The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy

ISSN: 2357-1330

http://dx.doi.org/10.15405/epsbs.2017.12.02.28

ISMC 2017
13th International Strategic Management Conference

THE MEDIATOR EFFECT OF R&D EMPLOYMENT ON R&D EXPENDITURES AND EXPORT REVENUES

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Abstract

Today's global economic conditions are inevitably forcing companies to develop a competitive advantage against their rivals to provide a long-term sustainability. An advantage based on low labor cost and natural resources, is losing its critical importance each and every day. A new approach to provide a competitive advantage is dependent on the development of information and production of new technologies which could enable the opening of gates into the arena of international markets. The main purpose of this study is to find out the mediator effect of the R&D employee numbers on the relationship between R&D investment expenditures and export revenues. It has been targeted to submit a proposal for organizational R&D employment policies and processes. Data collection has been executed by the data collected throughout the 250 most enterprises investing the most in R&D for 2015 in Turkey and also from the research of the first 1.000 exporter in Turkey. As a result of the study, a full mediation effect of R&D personnel employment on the relation between the R&D expenditures of the enterprises and the export revenues, has been observed.

Keywords: Research and development, Employment, Export revenue, Competitiveness.

1. Introduction

Globalized competition has created a strong force on many local organizations to transform into international organizations by the activities that are spreading abroad their local markets. Export capability has turned out the most crucial channel for sustainability of today's organizations by becoming

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eISSN: 2357-1330

a way to increase the number of potential customers. Value-added products are the products which are most important for those countries and companies who want to be the main actors in the international markets. Thus, countries could find an exit for development and organizations may have an existing advantage through their rivals. Research and development (hereinafter R&D) activities are the main base to counterbalance the new demands which have not been resolved.

R&D in conjuction with international trade is an inevitable tool for those countries who want to develop and flourish (Kaya and Uğurlu, 2013). According to empirical studies that have been executed in numerous companies and industries, it has been concluded that there is an existing positive relationship between R&D activities, productivity and gross domestic product (Özer and Çiftçi, 2009). Some of the research states that R&D expenditures is an important source to increase the economical outputs (Sungur et al., 2016). Companies have started to attach more importance to R&D expenditures to produce new and better featured products (Dilek, 2016).

Research and development activities are the basic key for success in competitive markets (Pak, 2003). In R&D activities, the main target is the development of new product and/or to design a scientific infrastructure (Uzkurt, 2017). Solving the needs of customers and building new technologies and implementations for determining their needs is a critical function of the R&D department in any organization (Banger, 2016). It is expected that the increase in the number of employees in the R&D department will increase the export revenue of the organization. As a result, the organizations which are aiming to increase their market share in international markets, have to increase their employee numbers in the R&D department who could produce new information and innovative technologies within the organization. Naturally, to increase the number of employees signifies a greater R&D investment. This results in a loop of increased R&D investments which enables the organization the ability to compete within the intense and dynamic global competition and also hiring more employees for the R&D department. This main loop could make the acceleration of export revenues possible by providing innovative products for international markets. At the point the key element is the existence of the qualified R&D employee who has the capability to add value to those new products by creating innovation. Otherwise it is not possible to transform R&D expenditures into a commercial value.

2. Literature Review and Theoretical Framework

Research and development could be defined as the systematic and creative activity that exists within organizations to bring out new products and production processes (Zerenler et al., 2007; Kaya and Uğurlu, 2013). In Turkey, the ration of R&D expenditures to the GDP gets to the point of 1 percentage in overall which is in the global wide at the level of 2,5 percentage. In November 2016, the number of employees who are working at R&D centers, is 27.885. The 250 companies who are investing the most has a total 4,6 billion Turkish Lira investment in their R&D departments (Özlale, 2016). Aselsan as a company with its 2.396 employees had an expenditure of 912 million Turkish Lira in 2015 TL (Açan, 2016).

In the global competition, enterprises which are willing to have a competitive upper hand in the market aretransforming their labor-intensive capital to technological intensive capital. Those enterprises give utmost importance to their R&D expenditures (Kaya and Uğurlu, 2013; Dilek, 2016). It is thought

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that the intensity of R&D activities has had an impact on the export capability of countries and the balance of foreign trade (Güloğlu and Tekin, 2012; Göçer, 2013). The relationship between R&D expenditures, export of advanced technology products, balance of foreign trade and economic growth has been shown schematically in the figure 1 (Göçer, 2013).

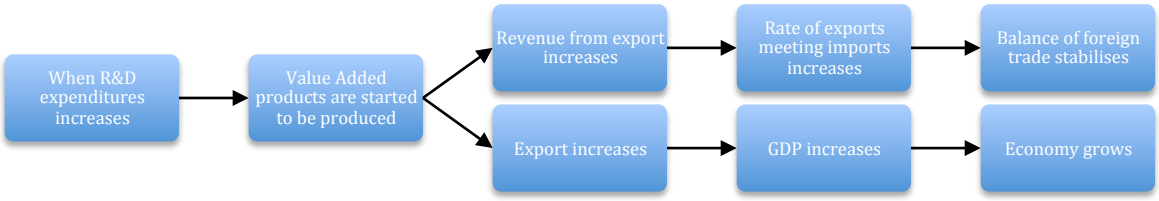

Figure 01. Relationship between R&D expenditures, balance of foreign trade and economic growth

In accordance with the literature, there have been studies that have been carried out by the data coming from enterprises along with the existing studies that has been performed by the annual data of the countries and the industries. It could be summarized as: Hirsch and Bijaoui (1985) enterprises in Israel (111 companies) were taken into consideration to examine the relation between their R&D expenditures and their export activities. It was concluded that R&D expenditure is one of the factors to increase the export performance. Ito and Pucik (1993) investigated 266 Japanese production enterprises. They pointed out the ratio of R&D expenditures to sales is a critical determiner for the export performance. Lefebvre et al. (1993) say that R&D intensity is not effecting the export performance according to their research that was followed through 101 Canadian enterprises which has employees under 200. On the other hand, they found that technological variables such as the employees which were hired in the technical level, scientific background and R&D alliances which has been established with outside partners has had an affirmative and positive impact on the export performance. According to Becchetti and Rossi (2000), R&D intensity is not increasing the export capacity due to their research among the 3.600 Italian manufacturers (Korkmaz et al., 2009).

Wagner (2008) in his study, explored the relationship between export, scale of the enterprise, intellectual capital and R&D activities. He used the panel data analysis and drew attention to intellectual capital and R&D intensity in the context of fixed effect model. In the probit model estimation, he could not catch a significant relationship. Korkmaz et al. (2009) stated that they could not find an additive effect of R&D activities on the export of those enterprises in accordance to their research amongst 70 manufacturers. Özer and Çiftçi (2009) focused on the R&D expenditures of OECD countries. They examined the panel data analysis of expenditure and export amounts of those countries. As a result of their research they found a positive and strong relationship between the R&D and exports of the OECD countries.

Uzay et al. (2012) scrutinized the relationship between export and R&D expenditures of manufacturing enterprises in Turkey during 1995-2005 by using the panel data analysis. As stated in this study, there is a delayed impact of R&D expenditures on the exports. In the research of Yıldırım and Kesikoğlu (2012), the existence of causality relationship was questioned bilaterally. According to this

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study there is a unilateral causality relationship in the direction from the R&D expenditures to the export. It was concluded that R&D policies could be an important tool to increase the export. Göçer (2013) searched the impact of R&D expenditures on export of advanced technology products, export of information-communication technologies, total export and economic growth. This study used panel data analysis of 11 emerging Asian countries during 1996-2012 period. Result of the study shows that %1 increase in R&D expenditures is increasing; the export of advance technology products as %6,5; the export of information-communication technologies as %0,6; the economic growth as %0,43. Sungur et al. (2016) found out that there is positive effect of the employment in the R&D area on the growth of the export. Related result is based on the data set collected annually for Turkey between 1990-2013.

In this study, the base is the relation between the R&D expenditures and its effect on the export. Main scope of the research is to find out the mediator effect of R&D personnel Employment on the relation between R&D expenditures of enterprises and export revenues. In line with this purpose the data set of the 250 most enterprises investing the most in R&D for 2015, has been taken into consideration. Enterprises as units of analysis are thought to be crucial in obtaining the effect of employment in R&D departments. The main target is to show a pattern for the enterprises by determining the importance of this kind of employment for them. It is also advantageous to see the model of the research as schematically. Model could be shown as Figure 2 which has been shown as below.

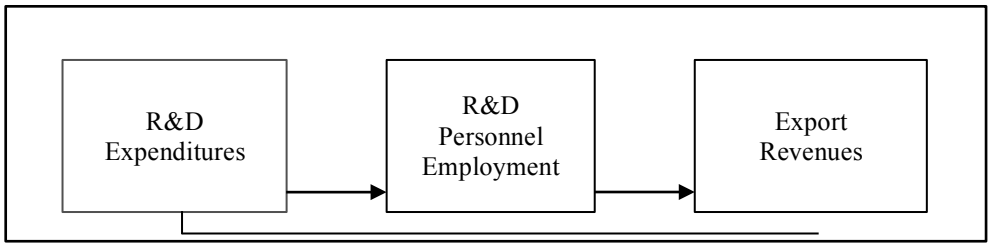

Figure 02. Research Model

3. Research Method

3.1. Hypothesis

It is supposed to be as enterprises are spending more on their R&D activities, the amount of the innovative products which are strengthening competitive advantage, will expand. Hence the companies which are composing their product portfolio with innovative products naturally will increase their sales in the international markets and as a fact this will have a positive effect on incoming revenue from exports. Therefore, the R&D personnel employment takes a big step forward as an important factor in the transformation of the R&D expenditures into export revenues. On the other hand, how so ever great the R&D expenditures may be, these R&D activities could not increase the export revenues to the desired level without the much-needed R&D personnel employment. Whereupon the hypothesis, to test the mediator effect of R&D personnel employment on the relation between R&D expenditures of enterprises and export revenues, has been designed as the following statement:

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H_1: *R&D personnel employment has a significant and positive mediator effect on the relation between R&D Expenditures of enterprises and export revenues.*

3.2. Sample and Data Collection

Data collection has been executed by the data collected throughout the 250 most enterprises investing the most in R&D for 2015 Turkey to test the hypothesis. Related data about the R&D expenditures and the number of employees working in the R&D departments has been consolidated from the report called as "the 250 most enterprises investing the most in R&D in Turkey" (for 2015) which was issued in Journal of Turkish Time in 2016. Another related data set about the export revenues has been collected from the report with the name of "Research of the first 1.000 exporter" (for 2015) which was issued by the Chamber of Turkish Exporters (TIM) in 2016. Existing net data is valid for the 151 companies in total.

3.3. Analyses

Hierarchical regression analysis method has been used to test the mediator effect of R&D personnel employment on the relation between R&D expenditures of the enterprises and export revenues. Hierarchical regression analysis groups the variables in the related model to determine the effect of each independent variable group on the model separately. Advantage of this analysis is to check and examine the multiple models in one analysis. Second advantage of the analysis is to analyze the effect of the independent variables and also gives opportunity to neglect this effect (Saruhan and Özdemirci, 2011:201). Concordantly, as a first step the effect of the independent variable on the dependent variable is being checked. Afterwards the effect of the independent variable on the mediator variable is being examined. If the both tests are statistically significant, both independent variable and the mediator variable has been tested by multiple regression analysis to determine the effect on the dependent variable. As a result of this analysis, if the effect of the independent variable on the dependent variable is decreasing, the mediator variable has a partial mediation effect. As a result of the multiple regression analysis, if the effect of the independent variable on the dependent variable is disappearing completely, it is concluded that the mediator variable has a full mediation effect.

4. Findings

Designed model, to test the mediator effect of R&D personnel employment on the relation between R&D expenditures of the enterprises and export revenues, has been analyzed by a test that has got three steps. Firstly, the effect of the R&D expenditures as an independent variable on the export revenues as a dependent variable has been examined. Secondly, the effect of R&D expenditures as an independent variable on the the R&D personnel employment as a mediator variable has been analyzed. As a third step, the total effect of the R&D expenditures variable and the R&D personnel employment variable on the export revenue variable has been observed by multiple regression analysis. Acquired results have been summarized in Table 1.

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Table 1. Analysis Result of the Mediator Effect of R&D Personnel Employment on the Relation between R&D Expenditures of the Enterprises and Export Revenues

Test 1	R^2	Adjusted R^2	F	Sig. F	Dur-Wat.	Stand. Beta	t	p
Independent Variable								
R&D Expenditures	,151	,145	26,472	,000	2,041	,388	5,145	,000*
Dependent Variable: Export Revenues								
*p < 0,01								

Test 2	R^2	Adjusted R^2	F	Sig. F	Dur-Wat	Stand. Beta	t	p
Independent Variable								
R&D Expenditures	,645	,643	270,74	,000	1,506	,803	16,454	,000*
Dependent Variable: Export Revenues								
*p < 0,01								

Test 3	R^2	Adjusted R^2	F	Sig. F	Dur-Wat	Stand. Beta	t	p
Variables								
Summary of the Model	,263	,253	26,427	,000	1,950			
R&D Expenditures						-,063	-,534	,594
R&D Personnel Number						,562	4,749	,000*
Dependent Variable: Export Revenues								
*p<0,01								

As the effect of the R&D personnel number mediator variable on the relation between the R&D expenditures variable and the export revenues variable has been tested with a three-stepped model, at the beginning simple regression analysis has been applied between R&D expenditures independent variable and the export revenues dependent variable. As a result of the applied analysis, R&D expenditures independent variable has been observed as explaining %14,5 of the change on the export revenues dependent variable. (Adjusted R2 = 0,145, F Sig. = 0,000). Therewithal, the R&D expenditures has a positive and significant effect on the export revenues (Standardized β = 0,388, p=0,000). Durbin-Watson test result has been found as 2,0410. As the first part of the analysis has resulted statistically significant, the second part the analysis has been started to be applied.

In the second part of the analysis, the effect of the R&D expenditures independent variable on the R&D personnel number as an anticipated mediator variable has been tested. As result of the simple regression analysis, it has been observed that the R&D expenditures independent variable is explaining % 64,3 of the change on the R&D personnel number mediator variable. (Adjusted R^2 = 0,643, F Sig. = 0,000). In addition to this, R&D expenditures has a ratio % 80,3 of significant and positive effect on the R&D personnel number (Standardized β = 0,803, p=0,000). Durbin-Watson test has been calculated as 1,506. Obtained conditions have made it possible to move to the last stage of the analysis.

In the last part of the analysis of the model, the R&D expenditures independent variable and the R&D personnel number mediator variable has been applied together in the multiple regression analysis to see their effect on the export revenues dependent variable. As a result of findings, Durbin-Watson test value has been calculated as 1,9500. This test result shows that there is no autocorrelation between the analyzed independent variables. Durbin-Watson test statistics could have a value between 0 and 4. As the

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test value comes how much closer to 0, it shows the positive autocorrelation between the independent variables and as the test value comes how much closer to 4, it shows the existing negative autocorrelation. If the test value stays around and closer to the value of 2, it shows that the suspicion for autocorrelation is disappearing. In the model, it has been calculated that adjusted R^2 value is 0,253 and F sig. = 0,000. This result indicates that the model is significant and independent variables are explaining %25,3 of the change on the dependent variable. Meanwhile standardized β coefficients has been checked to determine the effect of R&D expenditures variable and R&D personnel number variable on the export revenues, standardized β coefficient of R&D expenditures has been found as -0,063 which shows the statistically insignificance (p = 0,594). R&D personnel number mediator variable's standardized β coefficient is 0,562 and it has been observed as %1 significant (p = 0,000).

As the effect of the R&D expenditures and the effect of the R&D personnel number on the export revenue has been examined all together; multiple regression analysis shows that the effect of the R&D expenditures is statistically insignificant; R&D personnel number has a ratio %56,2 effect in the positive direction with a %1 significance level. As a result of the statistical findings; the mediator effect of R&D personnel employment on the relation between the R&D expenditures of the enterprises and the export revenues is a full mediation effect. In this respect, H_1 hypothesis has been accepted.

5. Conclusion and Discussions

We are living in a stage of the world that production of information is key for competitive advantage rather than the usage of information. In this respect, the enterprises should focus on their R&D activities now more than ever. It is a critical necessity innovative employee capacity which is qualified by technical information and capabilities which is generating innovative ideas each day to design the R&D based manufacturing infrastructures. The pre-planned budget availability for the R&D expenditures of the enterprises has a direct impact on the recruitment of the qualified employees. This could be a strong base for the transformation of the technical information and capability into innovative products to strengthen the competitive advantage in the international markets.

As a result of this study, it has been observed that the mediator effect of R&D personnel employment on the relation between the R&D expenditures of the enterprises and the export revenues is a full mediation effect. This fact shows that as enterprises are increasing their R&D expenditures, this is also resulting into an increase in their employee number and thus acquired new products is creating an increase in the export revenues. In another saying, it is not possible to target an accelerating impact in total export sales without giving an essential importance for the positioning of the necessary employee cost. According to the examination of 151 enterprises out of the 250 companies who are investing most list in Turkey, gives the possibility to show the vitalism in the related recruitment in the R&D departments. The outstanding limit of this study is the barrier to collect the data. For the future studies, structural equation modeling could be used by the interaction of more variables. Also, decomposition of the industries and the investigation in the separate areas specially customized according to sectors will make it possible to determine the effect of the R&D expenditures and R&D personnel employment in those segments. In addition, to analyze according to several years could be executed to see the positive effect on a longitudinal base.

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References

Açan, H. (2016), Ar-Ge çalışmalarının ekonomide karşılığı olmalı, Turkish Time- R&D 250, December, pp. 16-17.

Banger, G. (2016), Endüstri 4.0 ve Akıllı İşletme, Dorlion Publishing, Ankara, Turkey.

Becchetti, L. and Rossi, S. P. (2000), The positive effect of industrial district on the export performance of Italian firms. Review of industrial organization, 16(1), pp. 53-68.

Dilek, S. (2016), Enformasyon ve bilgiye dayali yeni ekonomi, Kastamonu University Faculty of Economics and Administrative Sciences Journal, 11, pp. 87-91

Göçer, İ. (2013). Ar-Ge harcamalarinin yüksek teknolojili ürün ihracati, diş ticaret dengesi ve ekonomik büyüme üzerindeki etkileri. Maliye Dergisi, 165(2), pp. 215-240.

Güloğlu, B. and Tekin, R.B. (2012), A Panel causality analysis of the relationship among research and development, innovation and economic growth in high-income OECD Countries, Eurasian Economic Review, 2(1), pp. 32-47.

Hirsch, S. and Bijaoui, I. (1985), R&D intensity and export performance: a micro view, Review of World Economics, 121(2), pp. 238-251.

Ito, K. and Pucik, V. (1993), R&D spending, domestic competition, and export performance of Japanese manufacturing firms, Strategic Management Journal, 14(1), pp. 61-75.

Kaya V. and Uğurlu, S. (2013). Ar-Ge harcamalari ile ihracat arasindaki ilişki: Türkiye örneği 1990-2011, EKEV Academy Magazine, 57, pp. 269-282

Korkmaz, S., Ermeç, A. and Yücedağ, N. (2009), İşletmelerin yenilikçi kabiliyetleri ve ihracat performanslarina etkileri, Anadolu University Journal of Social Sciences, 9 (2), pp. 83-104.

Lefebvre, E., Lefebvre, L. A. and Harvey, J. (1993), Competing internationally through multiple innovative efforts. R&D Management, 23(3), pp. 227-237.

Özer, M. and Çiftçi, N. (2009), Ar-ge harcamaları ve ihracat ilişkisi: oecd ülkeleri panel veri analizi. Dumlupınar University Journal of Social Sciences, 23, pp. 39-49.

Özlale, Ö. (2016), Ar-Ge çalışmalarının ekonomide karşılığı olmalı, Turkish Time- R&D 250, December, pp. 14-15.

Pak, N. K. (2003), Ar-Ge Mucizesi-Başarı Öyküleri, TÜBİTAK Publishing, Ankara, Turkey.

Saruhan, Ş. C. and Özdemirci, A. (2011), Bilim, Felsefe ve Metodoloji, Beta Publishing.Istanbul, Turkey.

Sungur, O., Aydin, H. İ. and Eren, M. V. (2016). Türkiye'de ar-ge, inovasyon, ihracat ve ekonomik büyüme arasindaki ilişki: Asimetrik nedensellik analizi, Suleyman Demirel University Journal of Faculty of Economics & Administrative Sciences, 21(1), pp. 173-192.

Uzay, N., Demir, M. and Yıldırım, E. (2012), İhracat performansi açisindan teknolojik yeniliğin önemi: Türkiye imalat sanayi örneği, Dogus University Journal, 13(1), pp. 147-160.

Uzkurt, C. (2017), Yenilik Yönetimi ve Yenilikçi Örgüt Kültürü, Beta Publishing. Istanbul, Turkey.

Wagner, J. (2008), Exports and firm characteristics: first evidence from fractional probit panel estimates, University of Lüneburg Working Paper Series in Economics, 97, pp. 1-19.

Yıldırım, E. and Kesikoğlu, F. (2012), Ar-Ge harcamaları ile ihracat arasindaki nedensellik ilişkileri: Türkiye örneğinde panel nedensellik testi kanıtları. Marmara University Faculty of Economics and Administrative Sciences Journal, 32 (1), pp. 165-180.

Zerenler, M., Türker, N. and Şahin, E. (2007). Küresel teknoloji, araştirma-geliştirme ve yenilik ilişkis, Selçuk University Journal of Social Sciences, 1(17), pp. 653-667.