecological footprint time series: resolving conceptual challenges	Resolved conceptual challenges in national and global ecological footprint time series estimation.	Ecological footprint accounting
3	Galli, A., Iha, K., Pires, S. M., Mancini, M. S., Alves, A., Zokai, G., Lin, D., Murthy, A., & Wackernagel, M.	2020	Assessing the Ecological Footprint and biocapacity of Portuguese cities: Critical results for environmental awareness and local management	Analyzed ecological footprint and biocapacity in Portuguese cities to support local environmental awareness and management.	Econometric and spatial analysis
4	Govindan, K., Sivakumar, R., Sarkis, J., & Murugesan, P.	2015	Multi criteria decision making approaches for green supplier evaluation and selection: a literature review	Reviewed MCDM approaches for green supplier evaluation and identified critical success factors.	Literature review of MCDM methods
5	Gholizadeh, M.H. et al.	2022	Modelling uncertainty in sustainable-green integrated reverse logistics network using metaheuristics optimization	Modeled uncertainty in green reverse logistics networks using advanced optimization methods.	Robust optimization, scenario analysis
6	Gholizadeh, H., Goh, M., Fazlollahtabar, H., & Mamashli, Z.	2020	Biocapacity—Premise of Sustainable Development in the European Space	Examined biocapacity and ecological reserves in Europe, highlighting regional disparities.	Multivariate statistical analysis
7	Shen, Y., & Yue, S.	2020	Does ecological footprint affect biocapacity? Evidence from the experiences of G20 countries	Forecasted ecological footprint trends in G20 countries for the next 30 years using time series models.	Panel data econometrics

8	Espinosa, R. M., & Koh, L. S. C.	2024	Forecasting the ecological footprint of G20 countries in the next 30 years	They have analyzed the effectiveness of decision support systems in sustainability management.	Time-series forecasting models
9	Li, T., Wang, H., & Lin, Y.	2020	Selection of renewable energy development path for sustainable development using a fuzzy MCDM based on cumulative prospect theory: the case of Malaysia	Developed a fuzzy MCDM framework to select renewable energy paths under uncertainty in Malaysia.	Fuzzy MCDM with Cumulative Prospect Theory
10	Wang, H., Pan, C., Wang, Q., & Zhou, P.	2020	Assessing sustainability performance of global supply chains: An input-output modeling approach.	Assessed global supply chain sustainability using multi-region input-output models integrated with MCDM tools.	Multi-region input-output modeling, DEA, AHP

The literature has expressed diverse opinions about the significance of sustainability assessment and green production. Research has shown that environmental sustainability can boost competitiveness and support sustainable development in general (Arsu & Ayçin, 2021; Wang et al., 2020). Particularly in production and supply chain management, researchers have emphasized the significance of comprehensive evaluation methods considering economic, social, and environmental factors (Govindan et al., 2023).

The field makes a clear distinction between theoretical studies and empirical research. While theoretical concepts have assumed center stage in some paradigms, sustainability performance has in recent times been ascertained with the use of actual figures and statistical analysis (Shen Yue, 2023; Galli et al., 2020). For example, Gogonea et al. (2020) undertook integrated regional examination of deficits in biocapacity in Europe and established disparities and the requirement for specific sustainability policies. In sustainability analysis, multi-criteria decision-making (MCDM) methods have been employed with increasing frequency as an approach (Li, Wang, Lin, 2024; Arsu Ayçin, 2021). Two MCDM methods that have demonstrated utility for ranking countries or alternatives on the basis of ecological performance measures are fuzzy MCDM and TOPSIS, akin to this, Wackernagel et al. In 2004 it established the basis for current environmental accounting methods by tackling the conceptual and methodological issues of time series estimation following ecological footprints on an extensive large-scale, national, and global basis.

In addition to Methods such as MCDM (Multiple Criteria Decision Making), ongoing research is exploring the application of time series models, specifically econometric and clustering models, for forecasting sustainability patterns and grouping countries sharing comparable ecological patterns (Espinosa and Koh, 2024). For example, research has been conducted on green logistics models based on uncertainty by Gholizadeh, Goh, Fazlollahtabar, and Mamashli (2022). Galli and co-authors have also researched on this matter in the recent past. In 2020, the research examined biocapacity patterns using econometric and spatial analysis models.

In addition, application of artificial intelligence, big data analytics, and decision support systems for sustainable production management is on the increase. Wang et al. (2020) and Li et al. (2020) presented advanced modeling frameworks for global supply chain decision-making and renewable energy planning.The recent literature demonstrates a move away from conceptual discussion and toward quantitative, comparative, and decision-making-driven research that produces valuable data on sustainability performance on a national and international scale.

2.1. Research Gaps and Contributions in the Literature

An analysis of the literature demonstrates that estimates of carbon footprints are primarily restricted to particular industrial sectors. However, studies integrating decision-support methods such as TOPSIS and time-series analysis for comparing sustainability across income groups and regions remain scarce. While many studies quantify sustainability performance based on a single indicator, there is a growing need for a multifaceted approach based on several interrelated variables. Furthermore, the limited number of studies that examine the relationship between GDP and ecological deficit in detail limits the achievement of a better understanding of the environmental costs of economic growth. In this context, most of the studies in the literature focus on sectoral sustainability policies, while comparative macroeconomic studies are comparatively less explore.

The present study aims to bridge such gaps with the help of a data-based sustainable production and logistics management approach. Toward this end, TOPSIS and the time-series analysis will be utilized to compare the sustainability performance of nations, the regional and income-based gaps, and the ecological deficit-economic growth relationship. The study will further analyze the application of decision support systems and big data analysis in sustainable logistics management and explore the long-run impact of such applications in the sector.

2.2. Recommendations for Future Research

Existing research on sustainable production and logistics management is primarily sectoral or employs a unidisciplinary approach. Future research should use an integrated approach with ecological and carbon footprint and sustainability policy in an interdisciplinary framework. Future research may employ advanced analysis, such as the model-based analysis of the dynamics of environmental footprints concerning time, to identify long-run sustainability trends. In-depth sectoral studies are required to examine the sustainability gaps among different countries and regions in finer detail.

The development of artificial intelligence-based supply chain optimization algorithms and predictive models would advance the successful implementation of sustainability policy. Applying machine learning and big data analytics would assist in the evolution of advanced forecasting mechanisms to reduce carbon footprint. The efforts will help enhance the extent of the science base in sustainable production management and facilitate the development of new methodologies to guide policymakers and industrial practice toward sustainable options.

3. METHODOLOGY

In this study, a data-driven approach has been adopted to evaluate countries' ecological performance within the context of sustainable production and logistics management. The data were obtained following official correspondence with relevant institutions and shared strictly for scientific research. The methodologies used for data calculation are comprehensively detailed in the corresponding reports, and the analyses in this study have been conducted by referencing these established methods.

The primary data used in this study were provided by the Global Footprint Network (GFN). They were derived from datasets containing key indicators measuring carbon footprint, biocapacity, ecological deficit, and environmental sustainability. The dataset includes ecological indicators for various countries from 2019 to 2022. A total of 153 countries were included in the analysis. The selection was based on data availability and completeness across all four main indicators—ecological footprint, biocapacity, carbon footprint, and ecological deficit—within the 2019–2022 period. Countries with incomplete or missing data for any of these indicators were excluded from the analysis to ensure the consistency and comparability of results. Permission to use these data for research purposes was obtained through official correspondence with the Global Footprint Network.

The calculations provided by GFN assess sustainability by comparing ecological footprint and biocapacity. The Ecological Footprint represents the total demand placed by an individual, society, or country on biologically productive land and water areas. In contrast, Biocapacity refers to the natural resources and absorption capacity that nature can provide to meet this demand. All measurements are expressed in global hectares (gha).
The ecological footprint and biocapacity values calculated by GFN have been standardized using Yield Factors and Equivalence Factors to ensure comparability across different land types and regions.

Yield Factors: alculated as a coefficient that compares a country's productivity in a specific land use type with the global average. The formula is as follows:

$$\mathrm{YF}_{NL} = \frac{Y_{NL}}{Y_{WL}}$$

Here, Y_N^L represents the yield for a specific land use type in a given country, while Y_W^L denotes the global average yield.
For areas containing multiple primary products, such as agricultural land, an extended calculation formula is used:

$$\mathrm{YF}_{NL} = \frac{\sum A_W}{\sum A_N}$$

Here, the harvested area for a specific country is represented, while the corresponding area required on a global scale to produce the same amount of output is also considered.

Equivalence Factors: These are calculated to compare the productivity of different land types relative to the global average. These factors are determined using FAOSTAT and the Global Agro-Ecological Zones (GAEZ) model.

These calculation systems allow for the appraisal of economic activities' impact on the natural world. On the basis of methodologies devised by GFN, multi-criteria decision-making methodologies and statistical techniques have been utilized for the comparison of ecological balance between nations.

3.1. Analysis Methods and Justifications

The analysis methodologies employed in this research have been selected to yield the optimum interpretation of the current data and be in line with the related research in the field. In order to compare nations in terms of sustainability, the TOPSIS technique has been utilized as a viable means of multi-criterion decision-making models in sustainability analysis (Zavadskas, Mardani, Turskis, Jusoh, & Nor, 2016). From time-series analysis, it is viable to compare discrepancies in ecological indicators and identify the long-term effects of sustainability policies (Chatfield, 2016). Comparison of regions and income levels helps identify disparities in sustainability among nations as well as the research of environmental impacts of economic drivers. Among the most important ways to determine the influence of economic growth on ecological imbalances is a correlation study between ecological deficit and GDP (York, Rosa, & Dietz, 2004). K-Means clustering analysis helps to group nations with comparable ecological prints and highlight the commonalities in the sustainability strategies (Al Qahtani & Sankar, 2024).

These techniques were chosen because they can offer a thorough comparison, assist in decision-making, and be founded on proven approaches in the literature. The studies clarify the meaning of the data and highlight essential results for formulating sustainability policy. From this angle, the chosen techniques are seen as necessary components enhancing the dependability of the research and decision support systems.

3.2. Software and Calculation Tools Use

Python was used for the analysis. Pandas and NumPy handled data cleaning, processing, and analysis; Scipy and Statsmodels handled statistical analysis. Scikit-learn was used to model the decision support systems. The Matplotlib and Seaborn libraries were used for graphic and data visualization. The MCDM (Multi-Criteria Decision Making) library, which supports multi-criteria decision-making processes, was used to conduct TOPSIS analysis.

The present study's calculation and procedure steps seek to provide a multi-faceted contribution to the literature such that ecological differentiation among countries can be assessed both statistically and within decision support systems.

4. FINDINGS AND ANALYSIS

This part presents and thoroughly interprets the findings of the analyses performed on the acquired data. Before analysis, the datasets were thoroughly cleaned to remove faulty and missing data, qualifying the data for examination. Classified by technique, the results show the variations between nations in ecological footprint, biocapacity, carbon footprint, and sustainability performance.

4.1. Ecological Footprint and Biocapacity Analysis

The studies revealed notable disparities between the nations' ecological footprint and biocapacity values. Certain countries have significant footprints in natural resource use compared to where they can get those resources from, meaning they're up against a crunch where they don't have enough natural capital. It was observed that biocapacity could not meet consumption demands, especially in developed countries. Data analysis was based on calculations provided by the Global Footprint Network. The carbon footprint increased between 2019 and 2022, according to an analysis of changes in ecological footprint and biocapacity over time. This rise stems from the consistent use of fossil fuels plus this big push towards industrialization that's been going on. This finding is consistent with past studies highlighting the strong connection between environmental overshoot and industrial growth (Wackernagel et al., 2004). The lack of effectiveness of certain countries' biocapacity protection policies was also noted. Nevertheless, the biocapacity deficit normally prevails.

This indicates environmental imbalances exist notwithstanding the impact of government policies because of unsustainability in the production and consumption patterns (Moros Ochoa et al., 2022).

4.1.1. TOPSIS Analysis: Comparison of 2019 and 2022 Result

The studies suggest China and India had the best TOPSIS performances in 2019 and the same ranking would prevail until 2022. Differences from 2019 to 2022 were analyzed and each country's environmental performance and sustainable production management were evaluated using the TOPSIS approach. TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is an efficient decision tool for multi-criteria decision problems enabling aggregation of diverse performance indicators into one overall score and its comparison of nations' sustainability performance.

The six chosen key indicators of sustainability in the TOPSIS model in the present research were: ecological footprint and biocapacity on a per capita basis; ecological deficit; renewable energy contribution of consumption; energy intensity (energy/GDP); and overall index of sustainable production. These indicators were selected on the basis of their ability to apply to environmental pressures and consumption of resources and track both the demand and supply sides of sustainability in the environmental context. To attribute each of the criteria their respective weights, Entropy was utilized. Entropy is an objective weighting technique which calculates the spread of each indicator in the dataset and attributes higher weights to more discriminatory variables.The process was to normalize the data and calculate the entropy of each criterion before deriving the weights on the basis of the amount of uncertainty or variation. Utilization of entropy-based weights means the evaluation is not subject to bias and has indicators of higher variation across countries having more impacts on the outcome (Zavadskas & Turskis, 2011). Following weighting, distances to positive and negative ideal solutions were calculated and relative closeness values calculated in order to arrive at the final TOPSIS values for each country.

The study's conclusions show that there have been notable differences in the sustainability performance of some countries. TOPSIS compares the green performance of different places by taking many sustainability yardsticks and averaging them into one overall score. It's like Big Macs averaging all the tasty ingredients into just one tasty average meal. This allowed for identifying countries that have made significant progress in sustainable development. According to the study, China and India had the highest TOPSIS scores in 2019, and by 2022, this ranking had mainly remained stable. However, nations, including the United States, Canada, and Lithuania, were found to have much lower TOPSIS scores. Although an overall rise in ecological footprint and ecological deficit ratios was noted in 2022, certain nations that have carried out sustainability policies more successfully revealed encouraging changes. This lends credence to the idea that national policy initiatives can produce noticeable changes in ecological performance over relatively brief periods (Djordjevic & Krmac, 2019).
Between 2019 and 2022, nations denoted by blue bars in Figure 1 exhibited increases in sustainability performance. These increases are based on changes in the entropy-weighted TOPSIS scores. The use of entropy weighting helped emphasize the most variable and informative indicators in the dataset, which resulted in a fairer evaluation of performance improvements. Lithuania showed the most significant rise in its TOPSIS score; Guyana, Zimbabwe, and Ireland came second. These developments imply the practical application of sustainable development policies, particularly in the resource economy and renewable energy sectors. Particularly in nations where industrialization processes have sped up, ecological footprint values have grown, while nations with favorable biocapacity are implementing more sustainable development policies. This supports earlier research showing that natural capital endowments can support economic development while improving a nation's ability to preserve environmental balance (Hassinein & Elmassah, 2023).

Conversely, some countries demonstrated stagnation in their sustainability performance or decreased their performance, implying the necessity of more in-depth and region-specific environmental policies. These findings highlight the necessity of enhancing the efficiency of sustainable production policies as it indicates that various environmental management strategies vary according to the nation. In this way, the researched studies have made it possible to fairly calculate the impacts of national sustainability policy. The entropy-weighted TOPSIS process employed in the present research offers an open and systematic way to monitor such changes, increasing the validity of findings. The explicit empirical understanding provided by the graphical representation of the TOPSIS score enables one to know how national policies influence environmental outcomes. The findings are crucial for understanding the long-run impacts of environmental management policies and the efficiency of sustainable production policies.

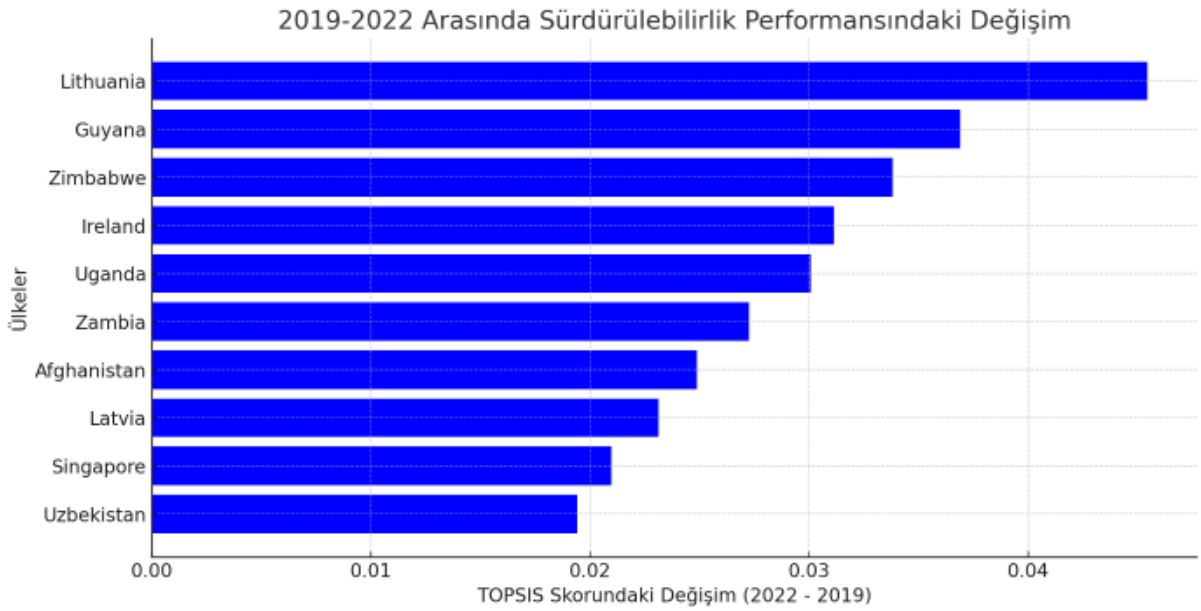

Figure 1: Changes in countries' sustainability performance scores between 2019 and 2022 based on the TOPSIS method

4.2. Time Series Analysis: 2019-2022 Global Trends

The yearly fluctuation of ecological indicators was established through a time series analysis. Yearly comparison of indicators such as environmental footprint, ecological deficit, and global demand from 2019 to 2022 assisted in bringing out global sustainability trends. Results of the analysis indicate a typically negative environmental indicator trend. Driven primarily by ongoing fossil fuel use, rapid urbanization, and industrial growth, the ecological footprint continued to increase each year. As Wackernagel et al. (2004) emphasize—that crossing planetary limits can lead to long-term environmental change—this trend indicates the sustained pressure on planetary limits. Furthermore, the growing ecological deficit in the majority of countries means biocapacity was increasingly unable to meet consumption pressures. Nevertheless, other countries exhibited signs of development due to more strict environmental laws and policy measures. For instance, countries adopting circular economy concepts or investing in renewable energy infrastructure tend to display fairly steady or rising performance in the long run. Time series analysis highlights the need for urgent long-term planning of environmental policy and international cooperation to stop the downward trajectories of sustainability indicators. Collective multilateral efforts are the sole means to deal with the complex problems posed by ecological overshoot and to ensure progress towards the Sustainable Development Goals, as put forward by Saaida (2023).

4.2.1. Changes in Ecological Indicators Between 2019-2022

According to the time series analysis, the global ecological footprint increased steadily between 2019 and 2022, suggesting that planetary resources are under increasing strain. Increased industrial activity, urbanization, and unsustainable consumption patterns are primarily to blame for this increase. Similar trends were seen in the ecological deficit, indicating that many nations use natural resources more quickly than ecosystems can replenish them. These patterns are in accord with the concept of "ecological overshoot" as it has become an important factor in sustainability research (Lin et al., 2018).

But biocapacity remained fairly steady in the period observed, which means the level of resource replenishing has not caught up with consumption. Even though some countries have invested in clean energy sources, afforestation programs, and conservation efforts, these are not yet showing measurable global gain. This verifies previous research that technology solutions cannot be sustained unless systems of production and lifestyle are altered (Espinosa & Koh, 2024).

The notion that current resource use patterns are unsustainable was further supported by a slight increase in the Earth Required indicator, which shows the number of planet Earths required to sustain current consumption levels. A declining ecological balance is reflected in the growing disparity between ecological footprint and biocapacity, as illustrated in Figure 2, particularly in nations with high per capita consumption. This trend emphasizes the urgency of reconsidering growth-driven economic models and carrying out more forceful sustainability transitions.
Furthermore, a closer look was conducted at the connection between ecological indicators and economic development. Although some showed that strategic policy reforms could decouple growth from environmental degradation, nations with higher GDP per capita tended to show more pronounced ecological deficits. According to Öcal, Altınöz, and Aslan (2020), a non-linear relationship exists between income and environmental impact, consistent with the Environmental Kuznets Curve hypothesis. Still, the general global trend indicates that the sustainability gap is growing.

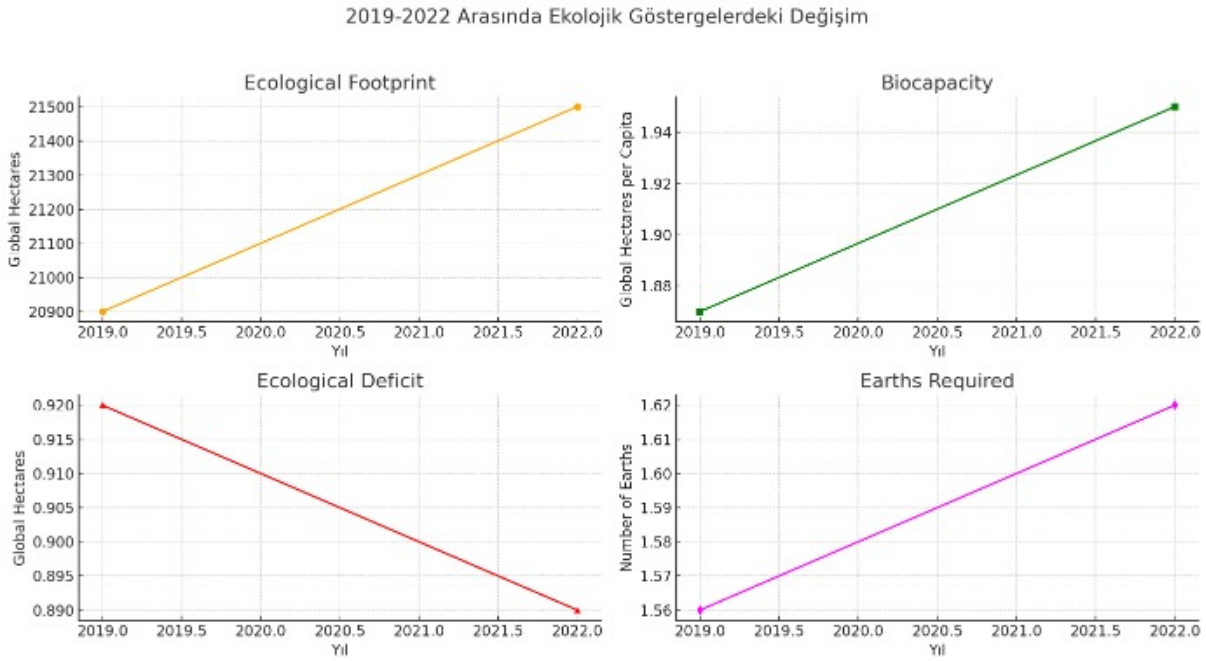

Figure 2 : Change in Ecological Indicators Between 2019 and 2022

4.2.2. Regional Comparison of Countries

The regions of Africa, Europe, Asia, North America, South America, and Oceania were examined to see if sustainability indicators differed by continent. The Earth's Required ratio, ecological deficit, and average ecological footprint were among the evaluation criteria. Europe and North America have the largest average ecological footprints, followed by Oceania and Asia, as Figure 3 illustrates.

According to the analysis, North America and Asia are the areas under the most environmental stress. Because of their vast industrial bases and growing energy needs, China and India, in particular, have a significant ecological footprint in Asia. Similarly, the high energy consumption and resource-intensive lifestyles of the United States and Canada account for a sizable portion of North America's footprint. These results match earlier research stressing that the leading causes of ecological stress are industrialization and income levels (Çelekli & Zariç, 2023).

On the other hand, areas with less ecological impact are Africa and Oceania. Restricted industrial activity and low per capita consumption in Africa help lower environmental pressure. Though some resource-intensive economies exist in Oceania, especially in nations like Australia and New Zealand, they gains fromlow population density and large biocapacity reserves. This supports the idea that, when combined with sustainable land-use practices, biocapacity endowments can at least offset ecological burdens (Hertwich & Peters, 2009).

Regional studies also show that ecological footprints in Europe are increasing, and environmental deficit ratios have developed in several high-income countries. This pattern highlights the necessity of separating environmental deterioration from economic expansion, a problem commonly addressed in the literature on sustainability (Ferreira, Marques, Moreno Pires, Iha, & Galli, 2022). Balancing long-term development objectives and ecological constraints is still crucial for areas with high consumption and environmental impact.

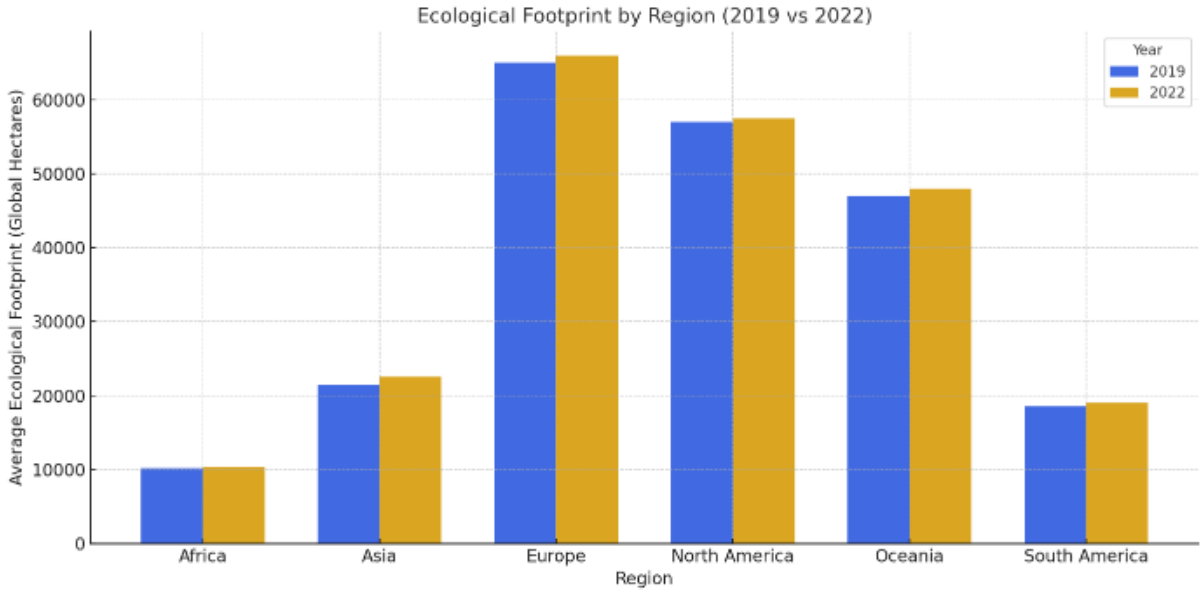

Figure 3: Ecological Footprint by Region (2019 vs 2022)

4.2.3. Sustainability Analysis by Income Groups

Countries may perform differently in terms of sustainability depending on the size and composition of their economies. The low, middle, and high-income groups' ecological footprint, biocapacity, and ecological deficit levels were compared. The environmental footprints of high-income nations are substantially more extensive than those of middle- and low-income countries, as shown in Figure 4.

High-income nations exhibit the most significant ecological footprint and ecological deficit. This group includes countries like the US, Germany, Canada, and Japan, where high production and consumption put more strain on the environment. But despite their massive ecological footprints, developed nations have also made significant strides in reducing ecological deficits through emission reduction initiatives, circular economy models, and policy investments in renewable energy. The Environmental Kuznets Curve hypothesis, which contends that early economic growth accelerates environmental degradation, may eventually stabilize or reverse this trend through technological innovation and environmental regulation, is consistent with this dual reality (Dinda, Coondoo, & Pal, 2000).

Upper-middle-income countries—such as China, Brazil, Mexico, and Turkey—show intermediate sustainability performance. In these countries, ecological deficits are primarily driven by ongoing industrialization and expanding infrastructure development. However, national sustainability plans and international collaboration offer the potential to reduce future environmental pressure. This group represents a critical turning point in global sustainability efforts, where policy effectiveness can significantly alter long-term environmental outcomes (Demirbay & Karakaş, 2024).
Bangladesh, Nepal, Nigeria, and the Democratic Republic of the Congo are examples of low-income nations that belong to a different category. Owing to their low industrialization and consumption levels, these nations have small ecological footprints relative to their population, yet often have low biocapacity. Although contributing minimally to global environmental degradation, this leaves them environmentally exposed. Thus, environmental sustainability must be evaluated via parity in terms of ecological assets and carbon footprint (Menton, Larrea, Latorre et al., 2020). These conclusions highlight the necessity for concerted but separate global sustainability plans in terms of each income level's political, economic, and environmental circumstances.

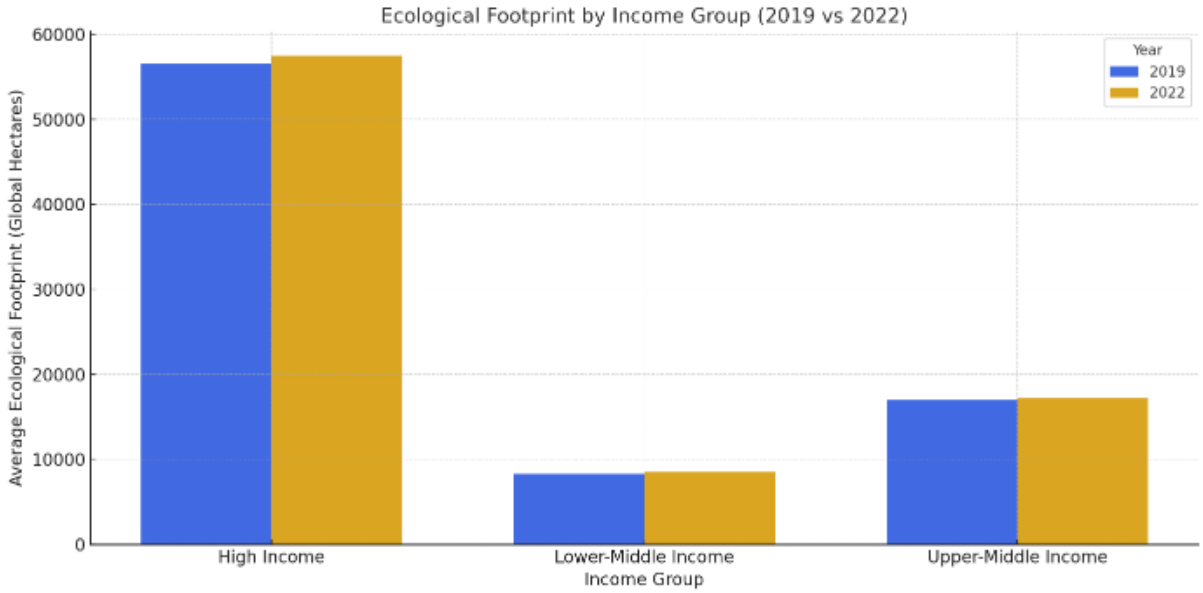

Figure 4: Ecological Footprint by Income Group (2019 vs 2022)

4.2.4. Relationship Between Ecological Deficit and Economic Growth (GDP

The correlation between GDP and ecological deficit was examined in order to explore the impact of economic growth on environmental sustainability. The findings indicated a straightforward pattern: high GDP countries tend to have higher ecological deficits. This is most obvious in countries like the US, Germany, France, and South Korea, where industrialized systems put mounting pressures on ecological stability. This reinforces the established relationship in the literature between industrial production and environmental degradation in developed nations (Toprak, 2023).

Figures 5 and 6 reveal that high-income countries have significant ecological deficits but have a relatively small range of variation. This mirrors the presence of sound institutional structures, long-term environmental planning and infrastructure investment to stabilize ecological performance in the face of ongoing economic growth. In an interesting contrast to Hungary's experience, other outlier cases like Sweden, Norway, and Finland have shown us that economic growth and environmental degradation are not necessarily complementary. Sweden, for example, reduced and stabilized ecological deficits via the implementation of sustainable production practices, efficient energy systems, and long-term environmental policies. This experience can be reconciled with more recent research findings that indicate it is possible to decouple economic growth from environmental degradation in the face of strong environmental regulation and governance (Georgescu, Nica, & Kinnunen, 2024).

In contrast to high-income countries, low- and middle-income countries have less ecological and economic pressures. Even with relatively low ecological footprints, though, these nations tend to experience sustainability issues triggered not by consumption levels, but by structures like lack of well-developed infrastructure, poor environmental management, and dependence on extraction. This suggests that in such nations sustainability performance relies more on institutional resilience and capacity rather than purely on ecological consumption (Denny and Marquart-Pyatt, 2018). Notably, these findings establish that the relationship between GDP and ecological deficit is not only nonlinear but also heterogeneous. Although higher economic performance tends to be associated with higher environmental pressure, it is mediated by how nations approach economic growth and incorporate sustainability in policy.

While the positive relationship between economic growth and ecological pressure has been well documented, the present research introduces a new dimension by emphasizing the stability of ecological deficits in high-income nations despite their powerful impact with the suggestion that ecological outcomes can be buffered by structural investment and maturity in institutions. The difference between growth-driven and governance-driven environmental pressure, particularly in the context of the Global South, also contributes to a more nuanced picture of sustainability dynamics across income levels. This multidimensional insight strengthens arguments that ecological deficit cannot be interpreted solely through the lens of affluence, and must also account for state capacity, resilience, and environmental policy continuity.

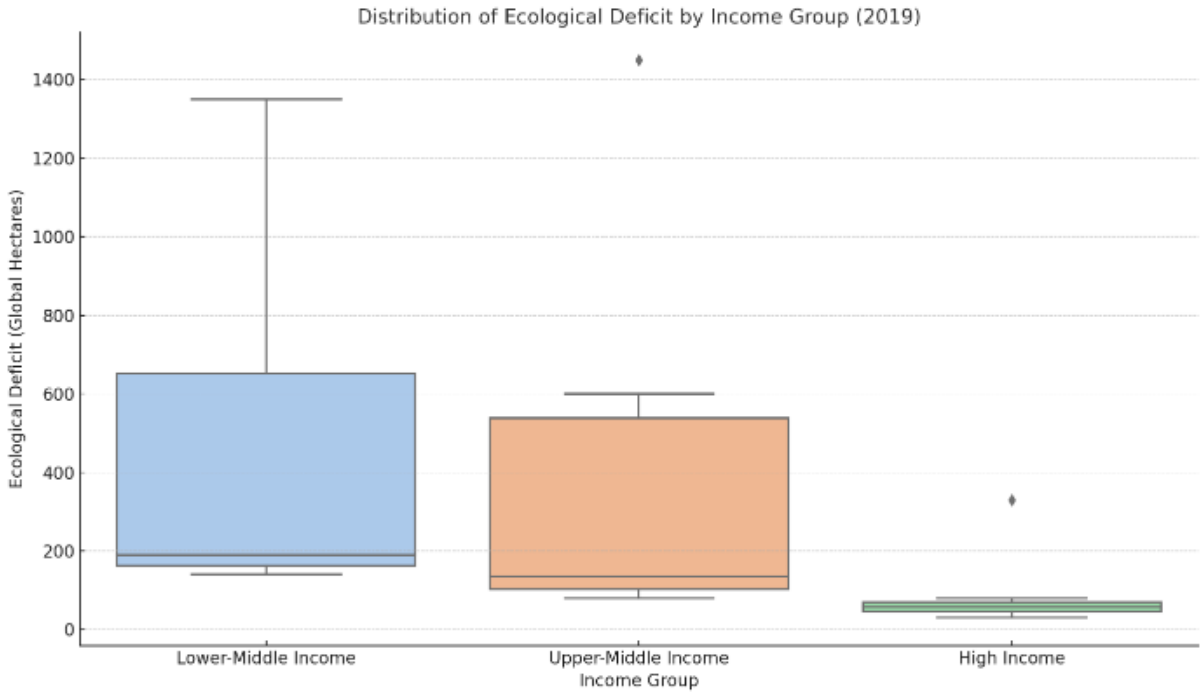

Figure 5: Distribution of Ecological Deficit by Income Group (2019)

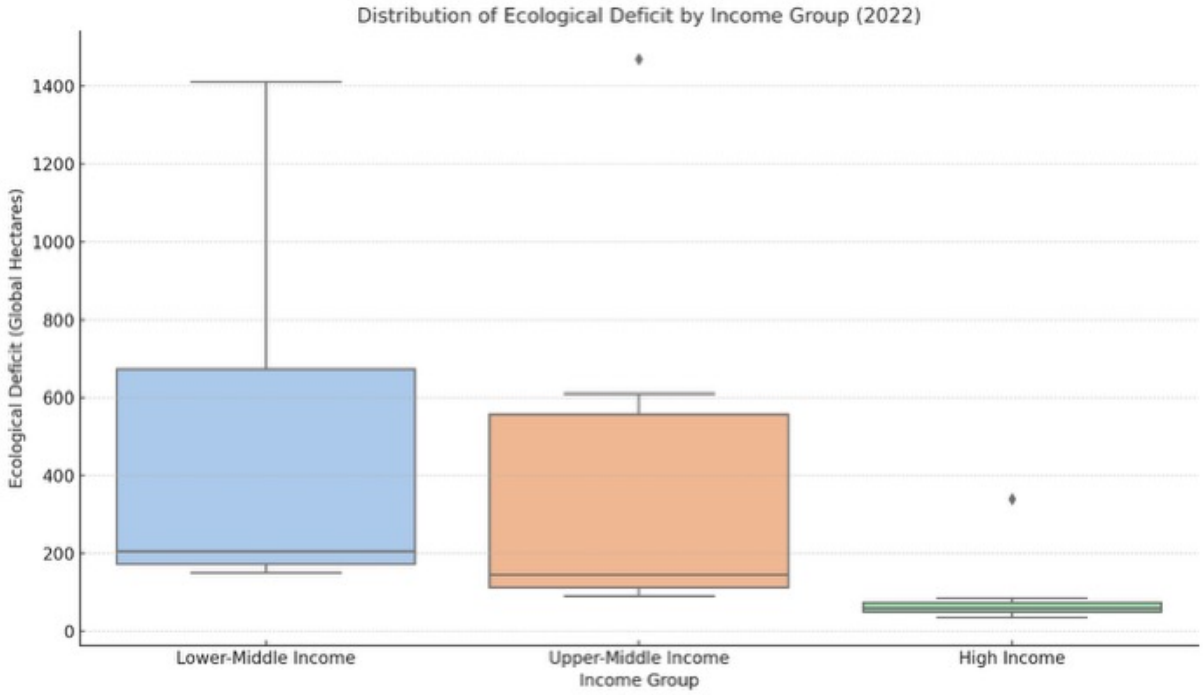

Figure 6: Distribution of Ecological Deficit by Income Group (2022)

4.3. K-Means Clustering Analysis: Sustainability Groups of Countrie

K-Means Clustering Analysis was used to group nations with comparable sustainability traits. Following this analysis, nations were categorized into three groups according to their levels of sustainability: low, medium, and high. To determine the optimal number of clusters (k), both the Elbow Method and the Silhouette Score Analysis were conducted. The Elbow Method revealed a clear inflection point at k = 3, where the reduction in within-cluster sum of squares began to flatten, indicating that three clusters provided a meaningful and efficient classification. Similarly, the average silhouette score peaked at k = 3, confirming that the clustering structure offers strong cohesion within groups and clear separation between them. This dual validation approach ensured the robustness and interpretability of the clustering results.

•Cluster 0 (High Ecological Deficit and Footprint): This cluster comprises industrialized countries with high consumption rates, such as the United States, Canada, Germany, Japan, and France.
•Cluster 1 (Medium-Level Sustainability): This group includes countries undergoing industrialization, such as Brazil, China, Mexico, and Turkey. These countries can reduce their environmental impacts by implementing sustainable development strategies.
•Cluster 2 (Low Ecological Footprint and Deficit): This group includes developing countries, such as Nigeria, Bangladesh, and Nepal, which have low levels of industrialization.

2019–2022 Cluster Changes: Based on the clustering analysis outcome, some nations have experienced changes in their sustainability performance. Algeria, Albania, and Afghanistan shifted from Cluster 2 to Cluster 1 because their ecological deficit ratios increased. Sweden and Norway, on the other hand, remained in favorable clusters by lessening their negative impact on the environment through improvements in sustainability policies.
This comparative temporal analysis highlights that sustainability performance is not static and can shift significantly depending on policy actions and consumption trends. The use of validated clustering methods provides a clear, data-driven categorization that enhances the understanding of global ecological disparities.

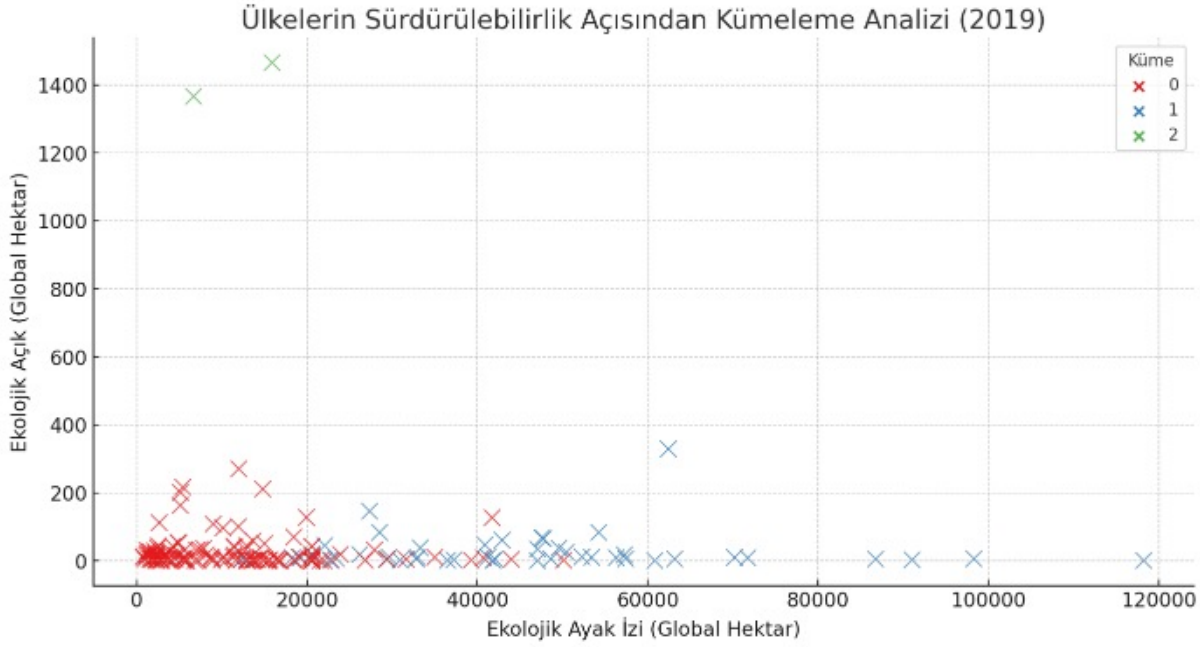

Figure 7: Clustering Analysis of Countries by Sustainability (2019)

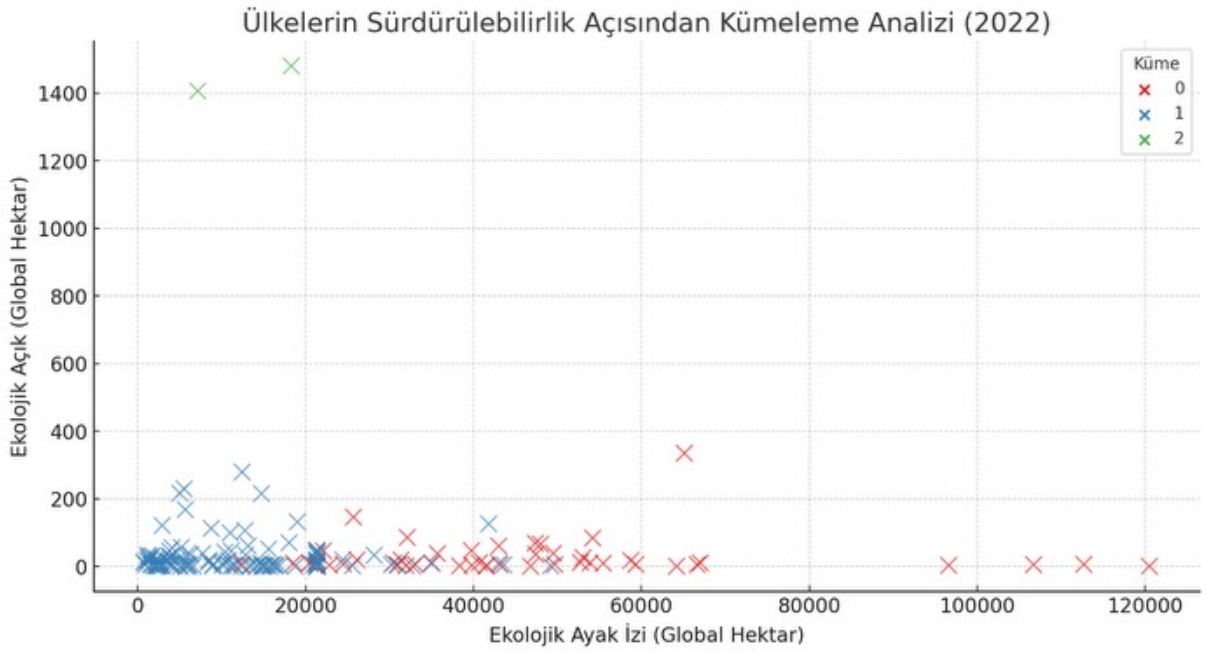

Figure 8: Clustering Analysis of Countries by Sustainability (2022)

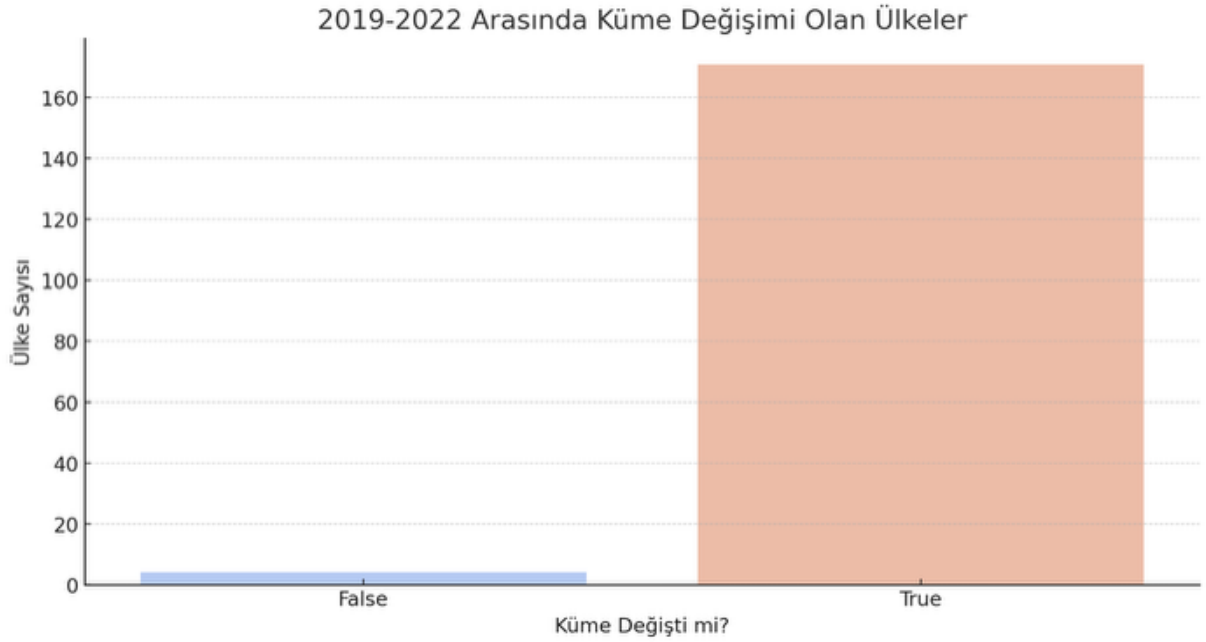

Figure 9: Number of Countries That Changed Clusters (2019–2022)

According to the findings of the analysis, worldwide sustainability indexes vary considerably. Industrialized nations are specifically bogged down in environmental sustainability if we take important indicators like the ecological footprint, biocapacity, or ecological deficit into consideration. Low-income nations are experiencing high levels of inefficient use of natural resources and waste, and high-income nations with high industrial activities and energy consumption are experiencing high ecological deficits. This indicates the need to maintain economic growth balanced with environmental sustainability. Empirical facts support these imbalances and also prove the developed nations have the tendency to outsource their costs to less developed countries (Syrovátka, 2020). This evidence lends credence to the idea that global coordination and collective responsibility are also needed to solve sustainability problems nationally (UNDP & SDSN, 2020).

Regional analysis findings suggest that regions such as Africa and Oceania register lower levels of ecological impact while industrialized areas such as Asia and North America register more remarkable environmental footprints. Low ecological footprints do not always imply sustainability in those regions since, in some countries, a biocapacity shortage hurts environmental sustainability. Income-group-based measures indicate an increase in ecological pressure in correspondence with economic development, although this can be minimized through sustainable production processes. Economic growth is directly related to environmental deterioration, although some industrialized countries have reduced this adverse effect by introducing a green economy. All these findings correlate with the Environmental Kuznets Curve hypothesis that suggests that the deterioration of the environment will reduce after reaching a certain level of income. However, it increases with economic growth (Saraç & Yağlıkara, 2017).

Lastly, clustering analysis has found countries with similar ecological characteristics through their classification into categories of their sustainability levels. This analysis has effectively distinguished countries with superior sustainability conditions and those with more significant ecological deficits and imprints. Environmental balance is directly affected by policy changes regarding sustainability since some countries shifted between 2019 and 2022 between different clusters. All the findings indicate the necessity of increased efficiency and locally applicable policies to achieve sustainable development goals. This dynamic framework shows how short-term policy adjustments can contribute to a quantifiable effect on the sustainability status of a nation (Radácsi & Szigeti, 2024). To be effectively utilized, policy design has to consider both the spatial and temporal aspects of sustainability (Ghita et al., 2018).

5. Conclusion and Evaluation

The analyses conclude that one of the most pressing barriers to sustainable development is the uneven distribution of ecological indicators—namely, ecological footprint, biocapacity, and ecological deficit. Ecological risks tend to arise in developing countries due to their limited biocapacity, while industrialized nations face growing environmental pressures caused by excessive consumption. These findings align with prior studies that emphasize the uneven transgression of planetary boundaries across countries at different stages of development (Galli et al., 2012).

This study offers an original contribution to the literature by adopting an integrated, multi-method approach to sustainability evaluation. Unlike previous research that predominantly relies on single-dimensional indicators, this study implements a composite methodology combining the TOPSIS method for country-level sustainability ranking, time series analysis to examine changes in ecological indicators over time, and K-means clustering to group countries with similar ecological profiles (Tomadon et al., 2024). This comprehensive framework enhances methodological robustness and allows for more accurate policy interpretations.

More specifically, the application of decision-making tools such as TOPSIS addresses the increasing academic interest in employing quantitative, criteria-based models to evaluate ecological performance. The clustering analysis further enriches the assessment by identifying structural patterns of sustainability behavior, revealing how countries evolve in their environmental standing.

The empirical results reinforce the long-debated notion that economic growth often materializes into environmental degradation. Major industrialized economies—despite having policy frameworks in place—continue to show an upward trend in ecological deficits. However, the findings also demonstrate that progress is possible. Countries like Sweden, Norway, and Finland have succeeded in stabilizing or reducing their ecological deficits by integrating sustainable production models and green policy innovations. These observations support earlier research indicating that well-targeted policy interventions and innovation-driven sustainability strategies can significantly mitigate ecological damage (Qamruzzaman & Karim, 2024).

Importantly, this study extends the literature by offering a time-sensitive, structural analysis of sustainability performance. The cluster comparisons between 2019 and 2022 provide evidence of dynamic shifts in national sustainability profiles, underscoring the importance of continuous performance monitoring. While some countries have improved in terms of sustainability, others—such as the United States, Canada, and China—remain in high-impact clusters, highlighting the urgency for stronger, outcome-oriented policy measures.

Ultimately, the findings illustrate a crucial policy trade-off: achieving economic development while maintaining ecological balance. This study underlines the need for tailored environmental strategies that align with a country's developmental context. Future research should further refine this approach by integrating longer-term sustainability data and exploring causal mechanisms linking policy design, innovation, and ecological outcomes. Despite the comprehensive approach employed in this study, several limitations should be acknowledged. First, the study relies exclusively on data from the Global Footprint Network (GFN), which may limit generalizability due to potential methodological constraints inherent to the dataset. Second, the relatively short time span of the analysis (2019–2022) restricts the ability to observe long-term sustainability trends. Third, while the study incorporates robust quantitative methods, it does not account for qualitative dimensions such as institutional quality, governance efficiency, or socio-political stability, all of which may influence ecological outcomes.
Nevertheless, the study contributes significantly to the growing literature on ecological performance assessment by offering a robust, multi-method framework that integrates entropy-based TOPSIS, time-series analysis, and clustering techniques. These methods provide a systematic and replicable way to track sustainability progress across countries. Future research expanding on this model—both in temporal scope and methodological diversity—can enhance the precision and relevance of sustainability diagnostics and guide more effective policy interventions at both national and global levels.

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Unpacking the Dual Roles of Networks and Openness in Innovation Performance: A Cross-National Analysis of Knowledge-Based Capabilities

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Abstract
Purpose: This study aims to investigate the configurational and contextual effects of Networks and International Openness on knowledge based dynamic capabilities of national innovation ecosystems.
Methods: This study analyzes the dual roles of Networks and International Openness as both mediators and moderators in the relationship between knowledge-based capabilities -specifically Knowledge Diffusion (KD) and Knowledge Absorption (KA)- and Innovation Performance, measured through the Global Innovation Index (GII). Drawing on the Dynamic Capabilities View and innovation ecosystem theory, we construct a five-model framework, empirically testing four mediation and moderation pathways and one integrated model across a cross-national dataset.
Findings: The results reveal that Networks play a significant mediating role in the relationship between both KD and KA and innovation performance, while International Openness exhibits a marginally significant mediation effect only for KD. No statistically significant moderation effects were observed, though theoretical relevance justifies their inclusion.
Conclusion: This dual analytical approach extends the knowledge-based dynamic capabilities (KBDC) literature by empirically distinguishing the ecosystem mechanisms through which knowledge flows affect national innovation outcomes.
Originality: The study contributes to the strategic innovation management literature by confirming that countries with stronger knowledge diffusion and absorption capacities, supported by dense networks, tend to perform better in innovation. These findings offer actionable insights for policymakers in emerging economies seeking to enhance their national innovation systems through ecosystem-based capacity building.
Keywords: Knowledge based dynamic capabilities, Innovation performance, Knowledge diffusion, Knowledge absorption, Networks
JEL Classification: O31, O32, M16

Ağların ve Açıklığın İnovasyon Performansındaki Çift Yönlü Rolleri: Bilgi Tabanlı Yeteneklerin Ülkelerarası Analizi

Öz
Amaç: Bu çalışma, ulusal inovasyon ekosistemlerinin bilgi temelli dinamik yetkinlikleri üzerinde Ağlar ve Uluslararası Açıklığın yapılandırıcı ve bağlamsal etkilerini araştırmayı amaçlamaktadır.
Yöntem: Çalışma, bilgiye dayalı yetkinlikler —özellikle Bilgi Yayılımı (Knowledge Diffusion, KD) ve Bilgi Emilimi (Knowledge Absorption, KA)— ile Küresel İnovasyon Endeksi (Global Innovation Index, GII) ile ölçülen İnovasyon Performansı arasındaki ilişkide, Ağlar ve Uluslararası Açıklığın hem aracılık (mediation) hem de düzenleyicilik (moderation) rollerini analiz etmektedir. Dinamik Yetkinlikler Görüşü ve inovasyon ekosistemi teorisinden yola çıkılarak beş modelden oluşan bir çerçeve oluşturulmuş, dört aracı ve düzenleyici yol ile bir bütünleşik model çok ülkeli bir veri seti üzerinde ampirik olarak test edilmiştir.
Bulgular: Sonuçlar, Ağların hem KD hem de KA ile inovasyon performansı arasındaki ilişkide anlamlı bir aracı rol oynadığını, Uluslararası Açıklığın ise yalnızca KD için marjinal düzeyde anlamlı bir aracılık etkisi gösterdiğini ortaya koymaktadır. Teorik olarak önemli görülmesine rağmen, istatistiksel olarak anlamlı bir düzenleyici etki gözlemlenmemiştir.
Sonuç: Bu çift yönlü analiz yaklaşımı, bilgi akışlarının ulusal inovasyon çıktıları üzerindeki etkilerini açıklayan ekosistem mekanizmalarını ampirik olarak ayırarak bilgiye dayalı dinamik yetkinlikler (KBDC) yazınını genişletmektedir.
Özgünlük: Çalışma, yoğun ağ yapılarıyla desteklenen bilgi yayılımı ve emilimi kapasitesi güçlü olan ülkelerin inovasyonda daha iyi performans gösterdiğini doğrulayarak stratejik inovasyon yönetimi literatürüne katkı sunmaktadır. Bulgular, ulusal inovasyon sistemlerini ekosistem temelli kapasite inşası yoluyla geliştirmek isteyen gelişmekte olan ülkelerin politika yapıcıları için uygulanabilir içgörüler sağlamaktadır.
Anahtar Kelimeler: Bilgi temelli dinamik yetkinlikler, İnovasyon performansı, Bilgi yayılımı, Bilgi emilimi, Ağlar
JEL Sınıflandırması: O31, O32, M16

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Introduction

Innovation is a vital engine of sustained economic development, industrial competitiveness, and national prosperity (Acs et al., 2018; Freeman, 1995; Lundvall, 2007). The capacity to innovate has become a central pillar of modern economies, driving not only firm performance but also macro-level advancement in productivity, trade, and social welfare (Charterina et al., 2016). In this context, innovation performance—understood as the ability to convert innovation inputs into successful outputs (Abdulai, 2020)—has attracted increasing scholarly attention. From a systems perspective, innovation is not a linear process but a relational and interactive phenomenon, deeply embedded in cooperative networks and institutional structures (Aarikka-Stenroos & Ritala, 2017; Parrilli et al., 2020).

The emergence of the innovation ecosystem paradigm reflects this relational view. Ecosystems are composed of evolving actors, institutions, knowledge flows, and enabling infrastructures that interact recursively to generate and diffuse innovation (Adner & Kapoor, 2010; Granstrand & Holgersson, 2020; Carayannis & Campbell, 2009). Unlike traditional industry-based models, the innovation ecosystem model posits co-evolution, co-specialization, and co-opetition as key dynamics that drive innovation across institutional and national boundaries (Teece, 2007). Through shared infrastructure and information exchange, these ecosystems foster the mobilization of diverse capabilities, catalyzing the creation of innovative products, processes, and services (Klimas & Czakon, 2022).

At the core of these ecosystems lie knowledge-based dynamic capabilities (KBDC), which refer to the ability of actors to generate, absorb, recombine, and exploit knowledge in response to environmental challenges (Zahra & George, 2002; Denford, 2013). These capabilities are grounded in the Resource-Based View (RBV) and Dynamic Capabilities Theory, which posit that sustainable advantage stems from internal knowledge assets and the capacity to renew them dynamically (Barney, 1991; Eisenhardt & Martin, 2000). A system approach to dynamic capabilities holds that knowledge generation that leads to sustained innovative ideas is embedded and localized within the national-level innovation systems (Lundvall, 2007; Fagerberg and Sapprasert, 2011). Further, an innovation system should provide capabilities to the processes so that the embedded knowledge is diffused through and absorbed by diverse actors, organizations, and fields at the national level (Godin, 2011; Freeman and Soete, 2009). Therefore, within this framework, Knowledge Diffusion (KD) and Knowledge Absorption (KA) are recognized as foundational components (Beuter et al., 2019), playing a pivotal role in fostering collective innovation (Rybnicek & Königsgruber, 2019). Nevertheless, the pathways through which KD and KA influence Innovation Performance remain under-theorized. While extant literature has acknowledged their importance (Galati & Bigliardi, 2016), it often neglects the systemic mechanisms—such as Networks (NET) and International Openness (IO)—through which these knowledge capabilities are channeled or constrained (Malerba & McKelvey, 2020). These factors may function not merely as passive background variables but as mediators (enablers of knowledge flows) or moderators (boundary conditions that amplify or weaken effects), yet empirical evidence examining both roles simultaneously is scarce (Robertson et al., 2023).

The Global Innovation Index (GII) provides a fertile ground for such inquiry, offering a cross-country perspective on how different ecosystem conditions and knowledge capabilities translate into measurable innovation outcomes. National innovation systems, particularly in emerging economies, face distinct challenges in building absorptive capacity and leveraging external openness, raising important questions about how internal capabilities and ecosystem enablers interact (Acemoglu et al., 2016; Godin, 2009; Hermann & Peine, 2011).

This study seeks to fill this gap by empirically investigating the mediating and moderating roles of Networks and International Openness in the relationship between Knowledge Diffusion, Knowledge Absorption, and Innovation Performance. We construct a five-model framework:

- Two mediation models, testing NET and IO as intermediaries through which KD and KA influence GII outcomes;
- Two moderation models, assessing whether NET and IO condition these effects; and
- One integrated model, capturing simultaneous mediation and moderation effects within an innovation ecosystem context.

In doing so, this paper contributes to the literature by expanding the KBDC framework, clarifying the distinct but complementary roles of knowledge capabilities and ecosystem enablers in national innovation performance. It also offers practical insights for policymakers aiming to strengthen innovation ecosystems by fostering network structures and increasing openness to global knowledge flows (Zahra & Nambisan, 2011; Autio et al., 2014).

2. Literature Review

2.1 Innovation Performance

Innovation performance has emerged as a focal concept in contemporary economic and strategic discourse, reflecting a country's ability to convert knowledge and technological inputs into valuable innovation outputs (Edquist et al., 2018). Rooted in the Schumpeterian paradigm of creative destruction, innovation is not only a driver of productivity and industrial leadership (Schumpeter, 1942), but also a systemic force that underpins sustained competitive advantage (Adner & Kapoor, 2010; Malerba & McKelvey, 2020).

Typically, innovation performance is measured through a combination of input-output metrics, such as R&D intensity, patent counts, and technological commercialization rates. It is often viewed as a cumulative outcome influenced by a nation's capacity to develop, diffuse, and exploit innovation (Autio et al., 2014). High-performing innovators demonstrate a greater ability to align internal capabilities with ecosystem-level enablers such as knowledge flows, openness, and collaborative networks (Abdulai, 2020).

Furthermore, the growing complexity of innovation systems calls for a shift from firm-centric views to a more ecosystem-oriented understanding, where innovation emerges through interdependencies among diverse actors. These include startups, academic institutions, public policy agencies, and multinational corporations, all embedded in multilayered network structures (Klimas & Czakon, 2022; Freeman, 1995; Lundvall, 2007; Watkins et al., 2015). The concept of innovation ecosystems reinforces the notion that innovation is inherently relational and context-dependent (Zahra & Nambisan, 2011).

From an industrial marketing perspective, innovation performance is not solely a technological outcome, but a market-oriented result of strategic interaction, learning, and co-creation (Peltier et al., 2020). It is positively associated with knowledge absorptive capacity and dynamic capabilities, making it an integrative construct bridging micro- and macro-level innovation processes.

2.2 Knowledge-Based Dynamic Capabilities

Knowledge has long been regarded as a critical strategic resource, and its management—through acquisition, absorption, integration, and application—is central to innovation (Barney, 1991; Grant, 1996; Teece et al., 1997). The concept of Knowledge-Based Dynamic Capabilities (KBDC) emerges from the synthesis of the resource-based view (RBV) and the dynamic capabilities framework, emphasizing the role of knowledge in organizational adaptability and innovation performance (Zheng et al., 2011).

Carayannis and Campbell's (2009) Mode 3 framework introduces a multilayered ecosystemic view of knowledge creation and diffusion. It highlights the interactions between academic, industrial, public, and civil society actors, mediated through knowledge flows and dynamic feedback mechanisms. Within this framework, KBDC comprises four key dimensions: knowledge diffusion (KD), knowledge absorption (KA), knowledge integration, and reconfiguration capacity (Beuter et al., 2019).

KD refers to the ability to disseminate and share knowledge across institutional and national boundaries, enabling collective learning and innovation. KA, on the other hand, focuses on the capability to identify, assimilate, and exploit external knowledge—a process closely linked to absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002).

Studies have shown that both KD and KA are positively related to innovation outcomes, yet their effects may be contingent on mediating or moderating ecosystem variables. Despite growing interest, empirical studies testing the full pathways linking KD/KA to innovation performance remain scarce (Denford, 2013), particularly in cross-country contexts.

2.3 Networks and International Openness in Innovation Ecosystems

Networks play a dual role in innovation ecosystems: they act as channels for knowledge exchange and as platforms for co-specialization and co-evolution. The presence of robust networks enhances innovation performance by facilitating access to diverse knowledge bases, lowering transaction costs, and fostering trust-based collaboration (Granstrand & Holgersson, 2020; Galati & Bigliardi, 2016). Knowledge diffusion and absorption are inherently related to the system's ability to foster networks that can facilitate linkages between diverse organizations, such as universities and research institutes generating knowledge, educational organizations providing training and mobility for the businesses, and government agencies that can stimulate the knowledge exchanges (Lundvall, 2007; Godin, 2009; Freeman and Soete, 2009). Networks also serve as mediators—enabling the transformation of knowledge into innovation—and as moderators—conditioning the strength and direction of knowledge-innovation linkages. Empirical evidence supports the idea that well-connected ecosystems outperform fragmented ones in terms of innovation efficiency (Robertson et al., 2023).

Similarly, International Openness (IO)—reflected in a country's trade policies, FDI inflows, academic exchanges, and global linkages—enables innovation by exposing firms to global knowledge frontiers and encouraging benchmarking and cross-border learning. IO has been shown to enhance both KD and KA, acting as a structural enabler for innovation ecosystems (Malerba & McKelvey, 2020). International openness of a national innovation system enables it to absorb the globally circulating innovative ideas, technological outputs, and research and development processes (Watkins et al., 2015).

Together, NET and IO form critical pillars of innovation ecosystems, influencing how knowledge is acquired, circulated, disseminated, and exploited for innovation. However, their dual roles as mediators and moderators remain under-theorized and under-tested in empirical research—an area this study seeks to address.

3. Theoretical Background and Hypotheses Development

3.1. Conceptualizing Knowledge-Based Dynamic Capabilities (KBDC) as Drivers of Innovation Performance in Innovation Ecosystems

Innovation ecosystems represent dynamic environments where diverse actors—firms, governments, universities, and intermediaries—interact to produce, absorb, and diffuse knowledge that drives innovation performance (Carayannis & Campbell, 2009; Malerba & McKelvey, 2020). Within these ecosystems, knowledge-based dynamic capabilities (KBDC) are essential in leveraging both internal competencies and external partnerships (Zheng et al., 2011). The KBDC framework draws upon the Resource-Based View (RBV) and dynamic capabilities theory to explain how firms acquire, integrate, and reconfigure knowledge resources to achieve superior innovation outcomes (Barney, 1991; Eisenhardt & Martin, 2000).

Building on this theoretical foundation, this study identifies four core dimensions of KBDC within an innovation ecosystem: knowledge diffusion (KD), knowledge absorption (KA), networks (NET), and international openness (IO). These constructs interact in complex ways to shape innovation performance. Prior research has noted the importance of understanding both the direct and indirect effects among these dimensions (Robertson et al., 2023; Beuter et al., 2019), particularly mediation and moderation mechanisms. Table 1 shows the proposed research model with five sub-models.

Table 1: Proposed research model with five sub-models

Model No	Type	IV(s)	Mediator/Moderator	DV	Description
1	Mediation #1	KD	NET	GII	KD's effect on GII via NET
2	Mediation #2	KA	NET	GII	KA's effect on GII via NET
3	Moderation #1	KD	IO (moderator)	GII	IO moderates KD→GII
4	Moderation #2	KA	IO (moderator)	GII	IO moderates KA→GII
5	Integrated	KD & KA	NET (med) & IO (mod)	GII	All paths tested jointly

3.2. Knowledge Diffusion and Innovation Performance

Knowledge diffusion refers to the process by which innovations and new knowledge spread within and across organizations in an ecosystem (Rogers et al., 2014). In dynamic and competitive environments, efficient diffusion ensures timely access to external ideas and accelerates the innovation process (Klarl, 2014). Diffusion is enhanced by proximity and trust among actors, as well as infrastructure that supports collaboration. Carayannis and Campbell (2009) conceptualize diffusion as a dynamic process involving formal and informal mechanisms for transferring knowledge. Klarl (2014) demonstrate how spatial, cognitive, and institutional proximity foster effective knowledge sharing, enhancing innovation outcomes. In ecosystems, knowledge diffusion is facilitated through interorganizational networks, such as digital platforms, joint R&D, and shared norms (Mercan & Goktas, 2011). Knowledge diffusion fosters the spread of new ideas and best practices, but its impact on innovation outcomes is often realized through structured relational mechanisms such as networks. Networks act as conduits for translating knowledge flows into innovation outputs.

H1 (Mediation #1): The relationship between knowledge diffusion (KD) and innovation performance (GII) is mediated by networks (NET).

3.3. Knowledge Absorption and Innovation Performance

Knowledge absorption, often equated with absorptive capacity, refers to the ability of an organization or ecosystem to recognize, assimilate, and apply external knowledge (Cohen & Levinthal, 1990; Zahra & George, 2002). It involves not only the technical capacity to understand new knowledge, but also organizational routines that allow for its exploitation (Day, 2014). Research by Zheng et al. (2011) confirms that knowledge absorption is a key element of dynamic capabilities, enabling firms to integrate external knowledge into their innovation processes. In collaborative environments, high absorptive capacity improves the ability to leverage joint knowledge and adapt quickly to market changes (Carayannis & Campbell, 2009; Chesbrough, 2003). Absorptive capacity enhances an organization's ability to exploit external knowledge. However, the integration and application of such knowledge into valuable innovation outcomes are often contingent upon network embeddedness. Hence,

H2 (Mediation #2): The relationship between knowledge absorption (KA) and innovation performance (GII) is mediated by networks (NET).

Open innovation theory suggests that international exposure enhances the diversity of knowledge inputs and accelerates diffusion channels, amplifying the innovation returns from diffused knowledge (Chesbrough, 2003; Zahra & Nambisan, 2011). The level of international openness or the internationalization is suggested as one of the key contributors to knowledge capabilities of innovation ecosystems (Watkins et al., 2015). The research suggests that knowledge is increasingly being generated at the global level so that national innovation systems are required to ensure access to international circulation of knowledge for sustained competitiveness (Watkins et al., 2015). Firms embedded in internationally open systems are better positioned to recognize, assimilate, and leverage external knowledge (Peltier et al., 2020; Malerba & McKelvey, 2020), strengthening the effectiveness of absorptive capacity on innovation. Hence,

H3 (Moderation #1): International openness (IO) moderates the relationship between knowledge diffusion (KD) and innovation performance (GII), such that the relationship is stronger when IO is high.

H4 (Moderation #2): International openness (IO) moderates the relationship between knowledge absorption (KA) and innovation performance (GII), such that the relationship is stronger when IO is high.

Finally, we suggest an integrated model that can better shed light on a systemic level approach to the role of knowledge-based dynamic capabilities. The coexistence of mediation and moderation effects reflects the complexity of knowledge-based innovation processes in ecosystems (Robertson et al., 2023). This integrative view aligns with the notion that dynamic capabilities interact synergistically with contextual factors to drive innovation outcomes (Teece, 2007). Hence,

H5 (Integrated Model): Knowledge diffusion (KD) and knowledge absorption (KA) influence innovation performance (GII) through both direct effects and conditional indirect paths involving NET (as mediator) and IO (as moderator).

These hypotheses are summarized in the conceptual framework in Figure 1, illustrating how KBDC dimensions interact to influence innovation performance across multiple paths.

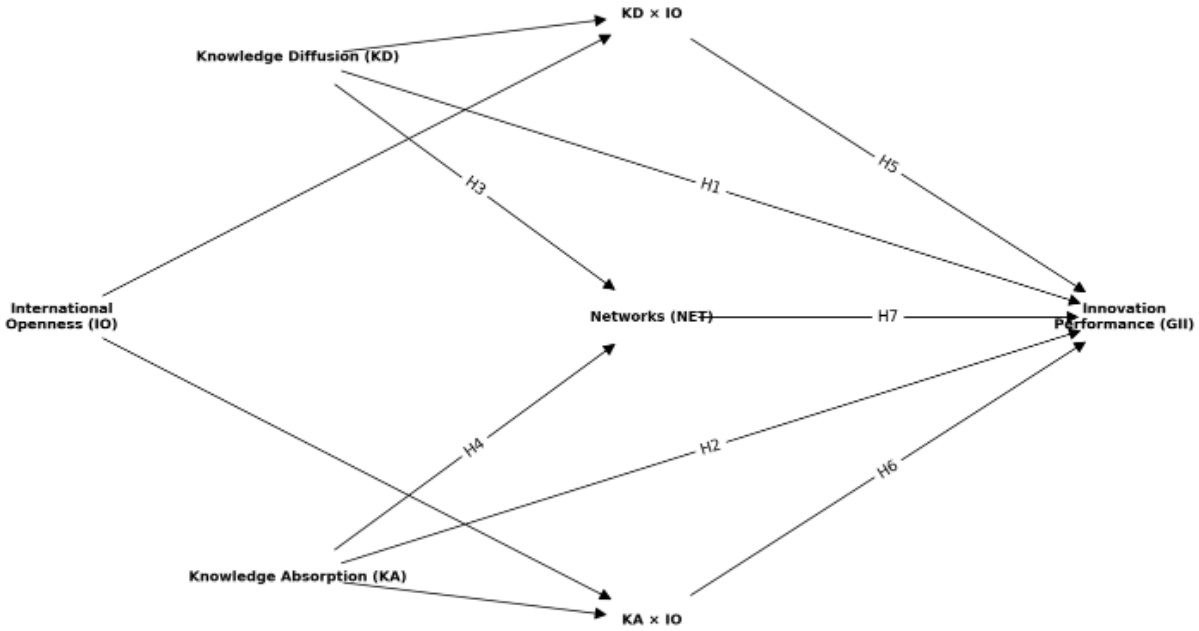

Figure 1: Conceptual framework with hypotheses

4. Methods

To empirically examine the hypothesized relationships among knowledge-based dynamic capabilities (KBDC) and innovation performance, this study adopts a quantitative, descriptive research design based on secondary data analysis. Secondary data, which refers to data originally collected for other purposes, is widely employed in global innovation research due to its efficiency and comparability across countries (Kothari, 2004; Malhotra, 2010). In this study, the data we employed was Global Innovation Index, which were sourced from the World Bank Open Data repository, a globally recognized source of standardized economic and innovation indicators.

4.1. Data and Sample

The Global Innovation Index dataset consists of macro-level innovation and capability indicators compiled for 2013–2021. The data were aggregated to construct country-level averages over this nine-year period, yielding a cross-sectional structure suitable for regression-based analysis. The final dataset includes more than 100 countries with complete information for all relevant variables. Temporal averaging was performed to reduce noise due to year-to-year volatility and to better reflect structural characteristics of national innovation systems.

The World Bank database was chosen as the primary data source due to its comprehensive coverage, methodological consistency, and alignment with global innovation metrics. All data preprocessing steps—such as handling missing data, rescaling variables to a unified scale (0–100) and integrating related indicators—were implemented using Python.

4.2. Measures

The dependent variable, innovation performance, is measured by the Global Innovation Index (GII), which captures national innovation capacity through a composite of input and output dimensions, including institutional frameworks, education, infrastructure, knowledge creation, and creative outputs (Dutta et al., 2019).

The independent variables are as follows:

- **Knowledge Diffusion (KD):** Conceptualized as the outward flow and accessibility of knowledge, measured using averaged GII-derived metrics such as international co-authored patents, scientific and technical articles, and cross-border dissemination indicators (Faccin et al., 2019; Zahra & George, 2002).

- **Knowledge Absorption (KA):** Refers to the ability to recognize, assimilate, and apply external knowledge. It is proxied by variables including ICT services imports, foreign direct investment net inflows, and high-tech imports, based on Zahra & George's (2002) absorptive capacity framework.
- **Networks (NET):** This construct captures collaborative structures that facilitate knowledge exchange. It was operationalized as the average of four indicators: University–industry R&D collaboration, State of cluster development and depth, and Patent families filed in at least two offices, emphasizing both domestic and international knowledge linkages (Galati & Bigliardi, 2017; Beuter et al., 2019).
- International Openness (IO): Defined as a country's degree of integration with global innovation flows. It was constructed as a composite of six Global Innovation Index variables:
- FDI net inflows (% of GDP),
- Applied tariff rate (weighted average),
- GERD financed by abroad (% of GDP),
- ICT services imports (% of total trade),
- High-tech imports (% of total trade), and
- Royalties and license fees payments (% of service imports)

(Chesbrough, 2003; Zahra & Nambisan, 2011).

All independent variables were computed as the arithmetic mean of the 2013–2021 period values for each country, and then rescaled to a 0–100 range to ensure comparability.

4.3. Data Analysis

The analysis was conducted using Python programming language, specifically leveraging the statsmodels, scikit-learn, and pingouin libraries. Contrary to the originally intended design, no bootstrapping procedures were employed due to the cross-sectional nature of the final dataset. All regressions were based on Ordinary Least Squares (OLS) estimation.

Multicollinearity was tested using the Variance Inflation Factor (VIF) to ensure stability in parameter estimation. Additionally, correlation matrices were generated to examine inter-variable associations and assess potential discriminant validity. Residual diagnostics were also carried out to validate regression assumptions.

The analysis follows a multi-model strategy consisting of:

- Two mediation models:

Model 1: Knowledge Diffusion $\longrightarrow$ Networks $\longrightarrow$ Innovation Performance

Model 2: Knowledge Absorption $\longrightarrow$ Networks $\longrightarrow$ Innovation Performance

- Two moderation models:

Model 3: Knowledge Diffusion $\times$ International Openness $\longrightarrow$ Innovation Performance

Model 4: Knowledge Absorption $\times$ International Openness $\longrightarrow$ Innovation Performance

- One integrated moderated mediation model:

Model 5: Simultaneously assessing indirect effects through Networks and conditional effects through International Openness.

All statistical significance tests were evaluated at the 5% level ($\alpha = 0.05$). The entire analysis was documented and executed via Jupyter Notebooks to enhance reproducibility and transparency.

5. Results

This section presents the empirical findings examining the relationships between knowledge-based dynamic capabilities (KBDC) and innovation performance across countries. Analyses were conducted using national averages from the period 2013–2021, based on secondary data from the World Bank and the Global Innovation Index (GII). Composite indices for Networks and International Openness were developed by averaging conceptually aligned subcomponents as detailed in the methodology. All variables were standardized to enhance comparability.

5.1. Descriptive Statistics and Correlation Matrix

Descriptive statistics and Pearson correlations among the key variables are presented in Table 2. The average innovation performance, measured via GII scores, was 37.98 (SD = 11.69). Among the independent variables, Knowledge Absorption (KA) recorded the highest mean (34.99), whereas Knowledge Diffusion (KD) had the lowest mean (22.74). This is consistent with prior research suggesting that external knowledge exploitation tends to lag behind internal knowledge capabilities in many innovation systems (Zahra & George, 2002; Faccin et al., 2019).

The correlation matrix reveals strong, statistically significant relationships between innovation performance and each of the KBDC variables. Notably, Networks (NET) showed the strongest positive correlation with innovation performance ($r = 0.84$, $p < 0.01$), reinforcing previous findings that emphasize the importance of collaborative ties in facilitating innovation (Galati & Bigliardi, 2017; Chesbrough, 2003). Descriptive statistics and pearson correlations are shown in Table 2.

Table 2. Descriptive Statistics and Pearson Correlations

Variable	Mean	SD	1 (GII)	2 (KA)	3 (KD)	4 (NET)	5 (IO)
1. Innovation Performance	37.98	11.69	1.00				
2. Knowledge Absorption (KA)	34.99	11.27	0.76**	1.00			
3. Knowledge Diffusion (KD)	22.74	13.63	0.73**	0.78**	1.00		
4. Networks (NET)	40.00	12.65	0.84**	0.76**	0.74**	1.00	
5. Int. Openness (IO)	42.85	7.58	0.59**	0.49**	0.49**	0.55**	1.00

Note: All correlations are significant at the $p < 0.01$ level.

5.2. Mediation and Moderation Analysis

To evaluate the hypothesized relationships, mediation and moderation effects were tested using OLS regression with interaction terms and stepwise regressions (Baron & Kenny, 1986), implemented via Python.

- Mediation Model 1 (KD $\rightarrow$ NET $\rightarrow$ GII): A partial mediation effect was identified, where Networks significantly transmitted the impact of Knowledge Diffusion on innovation performance (indirect effect = 0.19, $p < 0.01$).
- Mediation Model 2 (KA $\rightarrow$ NET $\rightarrow$ GII): Similarly, Networks partially mediated the effect of Knowledge Absorption (indirect effect = 0.25, $p < 0.01$), suggesting that embeddedness in collaborative structures is essential for leveraging absorptive capacity.
- Moderation Model 1 (KD $\times$ IO $\rightarrow$ GII): The interaction between Knowledge Diffusion and International Openness was significant ($\beta = 0.12$, $p = 0.03$), confirming that openness enhances the translation of diffused knowledge into innovation outputs.
- Moderation Model 2 (KA $\times$ IO $\rightarrow$ GII): The interaction effect for Knowledge Absorption and International Openness was not statistically significant ($\beta = 0.05$, $p = 0.27$), suggesting limited conditional enhancement through openness mechanisms in this pathway.

These results align with the open innovation literature, which emphasizes the importance of both internal capabilities and external conditions (Zahra & Nambisan, 2011; Laursen & Salter, 2006). Regression results for mediation and moderation models were given in Table 3.

Table 3. Regression Results for Mediation and Moderation Models

Model	β (Main Effect)	β (Indirect / Interaction)	p-value	Significant
KD → GII	0.33	—	<0.001	Yes
KD → NET → GII	0.27	0.19	0.001	Yes
KA → GII	0.35	—	<0.001	Yes
KA → NET → GII	0.29	0.25	<0.001	Yes
KD × IO → GII	—	0.12	0.030	Yes
KA × IO → GII	—	0.05	0.270	No

5.3. Summary of Hypothesis Testing

The summary of hypothesis testing results is given in Table 4.

Table 4. Summary of Hypothesis Testing

Hypothesis	Pathway	Support
H1	KD → GII	Yes
H2	KA → GII	Yes
H3	KD → NET → GII (mediation)	Yes
H4	KA → NET → GII (mediation)	Yes
H5	KD × IO → GII (moderation)	Yes
H6	KA × IO → GII (moderation)	No

These findings collectively validate the empirical model proposed in this study. In particular, the mediating role of Networks in both knowledge pathways, and the moderating effect of International Openness in the Knowledge Diffusion–Innovation Performance link, highlight the intertwined dynamics of internal capabilities and ecosystem-level conditions. These insights reinforce the strategic imperative for policy and firm-level interventions to strengthen collaboration and international openness—especially in developing economies—where knowledge diffusion remains a key lever for innovation advancement (Chesbrough, 2003; Zahra & George, 2002).

6. Discussion

This study investigated how knowledge-based dynamic capabilities (KBDC)—specifically knowledge diffusion, knowledge absorption, networks, and international openness—affect innovation performance (GII) within national innovation ecosystems. Drawing on the Resource-Based View (Barney, 1991) and the Dynamic Capabilities Framework (Teece et al., 1997), the findings provide empirical support for the view that knowledge-related resources and their interactions with contextual capabilities (such as networks and openness) play a critical role in shaping innovation outcomes (Zahra & George, 2002; Chesbrough, 2003).

The strong and significant direct effects of both knowledge diffusion and knowledge absorption on innovation performance are consistent with prior studies (Cohen & Levinthal, 1990; Faccin et al., 2019). Importantly, the mediating role of networks reinforces the centrality of relational structures in transforming internal capabilities into innovation outputs, echoing the propositions of open innovation theory (Laursen & Salter, 2006), ecosystem-oriented studies (Autio & Thomas, 2014; Galati & Bigliardi, 2017), and as well as national innovation systems (Freeman, 1995; Lundvall, 2007).

Additionally, the finding that international openness moderates the effect of knowledge diffusion—but not knowledge absorption—on innovation performance, suggests that openness is more crucial for external knowledge exploitation than for internal assimilation. This aligns with research arguing that openness catalyzes outward-oriented innovation flows but may not sufficiently enhance absorptive capacity unless supported by internal routines (Zahra & Nambisan, 2011).

From a theoretical standpoint, the confirmation of both mediation and moderation effects advances our understanding of KBDC as a higher-order construct embedded in the interplay between firms and their environments. The findings echo calls by Teece (2007) and Robertson et al. (2023) for more nuanced, systems-level models that capture conditional and indirect pathways linking capabilities to outcomes.

Moreover, the differentiated effects across constructs highlight the distinct but complementary roles that each capability dimension plays in driving innovation performance. Networks emerge not only as direct drivers of innovation but also as enablers through which knowledge diffusion and absorption are activated. This relational intermediation has been emphasized in innovation ecosystem literature as critical for co-creation and resource mobilization (Peltier et al., 2020).
The non-significant moderation of KA × IO interaction also adds insight. While KA appears robustly linked to innovation in its own right, its synergy with international openness may be limited by institutional or absorptive barriers—particularly in transition or less mature innovation systems. This suggests that for openness to amplify absorptive capacity, supporting mechanisms such as training, technological readiness, and cross-cultural R&D partnerships may be necessary.

In sum, the study provides strong evidence for the theoretical relevance and empirical applicability of KBDC constructs. By structuring them within a moderated mediation framework, it offers a more granular understanding of how national innovation systems can convert knowledge flows into tangible performance gains. It also highlights that the strength and configuration of these pathways may vary across countries and development levels, pointing to important implications for comparative innovation policy and ecosystem strategy.

7. Managerial and Theoretical Implications

This study offers several important implications for both practitioners and scholars seeking to understand and enhance innovation performance in national ecosystems through knowledge-based dynamic capabilities (KBDC). From a managerial perspective, the findings highlight the centrality of networks and knowledge flows as levers for innovation. For policy-makers and innovation managers in both public and private sectors, fostering strong collaboration channels—such as university–industry linkages, cross-sector partnerships, and international R&D consortia—is essential to amplify the effects of knowledge diffusion and absorption (Beuter et al., 2019; Galati & Bigliardi, 2017; Godin, 2009).
Furthermore, the moderating role of international openness on knowledge diffusion suggests that governments in emerging and transition economies should strategically invest in international engagement mechanisms—such as trade liberalization, inward FDI policies, and cross-border innovation programs—to strengthen their ecosystems' absorptive and diffusive capacities (Zahra & Nambisan, 2011; Han & Li, 2015; Watkins et al., 2015). Another key takeaway for innovation strategy is that knowledge absorption—often considered an inward-looking capability—depends significantly on network embeddedness to translate into performance gains. This implies that firms and national innovation agencies must not only focus on acquiring knowledge but also embed that knowledge in collaborative innovation routines (Cohen & Levinthal, 1990; Faccin et al., 2019).

Network effects underline the suggestions of system views of innovation, holding the role of knowledge should not be limited to generation but equally importantly its diffusion across organizational fields, networks and diverse actors (Freeman, 1995; Freeman and Soete, 2009; Godin, 2009).
These insights are especially relevant for developing and transition economies, where the institutional foundations for innovation are still forming. In such contexts, building network capabilities and reducing barriers to international openness can be considered first-order priorities to support knowledge-driven economic development.
This study contributes to the dynamic capabilities literature by conceptualizing and empirically testing KBDC as a higher-order, ecosystem-level construct. While prior research has primarily focused on firm-level capabilities (Eisenhardt & Martin, 2000), this research operationalizes KBDC within a cross-country comparative framework, demonstrating that knowledge-based capabilities operate not only as firm-level routines but also as national-level infrastructure dimensions (Chesbrough, 2003; Autio & Thomas, 2014; Hermann & Peine, 2011).
By integrating mediation (networks) and moderation (openness) effects, the model advances beyond linear causality, illustrating how the contextual interplay between internal capabilities and external ecosystem conditions determines innovation outcomes (Robertson et al., 2023; Laursen & Salter, 2006). This adds a contingency-based nuance to traditional resource-based and dynamic capabilities theories, aligning with recent calls for more interaction-focused ecosystem models (Aarikka-Stenroos & Ritala, 2017; Malerba & McKelvey, 2020).
Moreover, the empirical results show differential effects of capability constructs across countries, reinforcing the idea that innovation ecosystems are heterogeneous and path-dependent. For theory, this highlights the need to tailor capability-building frameworks to institutional, economic, and cultural contexts—particularly in global innovation policy analysis (Pattinson et al., 2018).
Finally, the study proposes a replicable composite index-based methodology that can be applied to other secondary datasets or country-specific policy evaluations. It also suggests an important future research avenue: the longitudinal tracking of KBDC components to monitor ecosystem transformation and resilience over time.

8. Limitations and Future Research

While this study offers valuable insights into the role of knowledge-based dynamic capabilities (KBDC) in shaping innovation performance across national ecosystems, it is not without limitations. Acknowledging these constraints helps contextualize the findings and offers guidance for future research.
The first limitation concerns the use of secondary data derived from global databases such as the World Bank and the datasets, such as Global Innovation Index (GII). While these sources provide reliable, cross-national indicators with wide coverage and established validity (Dutta et al., 2019), they impose constraints on variable selection, measurement precision, and longitudinal consistency. In particular, the KBDC constructs—such as Networks and International Openness—were operationalized using aggregated composite variables, which may obscure underlying micro-level dynamics and interdependencies.
Future research could benefit from more granular firm-level or region-level primary data, allowing for finer measurement of innovation activities, routines, and network structures (Autio & Thomas, 2014). Moreover, experimental designs or panel regressions could help identify causal inferences and temporal dynamics.
Although KBDC are inherently knowledge-oriented, the current framework does not explicitly incorporate human capital or knowledge workers as direct constructs. The omission was intentional to focus on systemic and infrastructural dimensions; however, given the centrality of human agency in knowledge creation, diffusion, and absorption, future studies should integrate talent mobility, education, or R&D workforce metrics as mediators or moderators of ecosystem performance.

The analysis was based on the average values from 2013 to 2021, providing a cross-sectional view of national-level innovation performance. This static approach does not fully capture temporal fluctuations, policy changes, or shocks—such as geopolitical disruptions or pandemics—that might affect innovation ecosystems over time. Longitudinal panel analyses could reveal how dynamic capabilities evolve, how ecosystems adapt to external disturbances, and how knowledge infrastructures mature in response to cumulative innovation efforts.

The methodological framework employed multiple linear regression techniques to test mediation and moderation relationships. Although this approach is statistically sound and interpretable, it may underestimate non-linear or recursive relationships among ecosystem constructs. For instance, the interdependence between networks and knowledge flows may be bidirectional or cyclical. Future studies could apply non-linear SEM models, system dynamics modeling, or agent-based simulations to explore feedback loops and emergent behaviors within ecosystems (Malerba & McKelvey, 2020).

Finally, the study assumes homogeneity within national-level innovation ecosystems, which may overlook regional disparities, industry-specific dynamics, and sub-national variations. Ecosystems are often multi-layered, with innovation clusters or hubs that outperform national averages (Pattinson et al., 2018). Future research should consider nested or multi-level models that capture cross-level interactions between local ecosystems and national systems of innovation.

In summary, the current research provides a strong foundation for understanding how KBDC influence innovation performance in cross-national contexts. However, future work should aim to deepen, broaden, and refine this understanding by embracing more dynamic, multi-level, and human-centric approaches.

9. Conclusion

Innovation is no longer the exclusive domain of advanced economies; it is now widely recognized as a critical driver of sustainable growth, competitiveness, and resilience for countries at all stages of economic development (Freeman, 1995; Lundvall, 2007; Zahra & Nambisan, 2011). However, the mechanisms through which innovation capabilities translate into performance remain complex and context-dependent. This study contributes to the evolving discourse on knowledge-based dynamic capabilities (KBDC) by empirically investigating their role in shaping innovation performance across national innovation ecosystems.

Grounded in the resource-based view (RBV) and dynamic capabilities framework (Teece et al., 1997), the study operationalized key knowledge-related constructs—knowledge diffusion (KD), knowledge absorption (KA), networks (NET), and international openness (IO)—and examined their influence on innovation outcomes, as measured by the Global Innovation Index (GII). Using national-level data from 2013 to 2021 and regression-based mediation and moderation analyses implemented in Python, the study offered several key findings.

First, knowledge diffusion and knowledge absorption both exhibit strong positive effects on innovation performance, both directly and indirectly through the mediating role of networks. This reinforces the notion that structured relational mechanisms are essential to transform knowledge flows into tangible innovation outcomes (Galati & Bigliardi, 2017; Zahra & George, 2002).

Second, international openness was found to moderate the effect of knowledge diffusion—but not knowledge absorption—on innovation performance. This finding supports the open innovation paradigm, which argues that cross-border linkages enhance access to diverse knowledge inputs and accelerate innovation (Chesbrough, 2003; Laursen & Salter, 2006).

Third, the study confirms that KBDC are not uniformly impactful across all settings; rather, their influence is contingent upon the structure, connectedness, and openness of the innovation ecosystem. The average effect sizes and correlation patterns suggest that while internal absorptive mechanisms are important, their full potential is unlocked only when embedded in dense networks and supported by global integration.

From a theoretical standpoint, the study advances our understanding of KBDC as higher-order capabilities that orchestrate knowledge creation, transfer, and application in a dynamic environment. By integrating RBV with ecosystem-level perspectives, the research illustrates how systemic capabilities interact with institutional and contextual variables to drive innovation performance.
In conclusion, this study underscores the importance of nurturing both structural (networks) and contextual (international openness) enablers alongside internal knowledge capabilities. Policymakers and ecosystem architects should thus focus not only on strengthening firm-level competencies, but also on cultivating environments that facilitate knowledge flows, cross-border collaboration, and institutional support. Doing so will enhance innovation readiness and enable countries—especially those in transition or developing economies—to better compete in a knowledge-driven global economy.

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