Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi • Cilt: 46 • Sayı: 1 2024, ISSN: 2587-2672, ss. 129-151
DOI: 10.14780/muiibd.1391541

ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

MICRO-EVIDENCE FROM BUSINESSES OPERATING IN THE BIST TECHNOLOGY AND INFORMATION SECTORS

BİST TEKNOLOJİ VE BİLİŞİM SEKTÖRLERİNDE FAALİYET GÖSTEREN İŞLETMELERDEN MİKRO KANITLAR

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Abstract

Today, technology trade and investment represent a global economy that disregards national boundaries. This study aims to reveal the effect of operating within technology zones on the financial performance of businesses in the technology and IT sectors, as well as to examine their levels of customer satisfaction and internationalization. The financial statements of 31 businesses listed in Borsa Istanbul (BIST) technology and IT sector for the year 2022 were subjected to ratio analysis. Businesses located in and outside of technology development zones were grouped and the results of the ratio analysis were compared with the Mann-Whitney *U* test. According to the findings, no difference was found between the businesses located in technology development zones and the businesses outside the zone in terms of liquidity ratios, activity ratios, and customer satisfaction. However, a significant difference was found in terms of the ratio of non-current assets to continuing capital among financial structure ratios; a significant difference was found in terms of gross profit margin ratio and operating profit margin ratio among profitability ratios. In terms of internationalization level, it was determined that the businesses located in technology development zones showed superior performance.

Keywords: Technology and Informatics Sector, Clustering, Technology Development Zones, Financial Performance, Internationalization Level, Customer Satisfaction

JEL Classification: M21, M40, M41, O14, O16, O32

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How to cite this article/Atıf için: Ateş, G., & Marşap B. (2024). Micro-evidence from businesses operating in the BIST technology and information sectors. *Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi, 46*(1), 129-151. DOI: 10.14780/muiibd.1391541

Makale Gönderim Tarihi: 15.11.2023 **Yayına Kabul Tarihi:** 24.02.2024 **Benzerlik Oranı:** %19

Öz

Günümüzde teknoloji ticareti ve yatırımı, ulusal sınırları aşan küresel bir ekonomiyi temsil etmektedir. Bu çalışma, teknoloji bölgelerinde faaliyet göstermenin teknoloji ve bilişim sektörlerindeki işletmelerin finansal performanslarına etkisini ortaya koymayı, ayrıca müşteri memnuniyeti ve uluslararasılaşma düzeylerini incelemeyi amaçlamaktadır. Borsa İstanbul (BİST) teknoloji ve bilişim sektöründe listelenen 31 şirketin 2022 yılına ait finansal tabloları oran analizine tabi tutulmuştur. Teknoloji geliştirme bölgelerinde ve bölge dışında yer alan firmalar gruplandırılarak oran analizi sonuçları Mann–Whitney *U* testi ile karşılaştırılmıştır. Elde edilen bulgulara göre teknoloji geliştirme bölgelerinde yer alan firmalar ile bölge dışındaki firmalar arasında likidite ve faaliyet oranları ile müşteri memnuniyeti bakımından bir farklılık bulunamamıştır. Ancak, finansal yapı oranlarından duran varlıkların devamlı sermayeye oranı ve kârlılık oranlarından brüt kâr marjı oranı ve faaliyet kâr marjı oranında anlamlı bir farklılık bulunmuştur. Uluslararasılaşma düzeyi bakımından ise teknoloji geliştirme bölgelerinde yer alan firmaların daha üstün bir performans gösterdikleri belirlenmiştir.

Anahtar Kelimeler: Teknoloji ve Bilişim Sektörü, Kümelenme, Teknoloji Geliştirme Bölgeleri, Finansal Performans, Uluslararasılaşma Düzeyi, Müşteri Memnuniyeti

JEL Sınıflandırması: M21, M40, M41, O14, O16, O32

1. Introduction

The challenges arising from the internationalization of capital markets due to the impact of economic globalization and the prominence of multinational businesses have created the need for more transparent and useful financial information. Financial reporting contributes to the presentation of financial information in terms of transparency, accountability, and economic efficiency to facilitate informed decision-making by investors, reduce the information gap between capital providers and those who manage the funds, and assist global investors in risk assessment[1]. The disappearance of economic borders with the phenomenon of globalization, the openness of capital markets to international investors, and national differences in the production of financial information have increased the importance of international financial reporting (Ding, et al., 2008: 146; Riahi, 2022: 28; Stefanescu & Nistor, 2012: 86). The information in the financial reports of organizations mainly traded on the capital market provides a systematic preview of the financial position and business performance of businesses acting as a business entity or a group (Isaković-Kaplan, 2010). "*Financial statements are formalized presentations of an entity's financial position and financial performance. The purpose of financial statements is to provide information about an entity's financial position, financial performance, and cash flows to a wide range of users to help them make economic decisions. Financial statements also show the results of how managers use the resources entrusted to them*[2]".

Listed businesses are obliged by legislation to prepare and present financial statements for the business or group they own (Müller, 2014: 976). In the background of these obligations, businesses aim to increase and create value by innovating for their business performance (de Oliveira et al., 2018). Innovation improves the financial position of the business by providing process-based advantages that make the business more efficient over time (Rubera & Kirca, 2012).

1 See also, "Conceptual Framework on Financial Reporting" 2018 version, https://www.kgk.gov.tr.

2 "TMS 1 Presentation of Financial Statements" https://www.kgk.gov.tr/Portalv2Uploads/files/Duyurular/v2/TMS_TFRS_Setleri/2023/Kirmizi_Kitap/TMS__/TMS%201.pdf

As the global economy evolves, innovation is transitioning from traditional closed-chain practices to open innovation. Collaborative research and development (R&D) among businesses are emerging as a crucial method for leveraging resources and achieving complementary advantages. By overcoming the limitations of independent innovation, this approach offers new prospects for businesses to enhance both their market value and innovative capabilities (Lo et al., 2023). This cooperation creates a clustering effect by improving businesses' access to knowledge, information, and institutions (Arikan, 2009; Felzensztein et al., 2012). The reason why certain regions are more advantageous in this context is that the relationship between innovative environments and regions can be traced back to the analysis of regional clustering of businesses and innovation-centered business clusters. Technology development zones, which have emerged as innovation and commercialization centers with the importance of agglomeration externalities, contribute to the performance of businesses as success factors of country policies (Dorfman, 1983; Kenney & Von Burg, 1999; Stephens et al., 2019).

Many countries are trying to create a favorable innovation environment and protective order that aims to promote R&D for businesses and consequently contribute to sustainable economic growth (Yang et al., 2012). In Turkey, the Ministry of Industry and Trade aims to pursue a strategy that focuses on sustainable technology development, innovation promotion, raising quality standards, cost reduction, supporting technology-intensive production, and increasing international competitiveness within the framework of Technology Development Zones Law (No. 4691)[3].

The importance of technology development zones for business development and regional economic growth is generally recognized. In the literature on this topic, there are several studies comparing businesses within the zone with businesses outside the zone to assess the effects of these zones (Colombo & Delmastro, 2002; Vásquez-Urriago et al., 2014). However, the existence of different regulatory influences, such as inter-organizational relationships, collaborations, and social interactions as potential mediators driving the relationship between innovation and internationalization, is complex, and the literature on the consequences of this interaction is limited (Do et al., 2023). Moreover, there are studies showing that businesses that are more active and consistent in their innovative activities tend to achieve superior competitive positions and financial performance (Roberts & Amit, 2003). There are also studies that question the relationship between innovation and financial performance (Bayus et al., 2003; Gök & Peker, 2017; Kostopoulos et al., 2011).

This study aims to explain the current situation by comprehensively comparing the gains in financial performance, customer satisfaction, and internationalization levels of businesses operating in and outside technology development zones where cooperation and social interaction are intense.

Among the reasons why businesses locate in technology development zones are the invisible first-order effects of cooperation and social interactions, which provide an opportunity to re-examine a deeper understanding of how businesses translate their innovative activities into practice and

3 See also, Republic of Turkey Presidency of Industry and Technology, "Technology Development Zones Law No. 4691", https://www.mevzuat.gov.tr/mevzuatmetin/1.5.4691.pdf.

commercialization and to compare selected indicators from the financial information of businesses inside the region with businesses outside the region.

If first-order invisible effects no longer operate or operate below a minimum threshold in the performance of businesses today, this study is better placed to observe the gains and losses of incentives and support provided to businesses. Therefore, the study can also provide useful insights and specific strategies for other businesses that are still struggling to achieve higher levels of technology integration. The study is structured to reexamine two key questions:

1. How does the location of recognized businesses in the tech-IT sector match their performance?

2. To what extent do invisible effects support the performance of businesses located in technology development zones, and in which indicators do their current performances differ among businesses outside the zone?

In the study, the 2022 financial statement information of the businesses in the BIST technology and IT sectors within the scope of static analysis was obtained from the Public Disclosure Platform (PDP), and ratio analysis, one of the financial statement analysis techniques, was used. The study aims to determine the effects of agglomeration models, incentive and support ecosystems, and international technology integration by comparing the financial performance, customer satisfaction, and internationalization levels of businesses operating in and outside technology development zones.

2. Conceptual Framework

Industrial clusters based on the cooperation of innovative activities tend to support the formation of new businesses by supporting entrepreneurial activities rather than simply as a potential mediator of productivity gains (Porter, 1998). According to the Swann model (1998), the cluster life cycle consists of four stages: new business formation, established business growth, and cross-sectoral effects. In the first stage, clustering occurs when new businesses are attracted to the cluster by 'pull' factors and contribute to the formation of a critical mass of businesses. In the next stage, clustering occurs when cluster economies kick in and established businesses grow in the same sector or in different sectors (growth-promoting factors). When the entry of new businesses' peaks, clusters are no longer attractive to new entrants, and the maturity stage is reached, especially in highly specialized single-sector clusters. In the final stage, saturation is reached when no new businesses are attracted to clusters. In this context, the concentration of businesses is measured and considered to be linked to the sector composition, size, and life cycle of a cluster (Swann et al., 1998; Swann, 1998).

Clusters, which emerge as the concentration of businesses are based on the Marshall-Jacobs agglomeration concept. Businesses realize the agglomeration effect because they benefit from the factors of skilled labor, specialized suppliers, and knowledge spillovers (Li et al., 2019; Marshall & Marshall, 1920). Marshall argues that industries specialize geographically because proximity promotes intra-industry knowledge transfer, reduces transportation costs of inputs and outputs, and allows businesses to benefit from a more efficient labor market. Jacobs, on the other hand, argues

that diversity is key to productive innovation because "the greater the number and diversity of the division of labor, the greater the economy's natural capacity to add more types of goods and services" (Beaudry & Schiffauerova, 2009: 318). The Marshallian intra-industry agglomeration mechanism involves industry/product-specific technological knowledge, value chain transactions, factor market transactions such as specialized buyers and suppliers/specialized labor, product market competition, and competition for specialized factors of production such as labor. In the Jacobian inter-industry agglomeration mechanism, there is competition for knowledge items and knowledge diversity that can be applied in technological fields, unknowable supplier-industry related transactions such as producer services, and competition for general factors of production. Whether the cluster is industry-specialized (Marshallian) or industry-diversified (Jacobian) suggests that each has different costs and benefits (Nielsen et al., 2021).

Another taxonomy introduced in the literature is sharing-matching-learning effects. Sharing effects involve the benefits of sharing benefits, sharing costs, and reducing risk. This includes advantages arising from a variety of inputs and the shared use of local resources and facilities (Combes & Gobillon, 2015). When technology and innovation activities are clustered locally, the production of specialized inputs and services, such as patenting and commercial R&D laboratories, provides an environment that allows businesses to reduce R&D costs and rapidly implement innovations (Carlino & Kerr, 2015). In the matching effect, extending their framework to allow for labor market competition, stronger competition helps businesses save on fixed costs by underestimating the number of businesses in proportion to their labor force. Regarding research and development (R&D) and innovation, learning stands out as the crucial mechanism that encompasses all aspects associated with the creation, spread, and buildup of knowledge. In this way, it is a necessary element in improving conditions (Duranton & Puga, 2004). However, beyond the impact of these factors, there are additional factors related to the spatial concentration/agglomeration of innovative activity (Carlino & Kerr, 2015: 390).

As one of the agglomeration factors, technology regions, which have emerged since the 1950s as a new and innovative concept of space where businesses can locate/concentrate, have been growing significantly both geographically and in terms of models and strategies (Lund, 2019). Since the concept of agglomeration regained importance following the crises in mass production in the 1970s, fast-growing regions such as Emilia-Romagna in Italy, Baden-Württemberg in Germany, and Silicon Valley in the US have attracted attention (Sakarya, 2023).

In agglomeration models, capital-intensive and high-tech sectors are supported rather than traditional and labor-intensive sectors. In this context, technology development zones prioritize the economic dimensions of innovation, technology, and science. They leverage knowledge and technology to enhance the competitiveness of businesses, elevate the overall innovation landscape in the region, and generate wealth for the community through the establishment of a thriving business community. Basically, with a skilled workforce, location in the flow of knowledge and technology, and environmental advantage, businesses become more competitive and thrive through collaborations and social interactions (Lund, 2019). In dense, specialized regions, close proximity

between elements is expected to boost businesses' ability to exchange key knowledge and ideas, reducing uncertainty and costs in R&D and scientific commercialization (Feldman, 1994). However, the empirical literature shows that these advantageous zones have positive and negative effects on business performance:

(i) Studies Showing Positive Effects

Factors such as knowledge sharing, social capital, and customer satisfaction as antecedents of business-level innovation strategy are examined and their impact on financial performance is investigated. The research is empirically validated through an analysis of 209 technology firms situated in Taiwan's technology zones. Employing structural equation modeling, the findings reveal that a company's innovation strategies—collaborative, in-house, and outsourcing—are influenced by its knowledge sharing and social capital. The study underscores the positive impact of collaborative and in-house innovation approaches on financial performance. Additionally, the business was observed to enhance complementarity by managing internal and external knowledge acquisition conflicts, leading to improved customer satisfaction and financial performance (Chen et al., 2018). Yang et al. (2009) compared 57 intra-regional businesses with 190 extra-regional businesses using 1998–2003 data from electronics businesses listed on the Taiwan Stock Exchange that also invested in R&D. They found an advantage in R&D and a positive effect on productivity for in-region businesses arising from the fact that these zones offer a clustering effect and establish links between businesses and research institutions (Yang et al., 2009). Colombo and Delmastro (2002) compared 45 businesses located within the region with 45 businesses located outside the region. The study addresses various factors, such as the founders' personal traits, reasons for pursuing self-employment, business growth, and innovation performance. It also examines the inclination toward networking and access to public subsidies. Businesses located in the region exhibit superior growth rates compared to those outside. Moreover, they excel in adopting advanced technologies, participating in global R&D programs, forming collaborative partnerships, particularly with universities, and have more accessible opportunities for securing public subsidies (Colombo & Delmastro, 2002).

(ii) Studies Showing Negative Effects

Malairaja and Zawdie (2008) compared 22 businesses from within the region and 30 businesses from outside the region. Their findings show that there is a high level of interaction between intra-regional and extra-regional businesses and local universities. In general, in-region businesses have more links with universities than out-of-region businesses, but the difference is not statistically significant (Malairaja & Zawdie, 2008). Ferguson and Olofsson (2004) compared 30 intra-regional businesses and 36 extra-regional businesses in terms of survival, growth, employment, and sales. They find that in-region businesses have significantly higher survival rates than out-of-region businesses, but the effect on survival is positive, while there is no significant effect on growth (Ferguson & Olofsson, 2004). Löfsten and Lindelöf (2001) compared 163 in-region businesses and 100 out-of-region businesses on growth (employment and sales) and profitability variables. While they show that the presence of in-region businesses may have a positive effect on growth in terms of sales

and employment compared to out-of-region businesses, there is no evidence of a direct relationship between the location of in-region businesses and profitability (Löfsten & Lindelöf, 2001).

In this context, this study has three main hypotheses based on financial performance, customer satisfaction, and internationalization level.

Ratio analysis was used to measure financial performance. Sub-hypotheses were formed in the context of ratio analysis.

H_1: There is a significant difference between the financial performance of businesses located in technology development zones and businesses located outside technology development zones.

> H_{1a}: There is a significant difference between businesses located in technology development zones and businesses located outside technology development zones in terms of liquidity ratios.
>
> H_{1b}: There is a significant difference between businesses located inside and outside the technology development zone in terms of their financial ratios.
>
> H_{1c}: There is a significant difference between the businesses located in the technology development zone and the businesses located outside the technology development zone in terms of operating ratios.
>
> H_{1d}: There is a significant difference between the businesses located in the technology development zone and the businesses located outside the technology development zone in terms of profitability ratios.

Sales revenue and sales return data will be used to measure customer satisfaction.

H_2: There is a significant difference in customer satisfaction between businesses located in technology development zones and businesses located outside technology development zones.

The last hypothesis of the study is based on the level of internationalization, which represents growth (employment, sales, and profitability). To measure this level, the ratio of foreign sales to total sales will be used.

H_3: There is a significant difference between businesses located in technology development zones and businesses located outside technology development zones in terms of internationalization level.

3. Method

This study is comparative quantitative research conducted to determine the differences in liquidity, financial structure, activity, and profitability ratios, return on sales ratios, and foreign sales ratios of businesses operating in the field of technology and informatics in BIST technology development zones, considering their financial performance, customer satisfaction, and internationalization levels.

3.1. Dataset and Analysis

Since two of the 33 businesses in the BIST technology and IT sector went public in 2023, the financial reports of 31 businesses for 2022 were accessed, and financial information for the purpose of the study was created through Microsoft Excel.

3.2. Data Analysis

In the analysis of the data, financial ratio analyses of businesses located in technology development zones and businesses operating outside the zones were conducted. Within the scope of static analysis, financial indicators for the year 2022 were used.

Liquidity ratios; Current Ratio (CuR), Acid Test Ratio (ATR), Cash Ratio (CaR) for current assets (cv), short-term liabilities (stl), inventories (i), cash and cash equivalents (cce),

$$CuR = \frac{cv}{stl}, ATR = \frac{(cv - i)}{stl}, CaR = \frac{cce}{stl} \tag{1}$$

Financial structure ratios; Financial Leverage Ratio (LLR), Debt to Equity Ratio (DEER), Shareholders' Equity to Total Assets Ratio (SETAR), stl to Shareholders' Equity Ratio (stlSER), stl to Total Liabilities + Total Equity Ratio (stlTLTER), ltl to Total Liabilities + Total Equity Ratio (ltlTLTER), Ratio of Non-Current Assets to Continuing Capital (NCACC) for items including operating income (oi), operating expenses (oe), long-term liabilities (ltl), shareholders' equity (se), total assets (ta), total liabilities (tl), non-current assets (nca),

$$LLR = \frac{oe}{oi}, DEER = \frac{\sum stl, utl}{se}, SETAR = \frac{se}{ta}, stlSER = \frac{stl}{se}$$
$$stlTLTER = \frac{stl}{tl}, ltlTLTER = \frac{utl}{tl}, NCACC = \frac{nca}{utl + se} \tag{2}$$

Operating ratios are Cash and Cash Equivalents Turnover Ratio (CCETR), Current Asset Turnover Ratio (CATR), Asset Turnover Ratio (AsTR), and Shareholders' Equity Turnover Ratio (SELR), and revenue item is taken for net sales (ns). Cash and cash equivalents (dh), total assets (ta) for the items used,

$$CCETR = \frac{ta}{cce}, CATR = \frac{ns}{cv}, AsTR = \frac{ns}{ta}, SELR = \frac{ns}{se} \tag{3}$$

Profitability ratios are Return on Equity Ratio (ROE), Return on Total Assets Ratio (ROA), Gross Profit Margin Ratio (GPMR), Operating Profit Margin Ratio (OPMR), Net Profit Margin Ratio (NPMR) for items using net profit (np), gross sales profit (gsp), operating profit (op),

$$ROE = \frac{np}{se}, ROA = \frac{np}{ta}, GPMR = \frac{gsp}{ns}, OPMR = \frac{op}{ns}, NPMR = \frac{np}{ns} \quad (4)$$

For customer satisfaction (CS), internationalization level (IL), returns on sales (rs), international sales (is),

$$CS = \frac{rs}{ns}, IL = \frac{is}{ns} \quad (5)$$

formulas were used to calculate. Then, descriptive statistics were used to determine the demographic characteristics of the groups. In the evaluation of the research hypotheses, the Mann-Whitney *U* test for independent groups was used in the analysis of the difference between the two group means due to the nonparametric test conditions. Analyses were conducted with the help of the SPSS.25-package program.

4. Results

4.1. General Results

In the study, liquidity, financial structure, activity, profitability, sales returns, and foreign sales ratios were calculated from the data obtained from the balance sheets and income statements of 31 businesses operating in the field of technology and IT at BIST for the year 2022 within the scope of static analysis, and the findings were presented in tables. In the testing of the research hypotheses, parametric test conditions were first checked for the groups. Shapiro-Wilk test was used to evaluate normality. According to the findings obtained as a result of the test, normality was not achieved ($p<0.05$). In the study, it was tried to determine whether there is a difference between the financial performance, customer satisfaction, and internationalization levels of the businesses located in technology development zones and the businesses not located in technology development zones. The research hypotheses are " H_1: There is a significant difference between the financial performance of businesses located in technology development zones and businesses located outside technology development zones.", " H_2: There is a significant difference in customer satisfaction between businesses located in technology development zones and businesses located outside technology development zones." and " H_3: There is a significant difference between businesses located in technology development zones and businesses located outside technology development zones in terms of internationalization level.". These hypotheses were analyzed with the Mann-Whitney *U* test. The effect size was calculated.

Table 1: Demographic Characteristics of BIST Technology and IT Businesses

Groups		**(f)**	**% f**
G_1: Businesses located in the technology development zone		13	41,9
G_2: Businesses located outside the technology development zone		18	58,1
Total		31	100,0
Financial Performance		**$\bar{x}$:**	
		N: G_1=13, G_2=18	
Analysis Technique	**Financial Ratios**	**G_1**	**G_2**
Liquidity ratios	CuR	1,98	3,04
	ATR	1,83	2,66
	CaR	,53	1,12
Financial structure ratios	LLR	,43	,53
	stlTLTER	,37	,44
	ltlTLTER	,056	,08
	SETAR	,56	,51
	stlSER	23,74	1,61
	DEER	24,71	2,04
	NCACC	1,08	,31
Activity ratios	CCETR	9,49	79,68
	CATR	1,40	4,61
	AsTR	,77	1,48
	SELR	24,36	4,85
Profitability ratios	ROE	,17	,27
	ROA	,19	,16
	GPMR	,48	,21
	OPMR	,26	,17
	NPMR	,26	,26
Customer Satisfaction		**$\bar{x}$:**	
		N: G_1=13, G_2=18	
Analysis Technique	**Financial Ratios**	**G_1**	**G_2**
Ratio of sales returns to total sales	CS	1,18	2,30
Internationalization Level		**$\bar{x}$:**	
		N: G_1=13, G_2=18	
Analysis Technique	**Financial Ratios**	**G_1**	**G_2**
International sales as a percentage of total sales	IL	19,10	3,44

Table 1 shows that 42% of the businesses listed in BIST technology and IT sector are located in technology development zones, while 58% operate outside these zones.

The averages of CuR, ATR, and CaR, which are liquidity ratios of businesses located in technology development zones, are lower than those of businesses located outside the zone.

The averages of LLR, stlTLTER, and ltlTLTER, which are among the financial structure ratios of businesses located in technology development zones, are lower than those of businesses located outside the zone.

When the averages of financial structure ratios such as DEER, SETAR, stlSER, and NCACC are compared, businesses located in technology development zones have higher averages than businesses located outside the zone.

The averages of the operating ratios of the businesses located in the technology development zones, namely, CCETR, CATR, and AsTR, are lower than those of the businesses located outside the zone. However, when the average of SELR is compared, businesses located in technology development zones have a higher average than businesses located outside the zone.

Among the profitability ratios of businesses located in technology development zones, the average of ROE is lower than that of businesses located outside the zone. When the averages of profitability ratios such as the ROA, GPMR, and OPMR are compared, businesses located in technology development zones have a higher average than businesses located outside the zone. In terms of NPMR averages, there is equality between the groups.

The average ratio of sales returns to total sales of businesses located in technology development zones is lower than that of businesses located outside the zone. When the average ratio of foreign sales to total sales is compared, businesses located in technology development zones have a higher average than businesses located outside the zone.

4.2. Results on the Comparison of Liquidity Ratios

Liquidity, a foundational trait of financial assets, holds significant importance in the operation of financial markets. It pertains to the ease with which assets can be bought and sold, facilitating seamless transactions for buyers and sellers in financial markets without causing substantial fluctuations in stock prices. Liquidity enables investors to address unexpected financial requirements without enduring significant losses. Additionally, it plays a crucial role in shaping investors' portfolio choices, being a key factor influencing a company's cost of capital; lower transaction costs signify higher liquidity, and conversely, increased costs indicate lower liquidity (Ahmed et al., 2020: 235). For this reason, liquidity ratios are indicators that help to reveal the solvency of the business in analyzing the current status of businesses (Karataş & Çinaroğlu, 2023: 160). In this study, the current ratio, acid-test ratio, and cash ratio were calculated, and the findings related to the liquidity ratios compared with the Mann-Whitney *U* test are presented in Table 2.

Table 2: Comparison of Liquidity Ratios of BIST Technology and IT Businesses

CuR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	16,08	15,94
Sum of Rank	209,00	287,00
Z	-,040	
Mann–Whitney *U*	116,000	
p	,968**	
ATR		

N: G_1=13, G_2=18	G_1	G_2
Mean Rank	16,85	15,39
Sum of Rank	219,00	277,00
Z	-,440	
Mann–Whitney *U*	106,000	
p	,660**	
CaR		
N: G_1=13, G_2=18	G_1	G_2
Mean Rank	17,00	15,28
Sum of Rank	221,00	275,00
Z	-,520	
Mann–Whitney *U*	104,000	
p	,603**	

Note: ** indicates that the null hypothesis of no difference is not rejected at the 5% level.

According to Table 2, there is no difference in liquidity ratios (current ratio, acid-test ratio, and cash ratio) between businesses operating in technology development zones and businesses operating outside technology development zones.

4.3. Results on the Comparison of Financial Structure Ratios

Financial structure ratios/indebtedness ratios are indicators that show how much of the liabilities in the financing of businesses are met by short/long-term liabilities and how much of equity (Karataş & Çinaroğlu, 2023: 161). The financial structure of a business provides a preliminary assessment of its impact on financial performance through its effects on financial management while determining the level of performance. The analysis of the financial structure can also have a dual effect on the ratio of debt to interest rate and economic profitability (IIeana, 2013). One should perceive debt not only as a risk but also as a potential advantage. Adopting this perspective, it is crucial to strike an optimal balance in the business financing mix between debt and equity. The optimum level involves finding the right balance between the relatively low after-tax cost of repayable loans and the higher cost associated with stable and continuing equity capital. Recognizing the inherent conflict of interest between lenders and shareholders is essential, as increased borrowing can boost shareholder profitability but poses risks for lenders who take on more risk without gaining additional returns. Consequently, there is a limit beyond which lenders may refrain from further financing a business's expansion (Coulon & Coulon, 2020a: 64). A business with minimal debt, indicating a lower proportion of liabilities in its capital structure, may encounter challenges if a significant portion of its debt is short-term. Simultaneously, having predominantly fixed and illiquid assets, such a business might experience an unexpected decline in its ability to generate operating cash flows. Conversely, a heavily indebted business can maintain solvency by having adequate liquid assets relative to its liabilities or by consistently generating reliable and predictable operating cash flows, enabling it to meet regular debt payments (Welc, 2022). In this respect, it is important to examine the analysis of financial structure ratios in addition to liquidity ratio analysis. In this study, financial leverage ratio, debt/equity ratio, equity to total assets ratio, stl to equity ratio, stl to Total Liabilities + Total Equity

ratio, ltl to Total Liabilities + Total Equity ratio, and ratio of non-current assets to continuing capital were calculated and compared with the Mann-Whitney *U* test (Table 3).

Table 3: Comparison of Financial Structure Ratios of BIST Technology and IT Businesses

LLR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,23	17,28
Sum of Rank	185,00	311,00
Z	-,921	
Mann–Whitney *U*	94,000	
p	,357**	
DEER		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,38	17,17
Sum of Rank	187,00	309,00
Z	-,841	
Mann–Whitney *U*	96,000	
p	,401**	
SETAR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	17,54	14,89
Sum of Rank	228,00	268,00
Z	-,801	
Mann–Whitney *U*	97,000	
p	,423**	
stlSER		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,23	17,28
Sum of Rank	185,00	311,00
Z	-,921	
Mann–Whitney *U*	94,000	
p	,357**	
stlTLTER		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,31	17,22
Sum of Rank	186,00	310,00
Z	-,881	
Mann–Whitney *U*	95,000	
p	,378**	
ltlTLTER		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	18,54	14,17
Sum of Rank	241,00	255,00
Z	-1,321	

Mann–Whitney *U*	84,000	
p	,186**	
NCACC		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	21,54	12,00
Sum of Rank	280,00	216,00
Z	-2,882	
Mann–Whitney *U*	45,000	
p	,004*	

Note: ** indicates that the null hypothesis of no difference at the 5% level is not rejected; * indicates that the null hypothesis of no difference at the 5% level is rejected.

There is no difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of financial leverage ratio, debt/equity ratio, equity to total assets ratio, stl to equity ratio, stl to Total Liabilities + Total Equity ratio, and ltl to Total Liabilities + Total Equity ratio. However, only one ratio differed in the comparison of financial structure ratios. Businesses operating in technology development zones perform better than businesses operating outside technology development zones in terms of the ratio of non-current assets to continuing capital ($p < 0.05$, U=45,000, r=-0.52).

4.4. Results on the Comparison of Operating Ratios

Operating ratios are the ratios that measure the level of efficient and effective use of the assets owned by the businesses and used in the realization of their activities (Karataş & Çinaroğlu, 2023: 162). Activity ratios reveal the relationship between the sales of the business and asset groups, especially the mobility of assets.

Table 4: Comparison of Operating Ratios of BIST Technology and Informatics Businesses

CCETR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,62	17,00
Sum of Rank	190,00	306,00
Z	-,721	
Mann–Whitney *U*	99,000	
p	,471**	
CATR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	13,92	17,50
Sum of Rank	181,00	315,00
Z	-1,081	
Mann–Whitney *U*	90,000	
p	,280**	
AsTR		
N: G_1=13, G_2=18	**G_1**	**G_2**

Mean Rank	13,23	18,00
Sum of Rank	172,00	324,00
Z	-1,441	
Mann–Whitney *U*	81,000	
p	,150**	
SELR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	14,00	17,44
Sum of Rank	182,00	314,00
Z	-1,041	
Mann–Whitney *U*	91,000	
p	,298**	

Note: ** indicates that the null hypothesis of no difference is not rejected at the 5% level.

In this study, cash and cash equivalent turnover ratio, current asset turnover ratio, asset turnover ratio, and equity turnover ratio were calculated and compared with the Mann-Whitney *U* test (Table 4). According to the findings, there is no difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of operating ratios.

4.5. Results on the Comparison of Profitability Ratios

The profitability ratio, which shows the level of profitability of the business, measures financial performance by establishing a relationship between operating or financial profit and the capital used by the investors of the businesses (Coulon & Coulon, 2020b: 86; Karataş & Çinaroğlu, 2023: 163). Therefore, profitability ratios are used as a strategic tool to have an idea about the prosperity level and earnings management of the business, to evaluate the success of the management situation of the business by managers, to determine whether the capital financed by the shareholders of the business is used appropriately, and to calculate the profit rate of the business from the sale of its products (Kara & Toraman, 2021: 298).

Table 5: Comparison of Profitability Ratios of BIST Technology and Informatics Businesses

ROE		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	17,15	15,17
Sum of Rank	223,00	273,00
Z	-,600	
Mann–Whitney *U*	102,000	
p	,548**	
ROA		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	17,15	15,17
Sum of Rank	223,00	273,00

Z	-,600	
Mann–Whitney *U*	102,000	
p	,548**	
GPMR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	22,23	11,50
Sum of Rank	289,00	207,00
Z	-3,243	
Mann–Whitney *U*	36,000	
p	,001*	
OPMR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	20,54	12,72
Sum of Rank	267,00	229,00
Z	-2,362	
Mann–Whitney *U*	58,000	
p	,018*	
NPMR		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	18,38	14,28
Sum of Rank	239,00	257,00
Z	-1,241	
Mann–Whitney *U*	86,000	
p	,215**	

Note: ** indicates that the null hypothesis of no difference at the 5% level is not rejected; * indicates that the null hypothesis of no difference at the 5% level is rejected.

There is no difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of ROE, ROA, and NPMR. However, when profitability ratios are compared, two differences are found:

Businesses operating in technology development zones outperform businesses operating outside technology development zones in terms of gross profit margin ratio and operating profit margin ratio ($p < 0.05$, U=36,000, r=-0.58; $p < 0.05$, U=58,000, r=-0.42).

4.6. Results on the Comparison of BIST Technology and IT Businesses in terms of Customer Satisfaction and Internationalization Level

One indicator of customer satisfaction is the number of products returned due to dissatisfaction. A high level of returns from sales indicates that the product produced does not meet customer wants, needs, and expectations (due to production defects, inadequate sales service, etc.) (Akdoğan & Tenker, 2007: 197). Therefore, sales returns are the return of products that are not of the desired quality and quality as an indicator of customer satisfaction (Chauhan, 2013: 18). In this respect, the

satisfaction level of the customers of a business is high if the number of sales returns is low, and the satisfaction level is low if the amount is high.

The level of internationalization can be measured by many factors (Assaf et al., 2012; Barcellos et al., 2010; Loulianou et al., 2017). In studies conducted within the framework of internationalization level, the ratio of foreign sales to total sales is accepted as a common indicator of internationalization level (Özbay & Taşel, 2020; Vithessonthi & Racela, 2016; Xiao et al., 2013). In this study, we focused on the ratio of foreign sales to total sales, as it is the main objective to show the most intensive use and to make comparisons based on financial data (Özbay & Taşel, 2020). The foreign sales account represents the values received in return for the products (goods & services) sold across borders (Dayı, 2013: 23). Table 6 shows the business groups compared in terms of the ratio of sales returns to total sales and the ratio of foreign sales to total sales.

Table 6: Comparison of BIST Technology and IT Businesses in terms of Customer Satisfaction and Internationalization Level

CS		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	13,69	17,67
Sum of Rank	178,00	318,00
Z	-1,203	
Mann–Whitney *U*	87,000	
p	,229**	
IL		
N: G_1=13, G_2=18	**G_1**	**G_2**
Mean Rank	20,00	13,11
Sum of Rank	260,00	236,00
Z	-2,084	
Mann–Whitney *U*	65,000	
p	,037*	

Note: ** indicates that the null hypothesis of no difference at the 5% level is not rejected; * indicates that the null hypothesis of no difference at the 5% level is rejected.

There is no difference in customer satisfaction between businesses operating in technology development zones and businesses operating outside technology development zones. However, a difference was found when the level of internationalization was compared. Accordingly, businesses operating in technology development zones perform better than businesses operating outside technology development zones in terms of internationalization level ($p < 0.05$, U=65,000, r=-0.37).

5. Evaluation and Conclusion

Since it is necessary to strengthen innovative production in the technology and IT industry and to develop technological core competence to provide businesses with a competitive advantage in the market, it is observed that technology development zones, a policy that will increase market

opportunities and strengthen competitive potential, are effective; however, business managers operating in technology development zones should have high liquidity. The higher the liquidity, the stronger the solvency. In this study, the average liquidity ratios of businesses operating outside the technology development zone are higher than those of businesses operating in the technology development zone. In the literature, research findings indicate that liquidity is important in determining the performance of businesses and that low debt levels and high liquidity are effective in improving the performance of businesses (Goel et al., 2015). A study of businesses with high R&D expenditure suggests that financial position, measured as cash flow, stock of liquid assets, or the ratio of liquid assets to current liabilities, is effective for small businesses, but there is no evidence of an effect for large businesses. It is not clear whether this is due to better access to capital markets or to higher adjustment costs in R&D (Hao & Jaffe, 1993). In this study, according to the Mann-Whitney *U* test results, there is no significant difference in liquidity ratios (current ratio, acid-test ratio, and cash ratio) between businesses operating in technology development zones and businesses operating outside technology development zones. The findings of this study are in line with the results of studies showing negative effects in the literature (Ferguson & Olofsson, 2004; Löfsten & Lindelöf, 2001; Malairaja & Zawdie, 2008).

While comparing financial structure ratios, according to the Mann-Whitney *U* test results of the study, there is no difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of financial structure ratios. However, there is a significant difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of the ratio of non-current assets to continuing capital ($p < 0.05$, U=45,000, r=-0.52). Similar studies in the literature focused on financial structure ratios in different sectors and found significant differences (Demirhan, 2010; Dikmen, 2021).

According to this evidence, it is desirable that the ratio indicating how much of the fixed assets of businesses operating in technology development zones (1.08) and businesses outside the zone (0.31) are financed by continuing capital be greater than 1. Fixed assets (tangible fixed assets and equipment, etc.) are long-term assets with a useful life of more than one year, while continuing capital (equity and long-term debt, etc.) are items that represent long-term capital invested in businesses. In this context, a higher ratio implies a higher level of asset coverage for continuing capital providers, which reduces risks and builds business confidence in their ability to repay debt and earn returns. This confidence indicates that the entity has low dependence on temporary financing, has operational production capacity, and has growth potential. Therefore, although a ratio greater than 1 indicates a long-term approach and stability in the investment decisions of the businesses in the technology development zones, it is thought that factors such as different business models and capital requirements of businesses outside the region affect the optimum level of this ratio.

Another point is the comparison of activity ratios from the financial ratio analysis of the study. According to the Mann-Whitney *U* test results of the study, no significant difference was found between businesses operating in technology development zones and businesses operating outside

technology development zones in terms of activity ratios. The fact that the findings of the studies examining the relationship between activity ratios and business value in the literature do not yield significant results coincides with the findings of this study (Birgili & Düzer, 2010).

Finally, profitability ratios were compared. According to the Mann-Whitney *U* test results of the study, there is no difference between the businesses operating in technology development zones and the businesses operating outside of technology development zones in terms of ROE, ROA, and NPMR. However, businesses operating in technology development zones outperform businesses operating outside technology development zones in terms of GPMR and OPMR ($p < 0.05$, U=36,000, r=-0.58; $p < 0.05$, U=58,000, r=-0.42). The findings of this study are like those of Yang et al. (2009) and Colombo & Delmastro (2002).

According to this evidence, gross margin measures the proportion of revenue remaining after deducting the cost of goods sold. Therefore, it reveals both the success of pricing and promotion policies and how efficiently production costs are managed. At this point, it provides a competitive analysis. In addition, it offers the opportunity to make strategic decisions, attract investment, and evaluate cost structures and price dynamics in the sector. The fact that businesses located in technology development zones have better performance than businesses outside the zone is thought to be an indicator of the positive impact of the ecosystem in which they are located. In general, tax issues have an impact on overall profitability and financial performance, as taxes affect the net profit margin and the amount of earnings reinvested in the business. However, the operating profit margin represents the percentage of revenue that remains as operating profit after deducting operating expenses, excluding non-operating items such as taxes. Therefore, when assessing the operating profit margin, the profitability of the core activities of the business is assessed first, regardless of tax status.

In the study, sales returns as an indicator of customer satisfaction, foreign sales as a common indicator of internationalization level, and total sales items were used as the main variables to provide reference. A low level of sales returns, which is an indicator of customer satisfaction, is considered a high level of satisfaction, so it can be said that technology development zones, which have a lower average, provide a better level of customer satisfaction than businesses outside the region. In the literature, it is discussed that sales returns correspond to a perceived value such as quality dissatisfaction, price dissatisfaction, and complaints in the evaluation of customer satisfaction and therefore its impact on business performance, and this study coincides with the findings of studies evaluating customer satisfaction from the business perspective (Suchánek & Králová, 2018). The level of internationalization shows a superior position for businesses located in technology development zones with a higher average. The findings of this study support studies in the literature showing that the level of internationalization is associated with better performance, especially in the service sector (Borda et al., 2017). According to the results of the Mann-Whitney *U* test, no difference was found between the businesses operating in technology development zones and the businesses operating outside the technology development zones in terms of customer satisfaction (rate of returns from sales). At this point, the findings of the study do not support the results of the

studies showing positive effects in the literature (Chen et al., 2018). However, there is a significant difference between businesses operating in technology development zones and businesses operating outside technology development zones in terms of internationalization level ($p < 0.05$, U=65,000, r=-0.37). In this study, it is concluded that businesses operating in technology development zones have better internationalization performance than businesses operating outside the zone.

This study aims to answer the questions "How does the location of businesses recognized in the technology-IT sector match their performance?", and "To what extent do invisible effects support the performance of businesses located in technology development zones, and in which indicators do their current performance make a difference between businesses outside the zone?" within the scope of static analysis. The Mann-Whitney *U* test was used to examine the performance of businesses operating in technology development zones (13) and businesses operating outside the zone (18) through financial ratio analysis. The variables of liquidity ratios, financial structure ratios, operating ratios, profitability ratios, sales returns to total sales, and foreign sales to total sales ratios of 31 businesses listed in the BIST technology and IT sector were analyzed comparatively, and the effect sizes of the differences were calculated.

In the study, the effects of agglomeration models, incentive and support ecosystems, and international technology integration were determined by comparing the financial performance, customer satisfaction, and internationalization levels of businesses located in technology development zones and businesses operating outside these zones. Although businesses located in technology development zones are still struggling to achieve meaningful technology integration, recent changes in customer access, current ratio characteristics, and financial structure and operating ratios may provide a much-needed impetus to mobilize businesses' profitability efforts. However, the advantages in the level of internationalization of technology development zones, which have emerged as an agglomeration model and as an ecosystem of incentives and support, represent a significant potential in preparing innovative talents for the future in the global economy, as they continue to provide more and more market share, high customer satisfaction, and a significant pace of "international technology integration" with professional development and changes to be made in regional technology plans.

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