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Investigating the Impact of Innovation and Intellectual Capital on Firm Performance Using Structural Equation Modeling

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ABSTRACT

Purpose: This study aims to analyze the effect of intellectual capital and innovation on company performance. Intellectual capital is defined through its relational, human, and structural aspects, while innovation is explored across product, process, marketing, and organizational categories.

Methodology: The research population includes pharmaceutical warehouses involved in R&D activities in Mersin Province as of December 2023. Data was gathered through surveys with 400 questionnaires. Of these, 314 questionnaires were returned, representing five pharmaceutical warehouses, which meets the required sample size. The research model was tested using SEM and multi-group comparison analysis with AMOS.

Findings: The findings show that intellectual capital and innovation are key factors influencing company performance.

Originality: This study offers valuable insights for pharmaceutical warehouses, with the relational capital dimension and process innovation having the most significant impact on company performance.

Keywords: İntellectual Capital, Performance, İnnovation, Structural Equation Model.

Jel Classification: O34, O30, L25.

İnovasyon ve Entelektüel Sermayenin Firma Performansına Etkisinin Yapısal Eşitlik Modellemesi Yoluyla Araştırılması

ÖZET

Amaç: Bu çalışmada, entelektüel sermaye ile inovasyonun firma performansına etkisinin incelenmesi amaçlanmaktadır. Entelektüel sermaye ilişkisel, insan ve yapısal sermaye alt boyutları ile inovasyon ise ürün, süreç, pazarlama ve organizasyonel inovasyon alt boyutları ile incelenmiştir.

Yöntem: Araştırmanın evrenini 2023 Aralık ayı itibariyle Mersin ilinde Ar&Ge faaliyetinde bulunan ilaç depoları oluşturmaktadır. Veriler anket yoluyla toplanmış il merkezinde faaliyet gösteren beş ilaç deposunda çalışan 400 kişiye ulaşılmış, 314 anket analiz edilmiştir. Bu sayı gerekli örneklem sayısını karşılamaktadır. Anket dört bölümden oluşmaktadır. Araştırma modeli YEM ve AMOS kullanılarak yapılan çoklu grup karşılaştırma analizi ile test edilmiştir.

Bulgular: Sonuçlar, entelektüel sermaye ve inovasyonun firma performansının önemli belirleyicileri olduğunu göstermektedir.

Özgünlük: İlaç depolarında ilişkisel sermaye ve süreç inovasyonu boyutlarının firma performansı üzerinde en yüksek etkiye sahip olduğu ortaya konulmuştur.

Anahtar Kelimeler: Entelektüel Sermaye, Performans, İnovasyon, Yapısal Eşitlik Modeli.

JEL Sınıflndırması: O34, O30, L25.

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1. INTRODUCTION

In today's world, where the significance of the information age is growing daily, intellectual capital and innovation remain vital for firms. Intellectual capital is part of a company's intangible assets, which are knowledge-based resources (Nuryaman, 2015). Researchers have offered various definitions for intellectual capital; according to Stewart (1997: 82), it refers to the collective knowledge, information, and intellectual property within an organization that can be used to generate wealth. Petty and Guthrie (2000) describe it as an indicator capable of creating future earnings or financial capital for an organization. Andriessen (2004: 255) classifies intellectual capital into three categories: human capital, structural capital, and relational capital. Intellectual capital creates value through monetary or non-monetary, tangible or intangible resources that businesses need to identify, utilize, measure, evaluate, develop, and manage effectively (Gogan et al., 2014). Researchers (Ante, 1998; Edvinsson, 1997; Bontis, 2001) argue that traditional financial metrics alone are insufficient for analyzing the performance of knowledge-based firms. Compared to conventional financial measures, assessing intellectual capital includes non-financial aspects such as human capital, customer satisfaction, and innovation (Chen et al., 2004). Recognizing tangible and intangible assets as potential strategic assets makes measuring intellectual capital essential for businesses (Kamath, 2008: 684). The intellectual capital of a firm encompasses knowledge, experience, inventions, innovation, and market share that can influence the company (Nuryaman, 2015).

Firms need to capitalize on new opportunities, develop new products and services, and expand into new markets to achieve success and maintain a competitive edge. In developed countries, economic growth is driven more by innovation than by investment. The product life cycle is becoming shorter, and firms can stay ahead in highly competitive markets by continuously creating new products to meet customer demand (Chen et al., 2004). Innovation includes new products, technologies, markets, materials, and novel combinations. It involves developing and implementing new ideas, technologies, products, and processes (Rezende et al., 2017). According to Barney and Hesterly (2006:30), a firm gains a competitive advantage when it creates greater economic value than its competitors. Innovations are the main way an organization can achieve such differentiation (Rezende et al., 2017). The Oslo Guidelines (2005:16) divide innovation into four categories: product, process, marketing, and organizational innovation. Product innovation involves introducing new goods and services to the market, along with substantial improvements in the functionality or user features of existing offerings. Process innovation refers to changes in methods, equipment, or software—for example, adopting a new production technique. Marketing innovation focuses on increasing sales, better serving customer needs, exploring new markets, and positioning products differently. It can include new sales methods and financial strategies. Organizational innovation involves implementing new organizational practices within business operations, workplace structures, or external relationships (Kalkan et al., 2014). Product innovation helps businesses reduce costs and boost revenue by offering a variety of products (Chen et al., 2004).

Firm performance can be assessed across various categories such as financial, product, and market performance (Chen et al., 2004). Financial, market, and product performance are different ways to measure a firm's success (Kalkan et al., 2014). For commercial companies, growth indicators like sales growth and profit metrics such as return on assets or return on sales can be used for performance evaluation. Growth measures show how effectively the company is expanding into new markets or strengthening its position in existing ones. In contrast, profit measures provide insights into operational efficiency and profitability.

Companies can boost their productivity and financial performance through components of intellectual capital. Organizations with highly skilled and dedicated employees can enhance productivity and efficiency, which leads to greater profitability (Nuryaman, 2015). Strong financial results can attract investment, drive up stock prices, and increase overall company value (Nuryaman, 2015). Numerous studies have shown a connection between components of intellectual capital and company performance across various sectors, such as banking, agriculture, tourism, health, manufacturing, the automobile industry, public companies, higher education, insurance, and social cooperatives (Olarewaju and Msomi, 2021). However, there remains a significant gap in research concerning pharmaceutical warehouses, with few studies specifically focusing on this area.

Since firms operate in a highly competitive environment, they are incredibly responsive to their rivals' new product developments. As a result, they react quickly to innovative outcomes from competitors. The swift introduction of new products into the market encourages the spread of similar or alternative offerings, increasing competition in an already saturated market. This shorter product lifespan reduces the profitability of innovative outputs. Additionally, the profit margin of new products tends to stabilize due to diminishing returns from conventional technology and the rapid shifts in customer preferences. (Huang, 2023). As competition drives innovation and variety, it influences firm performance.

Extant literature has thoroughly investigated the link between intellectual capital and innovation (Huang and Huang, 2020; Ozgun et al., 2022; Olarewaju and Msomi, 2021). Additionally, previous research has demonstrated a strong link between intellectual capital and firm performance (McDowell et al., 2018). The purpose of this study is to analyze how intellectual capital and its sub-dimensions, as well as innovation and its sub-components, affect firm performance.

In the report of the Global Innovation Index (GII, 2022), which evaluated 132 countries, Türkiye ranked 37th (TÜRKPATENT,2022). This index measures the innovation capabilities of global economies. In the 2024 GII report, Türkiye is among the top three economies in the Northern Africa and Western Asia region. The pharmaceutical industry is one sector that conducts extensive research and development activities. Total global spending on pharmaceutical R&D was $244 billion in 2022 and $262 billion in 2023. For comparison, R&D expenditures totaled $145 billion in 2014 (Statista, 2025). In 2023, the pharmaceutical sector led in R&D intensity at 19 percent (www.wipo.int/global-innıvation-index). Compared to other industries, pharma companies are more driven by innovative products.

Innovation in the pharmaceutical industry significantly affects the health of millions and the profits of the companies involved. As of December 2022, there are 855 active organizations in the Turkish pharmaceutical sector. The market for pharmaceutical and medical health products has reached 121.6 billion TL (IEIS, 2022). Profits from successful innovation provide companies with a competitive edge. This industry needs to prioritize customer satisfaction and revenue growth. Therefore, the sector must invest a larger share of its revenues in innovation. Pharmaceutical warehouses operate in a field that combines technology and human elements, serving as intermediaries between pharmacies and pharmaceutical suppliers. They act as connectors between pharmacies and medical suppliers concerning access to medicines. Meeting the needs, demands, and expectations of customers with the widest possible range of products will help the company establish leadership in the sector. Utilizing the latest technological advancements, developing new products and processes, and improving distribution methods are highly significant for the company. Since pharmaceutical warehouses act as intermediaries, innovative activities in this sector are crucial for gaining a competitive advantage and maintaining financial stability. As a result, this sector provides an ideal environment for examining the impact of intellectual capital and innovation on performance.

Intellectual capital components positively impact a company's productivity and financial results. Firms are consistently motivated to develop new products to remain competitive (Huang, 2023: 3). Simultaneously, they strive to build intellectual capital that offers sustainable competitive advantages and forms the foundation of their innovation strategies (McDowell et al., 2018). Numerous studies have explored how the components of intellectual capital influence a company's innovation capabilities, revealing that each component has a significant, positive relationship with innovation (Subramaniam and Youndt, 2005; Roxas et al., 2017; Kalkan et al., 2014; Amin and Aslam, 2017; McDowell et al., 2018; Huang and Huang, 2020).

As noted earlier, the pharmaceutical sector highly values innovation. Turkey is among the countries that have seen the most growth in the GII over the past decade. This highlights the importance of considering innovation in firm performance, especially in innovative sectors. To do this, the model includes intellectual capital and innovation activities, which are key drivers of firm success. The data will provide industry leaders with a solid basis to improve firm performance by focusing on implementing intellectual capital. Although existing research examines the impact of intellectual capital on firm performance, there is a lack of empirical studies specifically exploring this effect within a model of innovation and intellectual capital in the pharmaceutical industry. This research is conducted in pharmaceutical warehouses engaged in R&D activities in Mersin. Due to differences in innovative products, organizations, and processes, the relationships between intellectual capital and firm performance may vary from those in other sectors. Pharmaceutical warehouses in the industry are responsible for nationwide distribution of medicines, procurement of products, and sometimes, production of these products. They are not just participants; they are innovators. Their ability to respond quickly to changing consumer preferences enables them to offer specialized products and services that larger firms often cannot match. For this reason, pharmaceutical warehouses are located in many regions across the country. Serving both as suppliers and as players in developing new products and processes, pharmaceutical warehouses hold a crucial role in the healthcare sector. The literature review shows that this sector has remained relatively underexplored in the academic field in Turkey; therefore, it presents a significant gap for further research. On the other hand, from an economic perspective, the widespread presence of pharmaceutical warehouses across the country contributes significantly to the sector by creating employment and boosting local economies. Its goal is to make a meaningful contribution by exploring this area. First, it incorporates a research model that includes intellectual capital (covering human capital (HC), structural capital (SC), and relational capital (RC)), innovation (covering organizational innovation (OI), product innovation (PI), process innovation (PrcI), and marketing innovation (MI)), and firm performance to empirically test three proposed hypotheses. Second,

it investigates which sub-variables of intellectual capital and innovation influence firm performance. Finally, it offers recommendations based on the study results.

This paper is organized as follows. The next section reviews the theoretical background of the research, examines relevant literature, and presents the research hypotheses. Section 3 describes the research methodology, followed by the analysis and results in Section 4. Section 5 interprets the research findings, discusses their implications and concludes the study, including its limitations and suggestions for future research.

2. LITERATURE REVIEW and HYPOTHESES DEVELOPMENT

This section endeavors to outline the theoretical framework and advance the hypotheses underpinning this study. For this purpose, the key variables of the study are discussed in the extant literature. This section concludes with a presentation of the conceptual framework underpinning the research model.

The firm comprises tangible resources, such as land, labor, and capital, as well as intangible resources, including capabilities and knowledge (Ozgun et al., 2022). The modern business landscape is filled with uncertainty and change. As a result, firms must compete in the marketplace, innovate with new products, and adopt cutting-edge technological solutions. The structure of intellectual capital heavily depends on knowledge, creativity, competence, and valuable skills (Truong and Nguyen, 2024). It includes various intangible resources that are crucial to a firm's overall value and competitiveness (Yang et al., 2024). Intellectual capital can be divided into three main components: human capital, structural capital, and relational capital. Human capital refers to intangible assets like intellectual ability, creativity, and innovation that employees possess. It is essential for driving innovation, as having knowledgeable, skilled, and experienced staff enables companies to adapt more easily and enhances their ability to innovate (Beltramino et al., 2021). The more human capital a firm has, the greater its capacity to exchange and combine knowledge. Additionally, Marimuthu et al. (2009) suggest that human capital increases profitability and is a valuable asset for fostering future creativity. Structural capital involves a firm's ability to access markets, hardware, software, and other supporting elements. It encompasses organizational innovations in creating new products and services, as well as technological innovations related to engineering, systems, processes, and equipment owned by the company. Stiles and Kulvisaechana (2004) observed that structural capital links a firm's resources into processes that generate value for customers and provide sustainable competitive advantages. Gigade and Bhide (2025) investigated the impact of intellectual capital and green innovation on the firm performance of micro, small, and medium enterprises in India. Structural equation modeling (SEM) is used to test the hypotheses. The study found a positive relationship between intellectual capital, green innovation, and firm performance. Mennes et al. (2018), focusing on industrial SMEs in the Netherlands, note that structural capital promotes employee collaboration in decision-making and interaction with various knowledge structures, thereby boosting their innovative capacity. Relational capital pertains to the ability to develop positive relationships with internal and external stakeholders, such as customers, consumers, suppliers, creditors, and government agencies (Nuryaman, 2015). Well-developed relational capital facilitates knowledge sharing through trust and mutual understanding, which in turn stimulates idea generation and innovation (Beltramino et al., 2021). Zerenler et al. (2008) identified a positive relationship between relational capital and innovation in the Turkish automotive supplier industry. This study considers all three components to evaluate their impact on firm performance. Empirical research in existing literature explores the link between intellectual capital and firm performance. For example, Sumedrea (2013) analyzed the structure of intellectual capital and its influence on the economic performance of 62 non-financial companies listed on the Bucharest Stock Exchange. The results showed that during Romania's crisis, firm development was affected by structural and human capital, and a link between profitability and intellectual capital was observed. Olarewaju and Msomi (2021) found that human and structural capital significantly impacted the financial performance of 56 insurance companies from 2008 to 2019. Kalkan et al. (2014) studied the relationship among intellectual capital, innovation, organizational strategy, and firm performance, concluding that these elements positively influence a firm's success. Likewise, Subramaniam and Youndt (2005), Atalay et al. (2013), Roxas et al. (2017), and McDowell et al. (2018) also confirmed a positive connection between intellectual capital and firm performance. Building on these results, the study proposes the following hypothesis:

H1: Intellectual capital is positively related to firm performance.

The relationship between intellectual capital and innovation is a growing area of interest within the field of innovation development. Chen et al. (2004) suggest that companies with higher levels of intellectual capital tend to perform better in terms of innovation. Innovation involves introducing something new or newly developed (Yang et al., 2024). Intellectual capital is recognized as an internal competitive advantage that fosters innovation and is essential for growth (Arshad et al., 2023). The components of intellectual capital support activities necessary for generating innovation and maintaining competitive advantage, primarily

through human capital (Örnek and Ayas, 2015). The internal qualities of a firm serve as inputs to the innovation process. Encouraging employee ideas and promoting innovative behaviors positively impact a firm's performance. Previous studies highlight that innovation capabilities and intellectual capital significantly affect performance. Intangible skills and organizational resources are vital assets influencing a company's strategy and long-term success (Arshad et al., 2023). Nasiri et al. (2022) note that innovative firms tend to outperform their competitors. Atalay (2012) examined how intellectual capital influences innovation and, consequently, firm performance in the automotive supply industry using hierarchical regression analysis. The study found that increasing the sub-dimensions of intellectual capital led to greater product and organizational innovation. It was also observed that product and process innovations play a crucial role in enhancing firm performance by boosting the country's competitive power. Process innovations improve performance by reducing costs or increasing the quality of goods and services, although they are less tangible and less visible to customers than product innovations. Sustaining these improvements over time leads to increased competitiveness and higher performance (Beltramino et al., 2021). Product innovation is a key factor allowing firms to expand into new markets and industries, identify opportunities for abnormal profits, and generate revenue (Rajapathirana and Hui, 2018). In contrast, marketing innovation better addresses customer needs, penetrates new markets, or repositions a firm's product to increase sales, thereby securing a long-term competitive advantage and supporting growth. Organizational innovation can improve performance by reducing administrative and transactional costs, rather than enhancing workplace satisfaction. According to Abdelillah and Samuelides (2001), organizational innovation helps firms adapt and exploit evolving conditions to achieve rapid market growth, which positively impacts financial performance. In their study, McDowell et al. (2018) examined the role of innovation in linking intellectual capital and firm performance, especially among small and medium-sized enterprises (SMEs). Their survey of 460 SMEs in the USA suggested that human and organizational capital positively influence firm performance. It also indicated that innovation partially mediates the relationship between intellectual capital and performance. Huang and Huang (2020) found that market knowledge, relationship, and innovation capabilities have a positive effect on intellectual capital, utilizing SEM.

The components of intellectual capital not only influence each other internally but also promote innovation. Therefore, it is observed that performance, as the ultimate goal, improves positively. An enterprise's success in its field depends on its ability to effectively utilize its intellectual capital and develop innovative behaviors (Örnek and Ayas, 2015).

Similarly, studies exploring the relationship between intellectual capital and innovation show mixed results. Research by Atalay et al. (2013) in Turkey examined 113 senior managers from companies in the automotive industry to explore the link between firm performance and innovation. The study's results revealed that both product and process innovation significantly influenced firm performance. However, organizational and market innovation did not impact performance. Arshad et al. (2023) studied the relationship between innovation capability, intellectual capital, and firm performance in SMEs within the textile sector in Pakistan, using structural equation modeling. The findings suggest that innovation capabilities and intellectual capital influence the performance of SMEs. Alshuaibi et al. (2023) researched 318 SMEs in Pakistan, examining the connection between innovation, intellectual capital, and firm performance. The analysis showed that innovation capability and intellectual capital are key factors for sustainable growth and performance. Wang et al. (2018) assessed how intellectual capital affects firm performance, considering the mediating roles of both innovation speed and quality. The model was tested using structural equation modeling on data from 328 high-technology firms in China. The results indicate a positive relationship between the three components of intellectual capital and both innovation speed and quality. Cahyaningati et al. (2024), examined the correlation between intellectual capital, innovation, and corporate performance in micro, small, and medium enterprises in Indonesia. The results showed that innovation has a significant impact on business success and that intellectual capital has a considerable effect on both. Additionally, innovation mediates the relationship between intellectual capital and business performance. Beltramino et al. (2021), using SEM on 259 Argentine industrial SMEs, found that all three components of intellectual capital positively influence process and product innovation, with structural capital having the most substantial impact. Kalkan et al. (2014), Shin et al. (2016), and McDowell et al. (2018) also explored the link between intellectual capital and innovation. Therefore, the following hypotheses are proposed:

H2: Innovation is positively related to firm performance.

H3: Intellectual capital is related to innovation.

3. METHODOLOGY

This study aims to examine the impact of intellectual capital and innovation on a firm's performance. To achieve this, a questionnaire was distributed to pharmaceutical warehouses in Mersin Province in October

2023, using 400 sets of questionnaires. A convenience sampling method was employed for this purpose. There are 8 pharmaceutical warehouses in the Mersin city center. Out of these, five firms were randomly selected as the research sample. The researcher reached 350 employees and collected 314 questionnaires, with 36 excluded due to a high number of missing values. A total of 314 employees from the five firms participated, either online or face-to-face, with roughly 90% of the surveys conducted face-to-face. The omitted questionnaires were completed online. To address participants' questions about the questionnaire, face-to-face surveys were considered appropriate. This approach aimed to reduce missing data. Respondents were selected from different levels within the firms. The collected data were analyzed using structural equation modeling (SEM), utilizing SPSS and AMOS software. Sample size plays a critical role in SEM because it greatly influences the validity and reliability of the results. One standard guideline states that the minimum sample size should be between 100 and 150 for the model's fit indices to be valid (Acaravcı et al., 2018). In this study, the sample includes 314 employees, indicating the sample size is adequate. Additionally, according to Sekaran (2003), a response rate of about 30% is considered sufficient for gathering meaningful data, and four out of five respondents participated. Selecting pharmaceutical warehouses involved in research and development (R&D) activities is essential for investigating innovation.

In measuring the factors and variables identified in the analysis, scales previously established in the literature review, with reliability and validity confirmed by earlier studies, were used. To determine the participants' levels of intellectual capital, the scale developed by Kianto et al. (2010), which was also used by Atalay (2012), was employed. The scale created by Lin et al. (2010) and adopted by Atalay (2012) was utilized to assess the participants' innovation capabilities. Lastly, the performance scale developed by Alpay et al. (2008) was used to evaluate the firm's performance. The questionnaire consisted of four sections. The first section included seven questions to assess the firm's overall performance, using a 1 to 5 rating scale, where 1 indicates the lowest performance and 5 indicates the highest. The second section contained 21 questions aimed at measuring the participants' level of intellectual capital, also on a 5-point Likert scale. Similarly, the third section included 21 questions to evaluate the participants' innovation capabilities, along with a section for collecting socio-demographic information.

4. ANALYSIS and RESULTS

4.1. Research Model

This study's research model was developed through an examination of existing literature (Yorulmaz and Alkan, 2018; Sandalcı, 2020; Ada and Yardımcıoğlu, 2021; Özbaysal and Alkibay, 2023; Ampofo and Aidoo, 2022). The SEM models and hypotheses are shown in Figure 1.

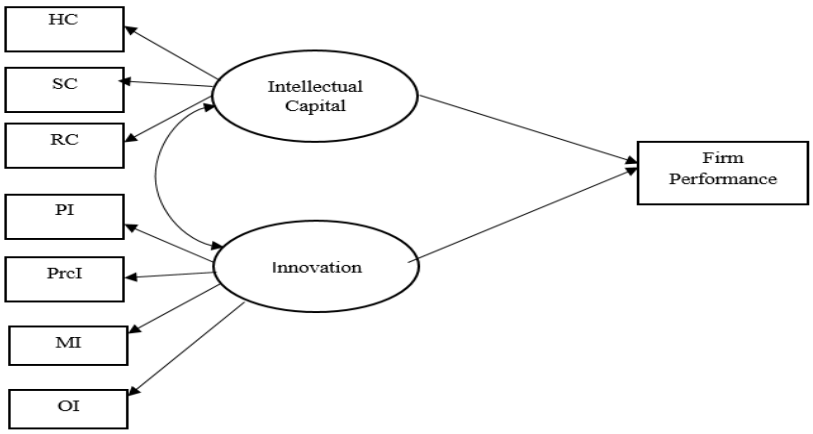

Figure 1. Research model

Cronbach's Alpha (α) coefficients were calculated for the scales and sub-dimensions used in the questionnaire, and it was observed that the reliability of the coefficients was within the acceptable range. The Cronbach's Alpha value for the firm performance scale is 0.93, the intellectual capital scale is 0.946, and the innovation scale is 0.957.

4.2. Results

Table 1 represents the descriptive statistics. The results indicate that 61.8% of the survey participants are male, while 38.2% are female. Additionally, 64.6% fall within the 25-34 age range and 70.4% of the participants graduated from high school. When examining the positions held by the participants within the firms, it can be observed that 91.4% are employees. Furthermore, 38,2% of the firms have been operating

in the sector for 25 years or more. It was also found that 82.8% of the firms have a workforce of 250 employees or more.

Table 1. Descriptive statistics

Variables	*Sub-groups*	*n*	*(%)*
Gender	Female	120	38.2
	Male	194	61.8
	18-24 Years	10	3.2
	25-34 Years	203	64.6
Age	35-44 Years	91	29
	45-54 Years	8	2.5
	>55	2	0.6
Education	Middle School	4	1.3
	High School	221	70.4
	Associate's Degree	49	15.6
	Bacholer's Degree	40	12.7
Positioning	Employee	287	91.4
	Employer/Manager	27	8.6
	1-5 Years	13	4.1
	6-10 Years	28	8.9
Firm Age	11-15 Years	56	17.8
	16-20 Years	41	13.1
	21-24 Years	56	17.8
	>25	120	38.2
Numbers of	10-49 employees	22	7
employees in the firm	50-249 employees	32	10.2
	250+	260	82.8
Total		314	100

The mean value of the innovation scale (3.35) exceeds the average. When examining the innovation types of the scale, it is evident that the lowest rating is in the sub-dimension of process innovation (3.28), while the highest rating is in the sub-dimension of organizational innovation (3.36). The mean of the intellectual capital scale (3.22) is also above average. Upon examining the intellectual capital types of the scale, it is observed that both the relational capital and human capital sub-dimensions (3,22) are higher than the structural capital sub-dimensions (3.2). It can be concluded that the average of the performance scale (3.2) is also above average. The outcomes of this estimation are detailed in Table 2. After that, the data were checked for normality. The normal distribution of the data depends on the skewness and kurtosis values being between ±3 (Shao, 2002). In this study, since the skewness and kurtosis values meet the expected values for normal distribution, it is stated that the scales used show normal distribution.

Table 2. Descriptive statistics for the research scales and sub-dimensions

Scale and Sub-dimensions	*Mean*	*Std. Deviation*
Innovation	3.35	0.728
Organizational Innovation (OI)	3.36	0.764
Product Innovation (PI)	3.4	0.794
Process Innovation (PrcI)	3.28	0.801
Marketing Innovation (MI)	3.36	0.863
Intellectual capital	3.22	0.761
Relation Capital (RC)	3.22	0.771
Human Capital (HC)	3.22	0.89
Structural Capital (SC)	3.2	0.798
Firm Performance	3.2	0.97

After that, the data were checked for reliability and validity. Table 3 presents the findings of the (α) coefficient for the scales used in the research. The reliability results for the (α) coefficients indicated that both the scales and sub-dimensions are within the acceptable range. The convergent validity of the scales was confirmed as all factor loadings exceeded 0.5, and the t-values were significant. The average variance extracted (AVE) values were above 0.5 (Fornell and Larcker, 1981; Hair et al., 2014). Table 3 shows that the AVE for each component exceeds 0.5, fulfilling the convergent validity criteria.

Table 3. Cronbach's alpha coefficient findings for the scales used in the research

Scale	*Number of Items*	*Cronbach's Alpha*	*AVE*
Firm Performance	7	0.728	0.733
Intellectual Capital	18	0.764	0.881
RC	7	0.794	0.674
HC	7	0.801	0.662
SC	4	0.863	0.540
Innovation	21	0.761	0.890
OI	5	0.771	0.797
PI	5	0.89	0.661
PrcI	6	0.798	0.584
MI	5	0.97	0.874

Table 4 presents the correlation coefficients among the research variables. The results indicate that all correlations are positive and statistically significant. In terms of the study's dependent variable, the highest correlation coefficient was found with the structural capital variable, and the lowest correlation coefficient was found with the human capital variable.

Table 4. Correlation coefficients between research variables

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Performance	1							
2. RC	0.772**	1						
3. HC	0.603**	0.836**	1					
4. SC	0.852**	0.797**	0.638**	1				
5. OI	0.694**	0.666**	0.737**	0.770**	1			
6. PI	0.606**	0.587**	0.601**	0.597**	0.617**	1		
7. PrcI	0.707**	0.644**	0.688**	0.628**	0.771**	0.802**	1	
8. MI	0.674**	0.733**	0.716**	0.615**	0.671**	0.830**	0.805**	1

Data were analysed using the AMOS programme. The model fit for different parameters is presented in Table 5. According to Kline (2015: 90), a χ2/df value below 3 is acceptable. A GFI index greater than 0.8 (Doll et al., 1994) and a CFI index greater than 0.9 (Bentler, 1990) are also considered acceptable. The RMSEA index below 0.08 (Yuhan and Bentler, 2007; Ali et al., 2021) is within acceptable limits. All goodness of fit indices (χ2/df= 2.966, GFI=0.965, CFI=0.943 and RMSEA=0.079) were within acceptable limits.

Table 5. Goodness of fit coefficients for the model

Indices	*Model fit value*
χ^2/df	2,966
GFI	0,965
CFI	0,943
RMSEA	0,079

The outcomes of the effects of intellectual capital sub-dimensions and innovation sub-dimensions on the scale, as per the SEM, are also presented in Table 6.

Table 6. Standardized coefficients for pathways in the final structural equational model

	Unstandardized Estimate	*Standardized Estimate*	*Standart Error*	*Critical Value*	*P*
Intellectual Capital					
HC	1	0.885			
RC	1.338	0.993	0.100	13.361	*
SC	0.637	0.778	0.066	9.665	*
Innovation					
PI	1	0.880			
PrcI	1.064	0.996	0.078	13.59	
MI	1.019	0.906	0.071	14.29	
OI	1.105	0.961	0.091	12.104	
Performance					
Innovation	0.237	0.160	0.114	2.073	0.038
IC	1.267	0.706	0.157	8.086	*

Note: *, p<0.05 is considered statistically significant

The findings indicate that all effect coefficients were statistically significant. Based on the standard effect coefficients, the relational capital dimension had the highest effect, while the structural capital dimension had the lowest effect. When analyzing the effects of innovation scale dimensions on the scale, all effect coefficients were found to be statistically significant. The standard effect coefficients indicate that the process innovation dimension had the highest effect, while the product innovation dimension had the lowest effect.

The structural equation model depicted in Figure 2 revealed that all effect coefficients were statistically significant, as indicated by the findings. In addition, the correlation value between the innovation scale and intellectual capital scale was calculated as 0.833 ($p<0.05$). Based on the standard effect coefficients, the effect of innovation on performance was 0.160, while the effect of intellectual capital on performance was 0.706 ($p < 0.05$). These results indicate that a 1 unit increase in innovation perception correlates with a 0.160 unit increase in firm performance and a 1 unit increase in intellectual capital perception correlates with a 0.706 unit increase in firm performance. Another finding of the structural equation model is the multiple coefficient of determination (R-squared), as in multiple regression. The coefficient of multiple determination for the model was calculated as 0.711. Accordingly, 71.1% of the variability in firm performance is explained by innovation and intellectual capital variables. Based on the results obtained, H_1, which examines the relationship between IC and firm performance, is accepted, with the model results indicating a correlation coefficient (r) of 0.706. H2 tests the impact of innovation on firm performance and the model results (r= 0,160) show that the hypothesis is accepted. Finally, H_3, which investigates the relationship between IC and innovation, is accepted, with the model results displaying a correlation coefficient of 0.833. It can be stated that, according to the hypotheses, intellectual capital and innovation are directly linked to a firm's performance.

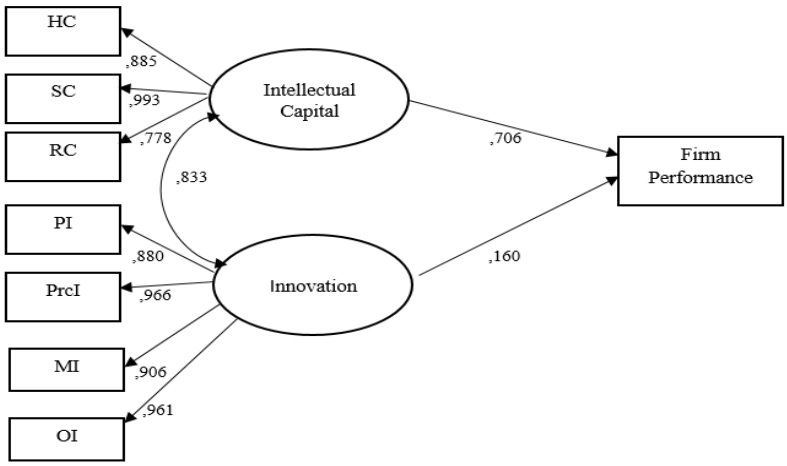

Figure 2. Final structural model

5. CONCLUSION

This study investigates how intellectual capital and innovation influence firm performance. Intellectual capital is evaluated through its human, structural, and relational components, while innovation is measured by its product, process, marketing, and organizational innovation aspects. To achieve this, a questionnaire was distributed to pharmaceutical warehouses involved in R&D activities within Mersin province, yielding data from 314 responses.

The results from SEM analysis show that the relational capital dimension has the greatest impact on market size among the sub-dimensions of intellectual capital. Relational capital is based on the relationships between the company and parties such as customers, consumers, suppliers, and creditors. In other words, relational capital is an intangible asset rooted in a company's ability to build, maintain, and foster positive relationships with anyone or anything that can influence its bottom line (Kamukama and Sulait, 2017). Since pharmaceutical warehouses are also companies that facilitate distribution between pharmacies and pharmaceutical suppliers, the research produced results that support this finding. For pharmaceutical warehouses across the country, quick procurement of products is essential. The results obtained align with the sector's characteristics. This significant impact has a positive influence on company performance, leading to competitive advantages that are vital for managing intellectual assets and ensuring long-term success. Notably, this finding highlights that efforts by pharmaceutical warehouses to strengthen relationships with stakeholders are closely linked to their competitive advantage (Kamukama and Sulait,

2017). Long-term relationships between the company and stakeholders strengthen networks and create channels through which a company can gain a competitive edge over others in the industry (Zahra et al., 1999; Kennerley and Neely, 2000; Kamukama and Sulait, 2017). Evidence indicates that intellectual capital and its sub-dimension, relational capital, positively interact with members of the business community, motivating to generate wealth by enhancing human and structural capitals (Ataei et al., 2024). Relational capital influences service roles and affects the causal relationships among people, customer satisfaction, loyalty, and financial performance (Naderi and Rostami, 2016). The relational capital component, which plays a critical role in the successful continuation of pharmaceutical warehouses' activities, will influence all stakeholders with whom warehouses maintain close relationships, including company managers, pharmaceutical manufacturers, and pharmacies. While these firms export domestic products worldwide, they also provide pharmaceutical support to domestic institutions. Therefore, the revenue generated from the exports of pharmaceutical warehouses will benefit the economy. At this point, both the Ministry of Health and company owners should undertake and implement the necessary planning.

Among the innovation sub-dimensions, the process innovation dimension showed the most substantial impact on the scale. Process innovation encompasses changes made to production or distribution processes, with the results supporting the conclusion that pharmaceutical warehouses can adopt newer, less costly methods of distribution or implement new software and equipment solutions. An example of process innovation is a new type of production method (Kalkan et al., 2014). Although product innovation should significantly support process innovation, it was found to have the lowest impact in this study. Conversely, Roger (1999) stated that the pharmaceutical industry's focus on product innovation affected firm performance. Similarly, Atalay et al. (2013) found a positive relationship between product and process innovation and firm performance. Furthermore, process innovation enhances profitability and efficiency, indicating that being a first mover in both product and process innovations significantly influences profitability. Therefore, implementing both product and process innovation can make firms more flexible in their operations, improve product quality, expand networks, and enhance competitiveness in terms of quality, people, and technology (Rajapathirana and Hui, 2018). For the pharmaceutical sector to grow quickly and adapt to digital innovations, it needs creative and imaginative employees who can develop engaging products and digital promotional content that attract customers. As a result, this can lead to higher sales and improve overall performance firms. On the other hand, innovative software and equipment solutions play a critical role in process innovation, The Ministry of Health of Türkiye should prioritize the development of digital health infrastructure and encourage the adoption of Industry 4.0 technologies across pharmaceutical supply chains.

Developments in information technology, increasing competition, and changes in traditional business concepts have led to the emergence of new approaches and innovative changes that are necessary in our era, in addition to conventional financial measurements. The literature review revealed a consensus indicating that both intellectual capital and innovation have a positive contribution to firm performance. (Chen et al, 2005; Wang and Chang, 2005; Kalkan et al, 2014; Gunday et al, 2011). Empirical findings from this research confirm the existence of a positive relationship between intellectual capital, innovation, and firm performance. The results indicate that higher levels of innovation processes and intellectual capital are associated with improved firm performance. Innovation not only contributes to the firm's sales growth, profitability, and productivity but also enhances intangible assets like intellectual capital. As a result, innovation and intellectual capital positively influence firm performance. Meanwhile, to maximize the benefits of innovation, human capital development should be a key policy priority. Providing continuous training programs for warehouse managers and employees in innovation management, logistics optimization, and digital tools will enhance operational flexibility.

This study has two critical theoretical contributions to the literature. First, to identify which intellectual capital subdimensions most significantly affect the firm's performance. Second, to determine which innovation subdimensions make the firm more likely to develop in innovation. Third, do pharmaceutical firms with higher innovation rates and higher levels of intellectual capital perform better?

Several recommendations concerning innovation and intellectual capital in the pharmaceutical industry are possible. As noted earlier, innovation and intellectual capital positively influence firm performance. The pharmaceutical industry, a crucial sector of global health, focuses on discovering, developing, producing, and marketing drugs aimed at preventing, treating, and curing various diseases. It must improve the effectiveness of innovative activities to remain competitive and profitable. Pharmaceutical companies rely on warehouses to help bring medicines to market. Therefore, warehouses should aid in understanding which subdimensions of innovation affect firm performance. Consequently, warehouse managers need to establish processes and encourage idea development toward practical innovation solutions. Innovation is seen as a factor capable of producing multiple benefits for organizations to gain a competitive advantage (Rajapathirana and Hui, 2018). Market trends are always vital for enterprises to guide their innovation

efforts. Additionally, intellectual capital is the key driving force for absorbing knowledge and achieving sustainable development. Warehouses should focus on investing in intellectual capital through ongoing training and development programs. These programs can enhance employees' skills, creativity, and innovation, and foster a culture of continuous improvement and learning. It works alongside innovation to develop business plans, choose suitable application technologies, and enhance product and service quality. This will help pharmaceutical warehouse firms become more profitable and secure a competitive edge. Furthermore, establishing networks with pharmaceutical companies, hospitals, and pharmacies can facilitate knowledge sharing and resource pooling, leading to collaborative projects that foster innovation across the industry.

However, this study has some limitations. Primarily, the population consists of employees working in pharmaceutical warehouses in Mersin. To improve understanding, future research could compare results by conducting studies in other sectors involved in research and development activities. Additionally, it was suggested that the explanatory power of the model could be improved by including more variables between the innovation and intellectual capital factors.

Conflict of Interest
No potential conflict of interest was declared by the author.

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Compliance with Ethical Standards
The study received approval from the Scientific Research and Publication Ethics Committee of the School of Graduate Studies at Tarsus University (2023/49).

Ethical Statement
It was declared by the author that scientific and ethical principles have been followed in this study and all the sources used have been properly cited.

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