

Turkish Studies

Economics, Finance, Politics

Volume 14 Issue 3, 2019, p. 781-792

DOI: 10.29228/TurkishStudies.23275

ISSN: 2667-5625

Skopje/MACEDONIA-Ankara/TURKEY



INTERNATIONAL
BALKAN
UNIVERSITY

EXCELLENCE FOR THE FUTURE
IBU.EDU.MK

Research Article / Araştırma Makalesi

Article Info/Makale Bilgisi

✍ *Received/Geliş:* 26.06.2019

✓ *Accepted/Kabul:* 10.09.2019

✍ *Report Dates/Rapor Tarihleri:* Referee 1 (26.07.2019)-Referee 2 (29.07.2019)

This article was checked by iThenticate.

THE ROLE OF R&D ON FIRM PERFORMANCE: EVIDENCE FROM BORSA ISTANBUL

*Ayşegül ÇİMEN**

ABSTRACT

Currently, the importance of research and development (R&D) expenditures is increasing in terms of both countries and firms. While countries want to be highly developed countries and increase their per capita income by rising their R&D expenditures; firms try to meet the main aim of a company from financial perspective, which is maximisation of the firm value. In this paper, the relationship between financial performances and R&D expenditures of technology firms that take place in the Public Disclosure Platform and Borsa İstanbul between 2013 and 2018 are analysed. As a result of the increasing competition, especially in the field of technology, companies want to increase their market shares, profits and firm values. Firms that can not keep up with the changes in technology face the probability of bankruptcy. Therefore, in order to understand the increasing importance of technology and the role of R & D expenditures in this sector better, firms in the technology sector are analyzed. Although many different variables have been used in the literature as indicators of innovation; the most widely used is R & D expenditures. Hence, in this study, R & D expenditures are used as a proxy of innovation, whereas net sales and profit items are included in the analysis as proxies of firm performance. The relationship between the variables is tested through panel causality test. The panel causality test is used for both of the relationships between R&D expenditures and net sales in addition to the relationship between R&D and profit. The findings of the study show that firms with higher R&D expenditures have greater net sales and profits. Besides, R&D has higher positive impact on sales than it has on profit.

Keywords: R&D, innovation, firm performance

Jel Classification Codes: O30, L25



* Dr., Dokuz Eylül Üniversitesi, E-posta: aysegul.cimen@deu.edu.tr

STRUCTURED ABSTRACT

The importance of R&D expenditures is rising for both countries and firms in this global environment. The emerging countries want to be a developed country and increase their per capita income by rising their R&D expenditures or per capita income whereas firms want to maximize share value, have higher profits and higher market share.

Governments and various institutions emphasise the role of R&D on the sustainable development of a country as well as the sustainable development of a firm. In order to support the firms, governing bodies provide incentives to foster the investments on R&D and attract investors.

R&D is an expenditure in its nature. Firms invest in R&D with a hope of having higher returns. As a result of cost-benefit analysis, investors and firms expect to have higher benefits than the costs. According to OECD Science, Technology and R&D Statistics, the countries with the highest R&D expenditure are the ones with the highest per capita income or with the highest growth rates, such as Korea. This statistic emphasizes the role of R&D expenditures on the growth rate or per capita income of countries. On contrary to this macro view, from the perspective of firms, the consequences are in the same direction. Regardless of the country, industry and timespan, in the literature it is found that research and development have positive impact on firm performance. Especially nowadays, as the firms mainly focus on catching the trends in the fast paced environment, the importance of R&D has risen.

In order to empirically prove the role of R&D on firm performance, this paper focuses on the causal link between financial performances and R&D expenditures. In this paper, the relationship between financial performances and R&D expenditures of technology firms that take place in the Public Disclosure Platform and Borsa İstanbul between 2013 and 2018 are analysed. Currently, there are sixteen companies in the technology sector at Borsa İstanbul but due to not being quoted to the Borsa İstanbul throughout the period, two companies are not involved in the dataset. So the dataset consists of fourteen companies, that are quoted to Borsa İstanbul from 2013 to 2018.

As a result of the increasing competition, especially in the field of technology, companies want to increase their market shares, profits and firm values. Firms that can not keep up with the changes in technology face the probability of bankruptcy. Therefore, in order to understand the increasing importance of technology and the role of R&D expenditures in this sector better, firms in the technology sector are analyzed. Although many different variables have been used in the literature as indicators of innovation; the most widely used is R&D expenditures. Hence, in this study, R&D expenditures are used as a proxy of innovation, whereas net sales and profit items are included in the analysis as proxies of firm performance.

For the empirical analysis, firstly regression analysis is implemented to understand how vital R&D is on net sales and profit separately. It is found that, R&D has higher impact on net sales than it has on profit. Secondly, Granger causality test is applied. No causal

relationship is found between R&D and profit. On the contrary, bidirectional causality is found between R&D and net sales.

The relationship between the variables is tested through panel causality test. The panel causality test is used for both of the relationships between R&D expenditures and net sales as well as the relationship between R&D and profit. The findings of the study show that firms with higher R&D expenditures have higher net sales and profits. Besides, R&D has higher positive impact on sales than it has on profit. Investing in innovation in this technology era is inevitable. So as to catch the trends of the market, have competitive power amongst the rivals and have sustainable growth, firms have to make investments. Research and development (R&D) is assumed is one of the main indicators of innovation all over the world. Not only for the companies, but also for the countries, the share of R&D as a percentage of gross domestic product is very important.

This study is in line with the previous studies that are conducted in the Turkish technology firms and the studies conducted on developing countries like Hsu et al. (2013). Namely, the importance of R&D on firm performance is once more proved by the empirical analysis in this paper. The findings also give an insight to policymakers regarding the positive relationship between R&D expenditures, net sales and profit.

Keywords: R&D, innovation, firm performance

Jel Classification Codes: O30, L25

AR-GE'NİN FİRMA PERFORMANSINDAKİ ROLÜ: BORSA İSTANBUL ÖRNEĞİ

ÖZ

Günümüzde Ar-Ge harcamalarının önemi hem ülkeler hem de işletmeler açısından artmaktadır. Ülkeler Ar-Ge harcamalarını artırarak gelişmişlik düzeylerini ve kişi başına düşen gelirlerini yükseltmek isterken; işletmeler ise en nihai hedefi olan şirket değerini maksimize etmeye çalışırlar. Bu çalışmada, Kamuyu Aydınlatma Platformu'nda yer alan ve 2013 ile 2018 yılları arasında Borsa İstanbul Teknoloji sektöründeki firmaların finansal performansları ile Ar-Ge harcamaları arasındaki ilişki analiz edilmiştir. Özellikle teknoloji alanındaki artan rekabet sonucunda, firmalar pazar paylarını, karlarını ve şirket değerlerini artırmak istemektedir. Teknolojideki değişimlere ayak uyduramayan firmalar ise, iflas tehlikesi ile karşı karşıya kalmaktadır. Bu yüzden, teknolojinin artan önemini ve bu sektördeki Ar-Ge harcamalarının rolünü daha iyi anlayabilmek için, teknoloji sektöründeki firmalar analiz edilmiştir. Literatürde çok farklı değişkenler inovasyonun göstergesi olarak kullanılmış olsa da; en çok kullanılan Ar-Ge harcamaları olmuştur. Bu sebeple, bu çalışmada da Ar-Ge harcamaları inovasyonun göstergesi olarak eklenirken, firma performansı ise net satışlar ve kar kalemleri cinsinden analize dahil edilmiştir. Değişkenler arasındaki ilişki, panel nedensellik testi aracılığıyla test edilmiştir. Panel nedensellik testi hem Ar-Ge harcamaları ile net satışlar arasındaki ilişkiyi hem de Ar-Ge ile firma karı arasındaki ilişkiyi ele almıştır. Çalışmanın

bulguları Ar-Ge harcamaları yüksek olan firmaların, net satışlarının ve karlarının daha yüksek olduğunu ve Ar-Ge harcamalarının satışlar üzerinde, kara göre daha yüksek olumlu katkısının olduğunu göstermektedir.

Anahtar Kelimeler: Ar-Ge, yenilik, firma performansı

Jel Sınıflandırma Kodları: O30, L25

1. Introduction

The main aim of a firm is to maximize its share value. In order to achieve this goal in such a competitive environment, firms put so much effort to catch the trends of the market. In this fast paced environment, with recent developments in technology, firms invest in innovation. Without innovation, the survival of the firms in this era is not possible.

Investing in research and development is assumed as a proxy for innovation in many firms. Research and development has an impact on firm performance and it is a means for developing performance (Ghaffar and Khan, 2014). So as to achieve the sustainable development as a goal, firms tend to minimize costs as well as maximizing sales, profit and firm value. The policies of governments and local institutions have switched because of the changes in the environment as a result of globalisation. For these reasons, governing bodies support the firms with incentives, to make more investment on R&D.

Due to its nature, R&D is an expenditure. Firms bear this expenditure with an expectation of higher returns in the future. As it is referred in Rational Choice Theory, outcomes of any condition is compared with its drawbacks and so as to make a decision, the benefits should be higher than the drawbacks. If this theory is implemented to the firms, benefits of any decision should be higher than the costs, so that that decision is worth implementing.

In addition to the companies, R&D is crucial for the countries as well. Table 1 shows the R&D expenditures of the G20 countries as a percentage of their GDPs based on the OECD data. According to Table 1, the countries with the highest R&D expenditure are the ones with the highest per capita income or with the highest growth rates, like Korea.

Table 1: Gross domestic spending on R&D (% of GDP)

	2010	2011	2012	2013	2014	2015	2016	2017
Argentina	0,56	0,57	0,64	0,62	0,59	0,62	0,53	
Australia	2,18	2,11		2,09		1,88		
Canada	1,83	1,79	1,78	1,71	1,72	1,70	1,70	1,59
China	1,71	1,78	1,91	1,99	2,02	2,06	2,11	2,13
France	2,18	2,19	2,23	2,24	2,28	2,27	2,25	2,19
Germany	2,71	2,80	2,87	2,82	2,87	2,91	2,92	3,02
Italy	1,22	1,21	1,27	1,31	1,34	1,34	1,37	1,35
Japan	3,14	3,25	3,21	3,32	3,40	3,28	3,14	3,20
Korea	3,47	3,74	4,03	4,15	4,29	4,22	4,23	4,55
Mexico	0,53	0,51	0,49	0,50	0,53	0,52	0,49	
OECD	2,28	2,31	2,31	2,33	2,35	2,34	2,34	2,37
Russia	1,05	1,01	1,03	1,03	1,07	1,10	1,10	1,11
South Africa	0,74	0,74	0,73	0,73	0,77	0,80		
Turkey	0,80	0,80	0,83	0,82	0,86	0,88	0,95	0,96
United Kingdom	1,66	1,67	1,59	1,64	1,66	1,67	1,68	1,66
United States	2,74	2,77	2,68	2,71	2,72	2,72	2,76	2,79

Source: OECD Science, Technology and R&D Statistics

At this point, the aim of this paper is to find out the impact of R&D on net sales and the profit of technology firms that are listed in Borsa Istanbul. This paper is organised as follows. Section 2 reviews the literature about the R&D and firm performance whereas Section 3 defines data and research methodology used for empirical analysis. Sections 4 indicates the findings of the analysis and finally Section 5 provides conclusion of this paper.

2. Literature Review

Prior studies mostly focus on the impact of R&D, especially in the industries like pharmaceuticals or information technology, in which R&D plays a big role. The literature in the developed countries dates back compared to the developing countries.

Regarding the developed countries; Leonard (1971) analyses the relationship between R&D expenditure and sales growth, assets, net income of sixteen companies in manufacturing industry. Finds the positive impact of R&D on firm performance which is measured in terms of growth in sales, assets and net income. Gee (1981) analyses the performance of major industries in U.S. and finds that the industries that invest a higher percentage of sales to R&D are more profitable and competitive, while industries investing less on R&D are the ones facing difficulties in foreign competition. Namiki (1986) focus on the relationship between R&D expenditure and exports of Japanese and US firms from different industries. Result show that impact of R&D on exports depends on the firm characteristics. Dave et al. (2013) investigates the relationship between R&D and firm specific characteristics like firm size, interest rate on the information technology firms listed in S&P Index. Findings show the positive impact of R&D on net sales.

Pharmaceuticals and chemicals are the industries in which the companies prefer to make R&D investment in a significant amount. For instance, Archarungroj and Hoshino (1999) studies the role of R&D on Japanese pharmaceutical and chemical industry by analysing 170 firms. Empirical findings show that R&D expenditures and R&D intensity have positive significant imoact on ROA, ROE, gross profit margin and operating income margin.

Regarding the developing countries; Ghaffar and Khan (2014) investigates the impact of R&D on firm performance in Pakistan pharmaceuticals industry. Return on asset, return on equity and earnings per share are used as indicators of firm performance. Results prove the positive impact of R&D on ROA, ROE and earnings per share. Hsu et al. (2013) investigates the relationship between R&D investment, patents and performance of Taiwanese firms from 2000 to 2011. Findings reveal that higher R&D results with higher net sales. Zhu and Huang (2012) analyses the relation between R&D investment and financial performance in Chinese listed information technology firms. The empirical results show that R&D intensity of firms are larger than other industries, and there's significant relation among R&D intensity and the firm performance.

In addition, there are some studies that focus on the importance of innovation on financial performance of technology firms in Turkey. For instance, Şişmanoğlu and Yaşar Akçalı (2016) studies the relationship between R&D expenditures, total assets and net sales in Turkey by using the data of seven information technologies companies for 2005-2014 period. Findings based on the Swamy's random coefficients model indicate the positive impact of R&D on net sales.

Ayaydın and Karaaslan (2014) analyse quarterly data of 145 manufacturing firms that are quoted to Borsa Istanbul from 2008 to 2013. Based on the panel data findings, R&D intensity's impact on firm performance is positive and statistically significant.

Öztürk and Zeren (2015) investigate the impact of R&D on sales growth of manufacturing firms in Turkey. Dataset covers period from 2007-Q1 to 2014-Q3 and Durbin-Hausman panel cointegration test is implemented to the dataset. Findings reveal the positive impact of R&D on sales growth.

Demirhan and Aracıoğlu (2017) conducts an empirical study on the impact of R&D in firm performance in the Turkish Technology industry. By implementing ratio analysis in TOPSIS, the firm performances are measured. Findings show that, intangible assets do not reflect the R&D in sales in the first three years.

İlarslan and Bıyıklı (2018) studies the impact of R&D on gross profit margin in pharmaceutical industry of Turkey from 1994 to 2016. Empirical findings indicate that gross profit margin is positively affected by the R&D intensity.

Aytekin and Özçalık (2018) analyse the relationship between R&D expenditures and the firm performance of seven companies that are continuously listed in Borsa Istanbul Technology and Information Technology Indices from 2011 to 2018. Empirical findings indicate the positive relationship between R&D and net sales and R&D and EBIT.

Regardless of the country, industry and timespan, it is found that research and development have positive impact on firm performance. Especially nowadays, as the firms mainly focus on catching the trends in the fast paced environment, the importance of R&D has risen.

3. Data and Methodology

Data consists of 14 companies that are listed in Borsa Istanbul Technology sector according to Public Disclosure Platform. Dataset covers period from 2013 to 2018 for a six-year period. Currently, there are sixteen companies in the technology sector at Borsa Istanbul but due to not being quoted to the Borsa Istanbul throughout the period, two companies are not involved in the dataset.

Table 2: Code and Name of the Companies

CODE	COMPANY NAME
ALCTL	ALCATEL LUCENT TELETAŞ TELEKOMÜNİKASYON A.Ş.
ARENA	ARENA BİLGİSAYAR SANAYİ VE TİCARET A.Ş.
ARMDA	ARMADA BİLGİSAYAR SİSTEMLERİ SANAYİ VE TİCARET A.Ş.
ASELS	ASELSAN ELEKTRONİK SANAYİ VE TİCARET A.Ş.
DGATE	DATAGATE BİLGİSAYAR MALZEMELERİ TİCARET A.Ş.
DESPC	DESPEC BİLGİSAYAR PAZARLAMA VE TİCARET A.Ş.
ESCOM	ESCORT TEKNOLOJİ YATIRIM A.Ş.
INDES	İNDEKS BİLGİSAYAR SİSTEMLERİ MÜHENDİSLİK SANAYİ VE TİCARET A.Ş.
KAREL	KAREL ELEKTRONİK SANAYİ VE TİCARET A.Ş.
KRONT	KRON TELEKOMÜNİKASYON HİZMETLERİ A.Ş.
LINK	LİNK BİLGİSAYAR SİSTEMLERİ YAZILIMI VE DONANIMI SANAYİ VE TİCARET A.Ş.
LOGO	LOGO YAZILIM SANAYİ VE TİCARET A.Ş.
NETAS	NETAŞ TELEKOMÜNİKASYON A.Ş.
PKART	PLASTİKKART AKILLI KART İLETİŞİM SİSTEMLERİ SANAYİ VE TİCARET A.Ş.

Table 2 shows the companies that are involved in the empirical analysis. Fourteen companies' names as well as the codes can be seen from Table 2.

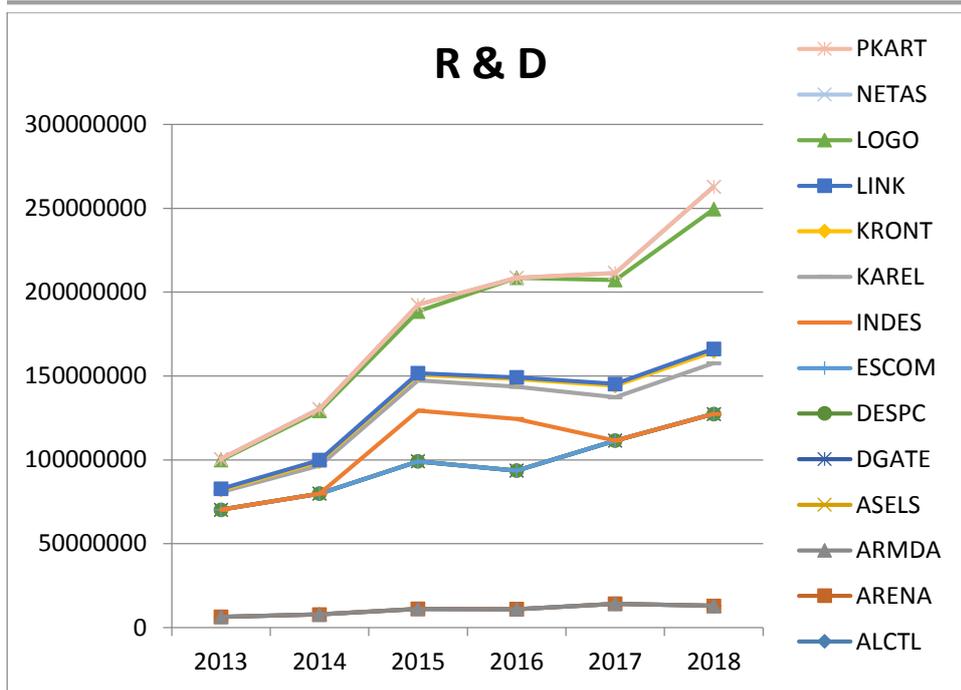


Figure 1: R&D Expenditures of Fourteen Companies

Figure 1 indicates the R&D expenditures of fourteen companies in the technology sector. PKART and LOGO companies have the highest R&D expenditure among the fourteen companies in the sector.

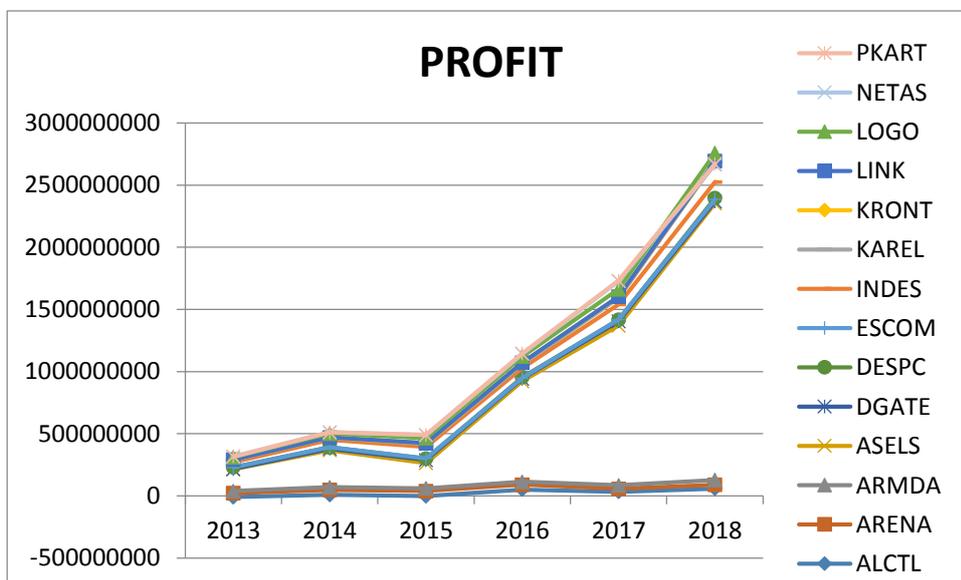


Figure 2: Profit of Fourteen Companies

Figure 2 shows the profits of fourteen companies in the analysis. ALCTL, ARENA and ARMDA are the companies with the lowest profit within the period analysed.

Figure 3: Net Sales of Fourteen Companies

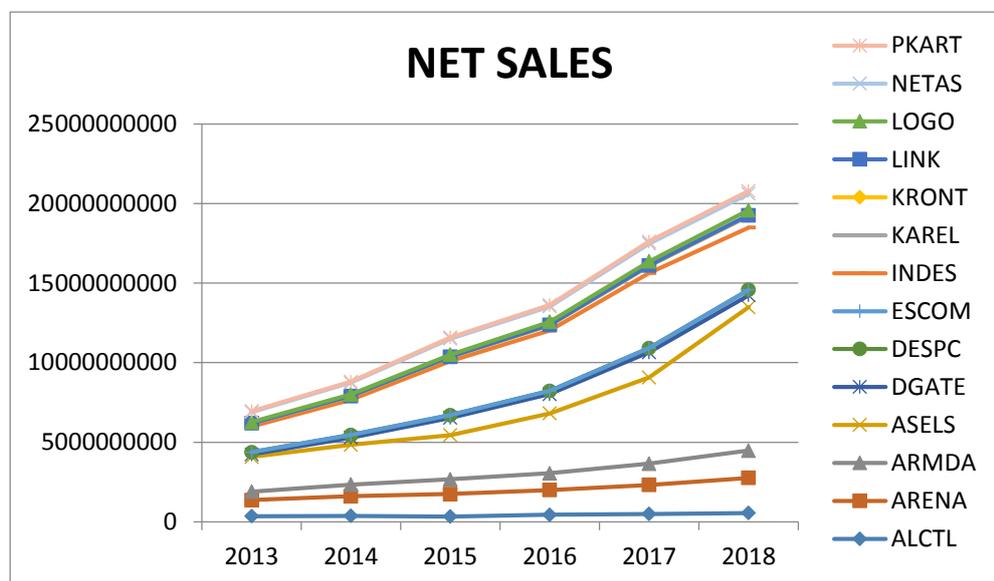


Figure 3 shows the net sales of fourteen companies. According to the net sales values, the companies can be classified into three groups. The first group represents the companies with the lowest net sales such as ARMDA, ARENA and ALCTL; the second group represents the companies with higher net sales such as ESCOM, DESPC, DGATE and ASELS. The remaining companies are in the third group in which net sales is the highest among fourteen companies.

In this paper, panel regression analysis is used. In Equation 1, the relationship between R&D and profit is explained whereas in Equation 2, the relationship between R&D and net sales is investigated. In the analysis, fixed cross section as well as the fixed period is used.

There are two hypotheses in this study. First one is;

H_0 = There is no relationship between R&D and profit.

H_1 = There is a relationship between R&D and profit.

The second hypothesis is;

H_0 = There is no relationship between R&D and net sales.

H_1 = There is a relationship between R&D and net sales.

The regression analysis is implemented by using the equations below.

$$P_{it} = RD_{it} + u_{it} \quad (1)$$

P_{it} = Profit

RD_{it} = Research and Development Expenditure

u_{it} = Error term

$$NS_{it} = RD_{it} + u_{it} \quad (2)$$

NS_{it} = Net Sales

RD_{it} = Research and Development Expenditure

u_{it} = Error term

In addition to the regression analysis, Granger causality test is used to analyse the causal relationship between R&D and profit; and R&D and net sales of a company.

$$X_t = a_1 + \sum_{i=1}^n (\beta_{1,i} X_{t-i}) + \sum_{i=1}^n (\gamma_{1,i} Y_{t-i}) + \varepsilon_{1,t}$$

$$\Delta Y_t = a_2 + \sum_{i=1}^n (\beta_{2,i} Y_{t-i}) + \sum_{i=1}^n (\gamma_{2,i} X_{t-i}) + \varepsilon_{2,t}$$

Null hypothesis of Granger causality test:

$H_0: \Delta X$, does not Granger cause ΔY

Or

$H_0: \Delta Y$, does not Granger cause ΔX

4. Findings

Table 3: The relationship between R&D and Profit

Variable	Coefficient	t-Statistic	Prob.
C	-52302554	-1.238	0.2202
RD	1.018	3.685	0.0005
R-squared	0.6456	Mean dependent var	81777859
Adjusted R-squared	0.5403	S.D. dependent var	2.90E+08
S.E. of regression	1.97E+08	Akaike info criterion	41.236
Sum squared resid	2.48E+18	Schwarz criterion	41.815
Log likelihood	-1711.952	Hannan-Quinn criter.	41.469
F-statistic	6.136	Durbin-Watson stat	0.724
Prob(F-statistic)	0.000		

Table 3 shows the impact of R&D on profit. Findings reveal that R&D has positive and statistically significant impact on the profit of the companies in the technology sector.

Table 4: The relationship between R&D and Net Sales

Variable	Coefficient	t-Statistic	Prob.
C	5.46E+08	3.738	0.0004
RD	30.270	3.168	0.0023
R-squared	0.831	Mean dependent var	9.45E+08
Adjusted R-squared	0.781	S.D. dependent var	1.46E+09
S.E. of regression	6.80E+08	Akaike info criterion	43.718
Sum squared resid	2.96E+19	Schwarz criterion	44.296
Log likelihood	-1816.162	Hannan-Quinn criter.	43.950
F-statistic	16.621	Durbin-Watson stat	0.741
Prob(F-statistic)	0.000000		

Table 4 indicates the impact of R&D on net sales. According to the probabilities, R&D has positive and statistically significant impact on net sales. In addition, the coefficient of R&D in Table 3 is quite higher than the coefficient in Table 2, which refers that R&D has more impact on net sales than it has on profit.

Table 5: Granger Causality Results

Null Hypothesis:	F-Statistic	Prob.
PROFIT \neq > RD	2.15407	0.1265
RD \neq > PROFIT	0.49078	0.6150

Table 5 indicates the causality results of profit and R&D. Null hypothesis which is profit does not granger cause R&D and R&D does not granger cause profit can not be rejected due to the fact that probability value is greater than 5 %. Namely, there is no causal relationship between profit and R&D in the period analysed.

Table 6: Granger Causality Results

Null Hypothesis:	F-Statistic	Prob.
NET SALES \neq > RD	7.23706	0.0017
RD \neq > NET SALES	7.35927	0.0016

Table 6 shows the causal relationship between net sales and R&D. Null hypothesis which is net sales does not granger cause R&D and R&D does not granger cause net sales are rejected because the probabilities are less than 5 %. Findings prove that there is bidirectional causality among net sales and R&D.

5. Conclusion

Investing in innovation in this technology era is inevitable. So as to catch the trends of the market, have competitive power amongst the rivals and have sustainable growth, firms have to make investments. Research and development (R&D) is assumed is one of the main indicators of innovation all over the world. Not only for the companies, but also for the countries, the share of R&D as a percentage of gross domestic product is very important.

To find out the impact of R&D on firm performance, this empirical study is conducted. In this paper, net sales and profit are taken as proxies for firm performance. Firms that are listed in Borsa Istanbul and in the technology sector according to Public Disclosure Platform are taken as the dataset from 2013 to 2018.

Firstly, regression analysis is implemented to understand how vital R&D on net sales and profit separately. It is found that, R&D has higher impact on net sales than it has on profit. Secondly, Granger causality test is applied. No causal relationship is found between R&D and profit. On the contrary, bidirectional causality is found between R&D and net sales.

This study is in line with the previous studies conducted in the Turkish technology firm and the studies conducted on developing countries like Hsu et al. (2013). Namely, the importance of R&D on firm performance is once more proved by the empirical analysis.

REFERENCES

- Archarunroj, P., & Hoshino, Y. (1999). Firm Size and R&D on Profitability: An empirical Analysis on Japanese Chemical and Pharmaceutical industry. *Japanese Journal of Administrative Science*, 13(2), 71-86.
- Ayaydın, H. ve Karaaslan İ. (2014). The effect of research and development Investment on Firms' Financial Performance: Evidence from Manufacturing Firms in Turkey. *Bilgi Ekonomisi ve Yönetimi Dergisi*. 9 (1): 23-39.
- Aytekin, S., & Özçalık, G. S. (2018). Borsa İstanbul Teknoloji ve Bilişim Endeksi Firmalarında Ar-Ge Harcamaları ve Finansal Performans İlişkisi. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, 6(ICEESS'18), 67-73.
- Dave, P., Wadhwa, V., Aggarwal, S., & Seetharaman, A. (2013). The Impact of Research and Development on the Financial Sustainability of Information Technology (IT) Companies Listed on the S&P 500 Index. *Journal of Sustainable Development*, 6(11), 122-138.
- Demirhan, D., & Aracıoğlu, B. İnovasyon ve Finansal Performans Arasındaki İlişki: BIST Teknoloji Endeksindeki Firmalar Üzerine Bir Araştırma. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, 195-218.
- Gee, S. (1981). Technology transfer, innovation and international competitiveness. John Wiley & Sons
- Ghaffar, A., & Khan, W. A. (2014). Impact of research and development on firm performance. *International Journal of Accounting and Financial Reporting*, 4(1), 357.
- Hsu, F. J., Chen, M. Y., Chen, Y. C., & Wang, W. C. (2013). An Empirical Study on the Relationship between R&D and Financial Performance. *Journal of Applied Finance & Banking*, 3(5), 107-119.

-
- İlarslan, K., & Bıyıklı, F. (2017). Araştırma-Geliştirme Harcamalarının İşletmelerin Finansal Performansına Etkisinin Ekonometrik Analizi: İlaç Sektöründen Bir Uygulama. *Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi*, 5(3), 122-137.
- Leonard, W.N. (1971) Research and Development in Industrial Growth. *Journal of Political Economy*, Vol.79, No.2, 232-256.
- Namiki, N. (1996). Relationship between R&D Cost and Export: A Comparative Study of Japanese & US Firms. *Nihon Boueki Gakkai, Gakkai Nenpou*, Vol.33, pp.119-121.
- Öztürk, E., & Zeren, F. (2015). The impact of r&d expenditure on firm performance in manufacturing industry: further evidence from Turkey. *International Journal of Economics and Research*, 6(2), 32-36.
- Şişmanoğlu, E., & Akçali, B. Y. (2016). The Effect of Innovation on Financial Performance of Some Information and Technology Companies in Turkey. *Ekonometri ve İstatistik e-Dergisi*, (24), 82-93.
- Zhu, Z., & Huang, F. (2012). The Effect of R&D Investment on Firms' Financial Performance: Evidence from the Chinese Listed IT Firms. *Modern Economy*, 3, 915-919.
- <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm> (Access on: 20 May 2019).