

**DÖNÜŞÜMCÜ LİDERLİĞİN AR-GE PERFORMANSINA
ETKİSİ: TÜRKİYE SAVUNMA SANAYİ SEKTÖRÜNDE BİR
ÇALIŞMA**

**EFFECT OF TRANSFORMATIONAL LEADERSHIP ON R&D
PERFORMANCE: A STUDY OF TURKISH DEFENCE
INDUSTRY**

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ÖZET

Liderlik, yönetim alanında her zaman çok önemli bir konu olmuştur. Bu konuda sayısız araştırma yapılmış ve liderlik konusu gün geçtikçe önemini arttırmaktadır. Liderlik ile ilgili çalışmalar gün geçtikçe şekil değiştirmiş ve en yaygın olarak kullanılan kavramlar etkileşimci ve dönüşümcü liderlik kavramları olmuştur. Liderlik, bir grubun üyelerini belirlenen amaçlar doğrultusunda istekli ve heyecanlı bir şekilde gerçekleştirebilmek için ikna edebilme kabiliyeti olduğundan dolayı, liderliğin örgüt performansına etkisi, üzerinde durulan konulardan olmuştur. Bu araştırmada, en yaygın kullanılan liderlik kavramlarından olan dönüşümcü liderlik ile Ar-Ge performansı arasındaki ilişki incelenmiştir. Dönüşümcü liderlik olgusunun varlığının ölçülmesi amacıyla Bass ve Avolio'nun Çok Faktörlü Liderlik Ölçeği kullanılmış olup, Ar-Ge performansının ölçülmesi için Hirst'in 2000 yılında geliştirdiği Ar-Ge performansı modelinden yararlanılarak anket hazırlanmıştır. Anket, Türkiye'nin savunma sanayi sektörünün merkezi olan Ankara'da bulunan çeşitli savunma sanayi şirketlerinde Ar-Ge bölümlerinde yönetici ya da yönetici adayı olarak çalışanlar tarafından doldurulmuştur. Elde edilen verilerin istatistiki analizlerinde SPSS for Windows paket programı kullanılmıştır. Program kullanılarak, ortalama (mean), frekans ve frekans yüzdesi dağılımı, güvenilirlik testi, korelasyon analizi ve regresyon analizinden faydalanılmıştır. Sonrasında anket sorularının veri analizleri yapılarak, sonuçlar değerlendirilmiş ve yorumlanmıştır.

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ABSTRACT

Leadership has been one of the important subjects in management. There has been numerous studies regarding subject and leadership has become more important each day. Studies regarding leadership has changed structure and the most common use of leadership have been transactional and transformational leadership. Since, leadership is the ability of convincing members of a group to achieve certain objectives willingly, effect of leadership on organizational performance has become one of the focussed subjects. In this study, the relationship between transformational leadership and R&D performance has been researched. In order to measure transformational leadership level, Bass and Avolio's Multifactor Leadership Questionnaire has been used. For R&D performance, Hirst's R&D performance model which has been developed in 2000 has been used as a survey. Data has been collected from managers or manager candidates that work at R&D departments of defence industry companies located in Ankara, which is the center of Turkish defence industry. SPSS for Windows application has been used to analyze collected data. Using SPSS, mean, frequency and frequency percent distribution, reliability test, correlation and regression analysis have been done. Afterwards, all results have been evaluated.

Keywords: Leadership, transformational leadership, R&D performance, R&D management, project

INTRODUCTION

Nowadays, team focused structures of organizations need leaders to motivate and lead not only individuals but also teams (Chen et al., 2007). Managing teams include difficulties such as, leading individuals towards certain objectives with a shared vision, using resources in most efficient way, creating a positive environment that has trust and support, coordinating information sharing and job assignments (Zaccaro et al., 2001). Changes in management, showed that current leadership approaches were not enough. As a result of this, new leadership approaches have come forward. These modern leadership concepts are called transactional and transformational leadership.

Transformational leadership, which is the most researched leadership subject to this day, is related to desired results for individuals and groups (Braun et al., 2013). It is argued that transformational leadership's most important effect is changing how teams work instead of individuals (Lord and Dinh, 2011). Research so far indicate that, managers' transformational

leadership perception is positively related to team performance. Team performance of United States of America Armed Forces infantry in battle simulations were effected positively from presence of transformational leadership and contingent rewards (Bass et al., 2003). The effect of individual perceptions of managers' transformational leadership on team performance has been shown in financial service organizations (Schaubroeck et al., 2007). Similarly, Eisenbeiss et al. (2008), has proven that employees' perception of supervisors' transformational leadership effects innovative performance of teams positively at research and development organizations. Research show that, employees have higher performance when their managers have transformational leadership traits.

Braun et al, (2013) measured effect of team members' perception of managers' transformational leadership in an objective manner. They considered that transformational leadership behaviours towards team could boost team performance to higher levels (Braun et al., 2013). Transformational leaders aim to create a shared vision in organizations (Wang and Howell, 2010). They encourage team members to find different solutions for problems using intellectual stimulation (Eisenbeiss et al., 2008). Besides, they have effective communication along team members to increase organization's ability to reach important objectives (Schaubroeck et al, 2007). Participant leadership style of transformational leadership results in a common intellectual model. This is because of equal importance of team members in organization. Combining and sharing intellectual models of team members increases effect and perception of individuals' perception of managers' transformational leadership (Dionne et al., 2010). These information shows that perception of transformational leadership in organizations is one of the most important aspects that increase organizational performance.

Because of the competition in current market, research and development (R&D) subject have been gaining importance. As a result, the performance of R&D organizations which require high level sector specific information has become more important. Kerssen-van Drongelen and Cook (1997), suggests that organizations desire measuring R&D performance in order to motivate researchers, specify activities and processes. In order to measure R&D performance, harmonizing behaviours and priorities, evaluating research, rewarding if necessary, gaining operational control, encouraging development and learning are important objectives (Loch and Tapper, 2002).

Despite studies related to transformational leadership's effect on organizational performance, studies about transformational leadership's relationship with R&D performance is limited in numbers. Therefore, aim of this study is examining relationship between transformational leadership

and R&D performance in detail. The relationship between R&D performance and transformational leadership has been analyzed by addressing different elements and results have been evaluated by addressing these elements.

LITERATURE REVIEW

I. Transformational Leadership

Transformation can be defined as, changing radically by renouncing exiting structures and habits or preparing for future situations and adopting necessary applications for future situations (Serinkan and Erdis, 2014: 7). Collins has suggested that many companies were good organizations but only some of them could transformed to the perfect organization. He investigated common characteristics of companies that completed their transformations succesfully in his research. He argued that leadership was the most important one from these common characteristics (Collins, 2004: 12).

The reason for a transformational leaders to emerge is transformation. Transformational leaders can be defined as representatives of change. They organize companies in a way that changes are made too easy. (Kocak, 2009: 28) This kind of leaders are focussed on future and they are capable of developing new strategies and oppurtunities. (Yavuz, 2008: 47) Transformational leadership can be considered as a concept which focusses on common objectives beyond employees' needs. All rewards are determined by management and employees together according to employees' mental needs (Durali, 2007: 9).

Transformational leaders, define expectations from employees clearly and they make effort to direct employees toward a shared vision. They focus on employees' abilities and improve their self-confidence in order to improve their performance. With the help of this, employees comprehend the importance of their work and they strive for organizational interests. As a result, a common organizational culture is formed and innovation is encouraged. If these newly formed organizational culture and behaviours towards innovation are cared by leaders, their charisma is effected possitively (Keegan and Hartog, 2004).

In 1978, Burns defined transformational leadership as; motivating employees towards independent or mutually formed objectives by using economic or political power and values, improving their moral values by having an effective communication and realizing their potentials (Krishhnan, 2001, Barnet and McCormick, 2004). In other words, transformational leadership aims to ensure employees to perform beyond

expectations by changing employees' feelings, thoughts, beliefs and values (Rafferty and Griffin, 2004).

In his 1985 study, *Leadership Beyond Expectations*, Bass transformed Burns' transformational leadership definition into an understandable and measurable leadership definition. Bass has developed Multi-Factor Leadership Questionnaire (MLQ) in order to make leadership to be investigated from all aspects (Brestrich, 2000: 101). According to Bass, transformational leaders escalate employees' needs to self-actualization level in Maslow's Hierarchy of Needs (Cumaguliyev, 2010: 25). Multi-Factor Leadership Questionnaire, developed by Bass has been used and its reliability has been tested by various organizations such as educational institutions, armies, law enforcement agencies, health organizations, local authorities and companies (Yilmaz, 2010: 30).

II. R&D Performance

Research and experimental development (R&D) is defined as creative studies which is made in order to improve knowledge of humanity and improving these knowledge to develop new applications (OECD, 2002).

Recently, it is accepted that R&D has been highly developed and R&D has reached to fifth generation. In the first generation of R&D which lasted from 1950s to 1965s, all produced products were demanded and they could meet people's needs. Supply and demand were in the balanced situation during second generation of R&D which lasted from mid 1960s to early 1970s. Since competition has increased, sales were tried to be increased, R&D was important in short term. Project management techniques have been started to be used in order to manage R&D activities. During third generation R&D which lasted from 1970s to 1980s, costs were tried to be decreased because of high inflation rates and low demand during that time. From 1980s to mid 1990s, in the fourth generation of R&D, the focus was on developing new products, processes were developed in order to reduce the time of development activities. At the present time, which is the period accepted as fifth generation of R&D, global competition and high technology improvement speed have made companies' borders larger. Because of this, R&D has started to interact with outside of the organization (Nobelius, 2004). Since, R&D changes rapidly, it has become difficult for companies to make profit. As a result of this, R&D structures that interact with outside of the organizations are needed (Ozsoy, 2012: 5).

R&D activities are different from other activities of the organizations. For a high performance R&D, sector specific information is required. R&D activities were considered as isolated from other activities and systematic management of R&D was difficult. Companies' approach was allocating a

specific resource to R&D and waiting for R&D to achieve good results in long term. With the new organizational structures' development, R&D management was revised and performance measurement has become necessary. When companies' have been considered generally, R&D performance was accepted as return of investment and investment on R&D has competed against other investments of the companies. As a result of this, reliable R&D performance measurement techniques and tools were required (Ojanen and Voula, 2006).

In 1999 R&D Performance Questionnaire, which consist of R&D performance metrics, has been developed by Giles Hirst. Hirst's questionnaire includes various aspects such as R&D project's success and quality together with its contribution to the company, whether the right methods have been used to achieve objectives, whether project has reached its short term and long term objectives, project's contribution to the company's development, conformity of company strategies, competitive process development capability, new knowledge acquisition and financial performance. These aspects classified into five scales. The scales of R&D performance are team performance, project quality, organizational development, competitive product/process development capability and total project satisfaction.

Team Performance: Team performance scale has been developed in order to measure different aspects of teams that make complex decisions in R&D organizations. This scale includes four items. Two of these items covers whether teams had chosen correct strategies and methods. Other two covers whether teams have reached objectives.

Project Quality: Project quality scale is identified as technical quality of the project and activities. In his study Hirst, referred to eight quality aspects listed in Garvin's 1983 study. These aspects are; performance, features, reliability, conformance, durability, servicability, aesthetics and perceived quality. These aspects emphasises on product specifications, therefore these aspects are related to R&D's product development.

Organizational Development: In his 1999 study, Hirst cited from the studies of Tacheuchi and Nonaka (1986) that an organization's new knowledge acquisition and awareness, how organizations use these knowledge in applications are important for innovation capability. Improvement of these abilities rely on organization's past. Lack of expertise development can affect development of technical abilities in this area negative. Investment for talent improvement is capable of supporting research development (Cohen and Levinthal, 1990). Therefore, this scale has been developed in order to measure project's contribution to the

developing organizations. This scale measures project's success in providing new knowledge and organizational development.

Competitive Product/Process Development Capability: The amount of investment in R&D and its reasons are defined by taking projects' market share gain or new market creation and technology development capability into consideration. In order to measure projects' competitive product/process development capability, Hirst brought this scale forward in his 1999 study. This scale includes aspects regarding organization's financial objective achievements.

Total Project Satisfaction: In order to measure project, team and leader performance total project satisfaction scale has been brought forward (Hirst, 1999). Measuring satisfaction is considered as a poor measurement. This scale includes difficulty, effectiveness of activities and probability of achieving objectives.

III. Transformational Leadership and its R&D Performance

Bass (1985) suggested that transformational leadership will be effective in every situation. In his 1985 and 1998 studies, Bass suggested that leaders can inspire and motivate workers in order to perform and accomplish objectives beyond expectations. Together with Bass's transformational leadership theory, research has showed that transformational behaviors of the leaders affected leadership performance in various organizations (Bass, 1997). In addition, Podsakoff, MacKensie and Bommer (1996) agreed that transformational leadership in organizations are related to employees' job satisfaction and performance.

Since R&D teams include many types of tasks, transformational leaders can convince team members via their charisma and mentorship in order to achieve technological innovation goals or conceive new products as a team (Bass, 1985; Yukl, 2002). Shin and Zhou (2003), studied Korean R&D workers and they agreed that transformational leadership was positively affecting employees' creativity which is essential for innovation. In their 1992 study, Waldman and Atwater examined 40 R&D projects. The result of their interviews show that existing of transformational leadership in an organization is effective for better project success. They suggested that this success increases when leaders influence higher management of organization (Waldman and Atwater, 1992). In a longterm study, Keller (1992) found that project leaders' leadership behaviors were resulted in a better project quality and budget/schedule performance.

Berson and Linton (2005), have compared the effects of transformational leadership in both R&D organizations and non-R&D organizations. They found out that transformational leadership is positively correlated with

outcomes such as quality, job satisfaction and total satisfaction in both R&D and non-R&D organizations. The correlation was stronger in R&D organizations (Berson and Linton, 2005). Literature review shows that, transformational leadership is effective in R&D organizations.

RESEARCH METHODOLOGY and HYPHOTHESES

Aim of this research is measuring relationship between transformational leadership and R&D performance.

In this research, both transformational leadership and R&D performance of employees and managers aimed to be measured. Afterwards, the relationship between transformational leadership, R&D performance and R&D performance's aspects is measured in order to understand how transformational leadership affects R&D performance. First, the relationship between transformational leadership and R&D performance by taking R&D performance as a single variable. Following, relationship between transformational leadership and R&D performance's five scales which are team performance, project quality, organizational development, competitive product/process development capability and total project satisfaction, has been measured. Therefore following hypotheses are developed;

H1: There is a positive relationship between transformational leadership and R&D performance

H2: Transformational leadership is positively related to project quality.

H3: Transformational leadership is positively related to competitive product/process development capability.

H4: Transformational leadership is positively related to organizational development.

H5: Transformational leadership is positively related to team performance.

H6: Transformational leadership is positively related to total project satisfaction.

Therefore, this research is conducted by collecting data from 101 R&D workers who work as managers or manager candidates at different defence industry companies located in capital city of Turkish Republic, Ankara. Data collection method is chosen as survey method. The survey consisted of three sections. First section included demographic questions, second section included questions about leadership traits of the participants, third section of the survey included questions regarding R&D performance. Leadership traits were measured by using Multi-Factor Leadership Questionnaire (MLQ) developed by Bass and Avolio. In order to measure

R&D performance, Hirst's R&D performance questionnaire has been used. Leadership traits and R&D performance questions consisted of 5 point Likert scale questions. Statistical analysis of the data collected from participants was analyzed using SPSS (Statistical Packages for Social Sciences) for Windows. Using SPSS and collected data, frequency, reliability, Pearson correlation and regression analysis were applied.

Transformational leadership's effect on R&D performance as a single variable was measured according to Regression Model 1 given in Fig-1.

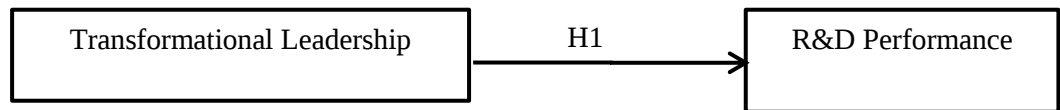


Fig-1 Regression Model 1

Relationship between transformational leadership and R&D performance's aspects, team performance, project quality, organizational development, competitive product/process development capability and total project satisfaction, were measured according to Regression Model 2 given in Fig-2.

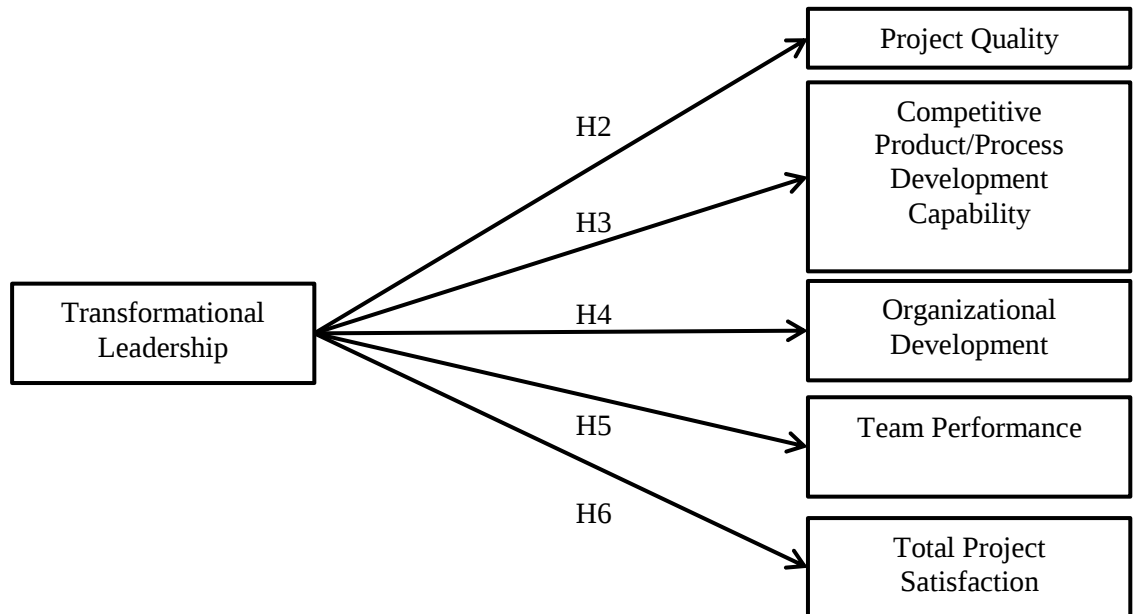


Fig-2 Regression Model 2

FINDINGS

Participants' frequency distribution of the demographic characteristics are given in Table-1.

Table-1 Demographic Characteristics of the participants

		N	Frequency
Gender	Female	18	17.8
	Male	83	82.2
Age	Less than 30 years	38	37.6
	Between 31-35 years	34	33.7
	Between 36-40 years	16	15.8
	More than 41 years	13	12.9
Job Experience	Less than 5 years	18	17.8
	Between 6-10 years	45	44.6
	Between 11-15 years	20	19.8
	Between 16-20 years	10	9.9
	More than 21	8	7.9
Marital Status	Married	70	69.3
	Single	31	30.7
Total		101	100

%82.2 of the participants are male (N=83), %17.8 are females (N=18). Most of the participants are male. It can be understood that male number of male workers are more than number of the female workers in Turkish defence industry. %37.6 of the participants (N=38) are younger than 30 years, %33.7 of the participants (N=34) are between 31 and 35 years old, %15.8 of the participants (N=16) are between 36 and 40 years old and %12.9 of the participants (N=13) are older than 41 years. Job experience frequencies of the participants are distributed as %17,8 less than 5 years (N=18), %44.6 are between 6 and 10 years (N=45), %19.8 are between 11 and 15 years (N=20), %9.9 are between 16 and 20 years (N=10) and %7.9 are more than 20 years (N=8). %69.3 of the participants (N=70) are married and %30.7 of the participants (N=31) are single.

Mean value, reliability coefficients (Cronbach's Alpha) and Pearson correlation coefficients of transformational leadership, R&D performance, scales of R&D performance are given in Table-2.

Table-2. Mean, Cronbach's Alpha, Pearson Correlation Coefficients

	Mean	S.D	1	2	3	4	5	6	7
1. Transformational Leadership	3.73	0.37	(0.76)	-	-	-	-	-	-
2. R&D Performance	3.78	0.48	0.31*	(0.89)	-	-	-	-	-
3. Project Quality	3.72	0.66	0.20	0.74*	(0.81)	-	-	-	-
4. Competitive Product/Processes Development Capability	3.64	0.74	0.19	0.55*	0.38*	(0.76)	-	-	-
5. Organizational Development	3.84	0.76	0.17	0.68*	0.45*	0.06	(0.82)	-	-
6. Team Performance	3.80	0.56	0.30*	0.83*	0.54*	0.37*	0.40*	(0.83)	-
7. Total Project Satisfaction	3.83	0.61	0.27*	0.81*	0.50*	0.41*	0.40*	0.66*	(0.74)

**p<0.01; S.D.:Standard Deviation; (): Cronbach's Alpha Coefficients

According to Table-2, Cronbach's Alpha coefficients of values are, 0.76 for Transformational Leadership, 0.89 for R&D Performance, 0.81 for Project Quality, 0.76 for Competitive Product/Process Development Capability, 0.82 for Organizational Development, 0.83 for Team Performance and 0.74 for Total Project Satisfaction. These results indicate that measurements are reliable statistically.

Pearson correlation analysis indicate that; relationship between transformational leadership and R&D performance is positive and meaningful ($r=0.31$, $p<0.01$); relationship between transformational leadership and team performance is positive and meaningful ($r=0.30$, $p<0.01$); relationship between transformational leadership and total project satisfaction is positive and meaningful ($r=0.27$, $p<0.01$); relationships between transformational leadership and project quality ($r=0.20$, $p>0.05$); transformational leadership and competitive product/process development capability ($r=0.19$, $p>0.05$); transformational leadership and organizational development ($r=0.17$, $p>0.05$) are positive but they are not meaningful. Transformational leadership and all variables of R&D performance are positively related but only team performance's and total project satisfaction's relationship between transformational leadership is meaningful while others' relationships are not meaningful. These relationship statuses indicate that team performance and total project satisfaction have more effect on total R&D performance than project quality, competitive product/process development capability and organizational development.

In order to test suggested hypotheses two regression models have been put forward. Regression Model 1 is used for testing the relationship between transformational leadership and R&D performance as a single variable which is asserted as H1. Regression Model 2 is used for testing relationship between transformational leadership and scales of R&D performance; project quality, competitive product/process development capability, organizational development, team performance, and total project satisfaction which are H2, H3, H4, H5, H6 respectively. Results of the regression analysis for measuring transformational leadership's relationship with R&D performance and its scales are given in Table-3.

Table-3. Results of Regression Model 1 and Model 2

Dependent Variables						
Independent Variable	Model 1			Model 2		
	R&D Performance	Project Quality	Competitive Product/Process Development Capability	Organizational Development	Team Performance	Total Project Satisfaction
Transformational Leadership (β)	0.30**	0.19	0.19	0.16	0.30**	0.27**
R ²	0.12	0.04	0.04	0.03	0.10	0.10
F	10.143	3.905	3.454	2.638	9.725	7.321
**p<0.01						

According to Table-3, independent variable transformational leadership's effect on dependent variable R&D performance is statistically meaningful and positive (β : 0.30, $p<0.01$). Transformational leadership explains %12 of the change in R&D performance. Basic linear regression analysis indicate that transformational leadership has a positive and meaningful effect on R&D performance. Therefore "H1: There is a positive relationship between transformational leadership and R&D performance." was supported.

Table-3 indicate that dependent variable project quality is affected by independent variable transformational leadership positively but the relationship is not statistically meaningful (β : 0.19, $p>0.05$). Therefore according to basic linear regression analysis " H2: Transformational

leadership is positively related to project quality." was rejected. According to Table-3, relationship between independent variable transformational leadership and dependent variable competitive product/process development capability is positive but it is not statistically meaningful (β : 0.19, $p > 0.05$). Therefore basic linear analysis indicate that "H3: Transformational leadership is positively related to competitive product/process development capability." was rejected. Basic linear analysis results show that relationship between transformational leadership and organizational development is positive but it is not statistically meaningful (β : 0.16, $p > 0.05$). As a result of this, "H4: Transformational leadership is positively related to organizational development." was rejected. Effect of transformational leadership on team performance is positive and statistically meaningful (β : 0.30, $p < 0.01$). Transformational leadership explains %10 of the change in team performance. Since, transformational leadership's effect on team performance is positive and meaningful, " H5: Transformational leadership is positively related to team performance." was supported. Finally, relationship between transformational leadership and total project satisfaction is positive and statistically meaningful (β : 0.27, $p < 0.01$). Transformational leadership explains %10 of the change in total project satisfaction. According to basic linear regression analysis results, " H6: Transformational leadership is positively related to total project satisfaction." was supported.

CONCLUSIONS AND DISCUSSION

The results of this study have provided important information regarding relationship between transformational leadership, R&D performance and scales of R&D performance which consist of team performance, project quality, organizational development, competitive product/process development capability and total project satisfaction. This study had multiple organizations in same business sector and various R&D activities. R&D performance and leadership traits of the managers and manager candidates have been measured by their own evaluation. Since data have been collected by different organizations and preferred questionnaires are verified measurement models and reliability tests provided good results, obtained leadership traits and R&D performance values were considered objective.

Results indicate that, team performance and total project satisfaction are positively affected by transformational leadership and effects are statistically meaningful. This study showed that having transformational leaders in a R&D organizations is beneficial for those organizations' team performance and total project satisfaction as Braun et al. suggested in their 2013 study. The relationships between transformational leadership and other scales of R&D performance, project quality, competitive

product/process development capability and organizational development, are positive but the relations are not statistically meaningful. These relationships show that transformational leadership effect on project quality, competitive product/process development capability and organizational development is not as much as its effect on team performance and total project satisfaction. Testing transformational leadership's effect on R&D performance as a single variable using the same data collected from participants indicate that transformational leadership significantly and positively affect R&D performance. As Keller (2006) suggested, this study also shows that transformational leadership is important for good R&D performance.

A limitation of the study is that demographic differences' effect on transformational leadership and R&D performance could not be measured due to limited participation. For example, 18 of the participants female and 83 of them are male. For future study, larger sample can be used by having data collected from more companies and more participants.

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