**BENEFITS OF TECHNOPARKS FOR INNOVATIVE & TECHNOLOGY-BASED ENTREPRENEURS**

 **Mehmet CANSIZ[[1]](#footnote-2)**

 **Bilgehan ÖZBAYLANLI[[2]](#footnote-3)**

***ABSTRACT***

*One of the important impacts of transition from industrial society to knowledge society is the transformation of classical entrepreneurship to innovative technology-based entrepreneurship led by the creative class. Technoparks are cluster-based, socio-spatial systems that bring techno-entrepreneurs together. Technoparks are expected to create several types of externalities to the benefit of the firms they host in order that more innovations and qualified new jobs can be triggered. Under this assumption, governments provide important incentives, mainly in the type of tax deductions and infrastructure investments, for the technopark firms. However, if the technopark firms do not accrue sufficient benefits from mentioned potential externalities, then forgiven taxes and incurred investment costs would go down the drain. More importantly, a golden opportunity to significantly boost the performance of innovative techno-entrepreneurs would be lost. This brings the importance of evaluation studies that investigate if the potential desired benefits in technoparks are actually realized.*

*This study proposes and exemplifies a survey based evaluation approach for to reveal the level of benefits obtained by the firms from the technopark externalities. It involves asking counterfactual questions to the 1,112 entrepreneurs randomly chosen from 26 different technoparks that host at least 50 firms in Turkey. It’s asked what would happen to them in terms of the 12 criteria related to potential technopark externalities, if they had not chosen to move to a technopark. In addition, it is further investigated if the perceived benefits change with differentiation of sociological and firm-specific background characteristics of the entrepreneurs and their firms; since if the benefits differ by those then specialized policies may be required instead of monotype policies. In this purpose, we conduct ordered logit regression analysis for each of the 12 counterfactual questions using 12 different background characteristics.*

*In the context of 10 technopark externalities out of 12, we observed statistically significant perceived mean benefits. Results of the ordered logit regression analysis indicated that significantly larger perceived benefits are generally associated with being a female entrepreneur, having higher numbers of partners, having lower levels of education, having less entrepreneurial experience, being an exporter, being a software firm, being located in a newly developing technopark, and being located in a less developed city. These results indicate that technoparks seem to play an important role from the perspective of inclusive development. On the other hand, perceived benefits do not generally vary depending on the age of the entrepreneur, on the age of the firm, on the employee size of the firm, and on the fact that the firm is a high-growth one or not. One core impact expected to be created by technoparks is that they trigger the flourishing of firms which will become leaders at international scale, aka “star firms”. High-growth firms are the best candidates for this, and we expect from them to utilize the technopark externalities to the outmost degree to achieve this objective. However, our findings indicate that more effort shall be invested by technopark administrations and government organizations to push them forward.*

*We believe our findings and our approach as a complimentary evaluation tool can aid in the pursuit for improving the performance of technoparks in Turkey. One of the prominent aspects of our approach is that it aims to embrace sociological perspective in addition to economic perspective to the evaluation process. Findings of this study also provides an example for technopark policies and dynamics in a developing/emerging country context.*

***Keywords:*** *Technopark, Entrepreneurship, Innovation, Evaluation, Ordered Logistic Regression Model.*

**TEKNOPARKLARIN YENİLİKÇİ VE TEKNOLOJİ TABANLI GİRİŞİMCİLERE FAYDALARI**

***ÖZET***

*Sanayi toplumundan bilgi toplumuna geçiş sürecinin önemli etkilerinden biri de klasik girişimciliğin, kreatif sınıfın önderliğinde yenilikçi, teknoloji tabanlı girişimciliğe dönüşmesidir. Teknoparklar tekno-girişimcileri bir araya getiren küme bazlı, sosyo-mekansal sistemlerdir. Teknoparklardan muhteva ettikleri firmalara yönelik daha fazla yenilik ve nitelikli istihdam üretmelerini sağlamak üzere çeşitli dışsallıklar yaratmaları beklenir. Bu varsayım dâhilinde, devletler teknoparklara yönelik vergi desteği ve altyapı yatırımları gibi önemli teşvikler sağlamaktadır. Bununla birlikte, teknopark firmaları bahse konu teknopark dışsallıklarından yeterince faydalanamıyorsa vazgeçilen vergiler ve yapılan kamu yatırımları boşa gidecektir. Daha da önemlisi, yenilikçi, teknoloji tabanlı girişimcilerin performansını ciddi anlamda artırma fırsatı da elden kaçmış olacaktır. Bu da, teknoparklarda arzu edilen potansiyel faydaların gerçekten hayata geçip geçmediğine ilişkin etki değerlendirme çalışmalarının önemini öne çıkarmaktadır.*

*Bu çalışma firmaların teknopark dışsallıklarından hangi seviyede fayda sağladığını ortaya çıkarma amacını taşıyan anket bazlı bir etki değerlendirme yaklaşımını ortaya koymakta ve örneklendirmektedir. Çalışma kapsamında Türkiye’deki en az 50 firmanın bulunduğu 26 farklı teknoparktan rastgele seçilmiş 1.112 tekno-girişimciye, teknopark dışsallıklarından hareketle belirlenen 12 ölçüt bağlamında teknoparkta yer almamış olsalardı ne durumda olurlardı şeklindeki karşı-olgusal sorular yöneltilmiştir. İlave olarak, girişimcilerce algılanan faydanın, farklı girişimci ve firma-spesifik özellikler dahilinde değişim gösterip göstermediğini incelemek üzere 12 karşı-olgusal sorunun her biri için 12 farklı özellik ele alınarak sıralı logit regresyonu analizi gerçekleştirilmiştir. Eğer algılanan faydalar girişimci ve firma özelliklerine göre değişim gösteriyorsa o zaman tek tip uygulamalar yerine özelleştirilmiş uygulamalara yönelinmesi daha etkin olacaktır.*

*Analiz edilen 12 teknopark dışsallığından 10 tanesi kapsamında istatistiki olarak anlamlı algılanan ortalama fayda gözlemlenmiştir. Sıralı logit regresyonu analizi sonuçları, daha yüksek fayda düzeyinin kadın girişimci olmayla, daha fazla sayıda ortağa sahip olmayla, daha düşük eğitim düzeyine sahip olmayla, ihracat yapmayla, sektörün yazılım/bilişim olmasıyla, daha az gelişmiş bir teknoparkta olmayla ve daha az gelişmiş bir şehirde olmayla ilişkili olduğunu ortaya koymuştur. Bu bulgular teknoparkların içerici kalkınma perspektifi açısından önemli bir rol oynadığına işaret etmektedir. Diğer taraftan, algılanan fayda düzeyinin girişimcinin ve firmanın yaşı, firmanın çalışan sayısı ve firmanı hızlı büyüyen firma olup olmaması özelliklerine göre farklılaşmadığı gözlemlenmiştir. Teknoparklardan beklenen temel etkilerden biri uluslararası düzeyde lider firmaların, diğer ifadeyle “yıldız firmaların” teknoparklarda gelişip atılım yapmasıdır. Hızlı büyüyen firmalar buna en uygun adaylar olup, bu firmaların teknopark dışsallıklarından diğer firmalara oranla en üst düzeyde istifade etmeleri beklenir. Bu çalışmanın bulgularından hareketle bu konuda teknopark idarelerinin ve ilgili kamu kurumlarının daha fazla çaba göstermesi gerektiği anlaşılmaktadır.*

*Bu çalışma bulgularının ve yaklaşımının Türkiye’deki teknoparkların performansını artırma anlamında tamamlayıcı bir etki değerlendirme aracı olarak faydalı olacağını ummaktayız. Yaklaşımımızın önemli bir boyutunu da etki değerlendirmeye ekonomik perspektifin yanı sıra sosyolojik perspektiften de yaklaşmamız oluşturmaktadır. Çalışma bulguları aynı zamanda kalkınmakta olan/ yükselen ülkeler bağlamındaki teknopark politikaları ve dinamiklerine ilişkin de örnek teşkil etmektedir.*

***Anahtar Sözcükler:*** *Teknopark, Girişimcilik, Yenilik, Etki Analizi, Sıralı Logit Regresyon Modeli.*

1. **INTRODUCTION AND MOTIVATION**

Technoparks are cluster based initiatives which have an important role in national industry and innovation policies. Technoparks potentially can create several types of externalities to the benefit of their member firms and as a result of this, more innovations and qualified new jobs can be triggered, which are considered as the most important sources of economic growth and international competitiveness. Under this assumption, governments provide important incentives, mainly in the type of tax deductions and infrastructure investments, for the technopark firms. However, if the technopark firms do not accrue sufficient benefits from mentioned potential externalities, then forgiven taxes and incurred investment costs would go down the drain. More importantly, a golden opportunity to significantly boost the performance of innovative firms would be lost.

This brings the importance of evaluation studies to the front. In order to evaluate if the potential benefits turn into actual benefits, it is most effective to employ a myriad of approaches from quantitative to qualitative, from objective to subjective in a complementary manner under a broader evaluation program.

This study aims to propose a survey based evaluation approach for to reveal the level of benefits obtained by the firms from technopark externalities. It involves asking counterfactual questions to the 1.112 entrepreneurs randomly chosen from 26 different technoparks in Turkey about what would happen to them in terms of 12 different types of potential technopark externalities -which are determined from technoparks and clusters literature- if they had not chosen to move to a technopark. In addition to the statistical analysis of the responses, we will further investigate if the perceived benefits change with differentiation of background characteristics of the entrepreneurs and their firms. This is important since if benefits differ by those characteristics then specialized policies may be required instead of monotype policies. In this purpose, ordered logit regression analysis will be conducted for each of the 12 counterfactual questions using 12 different background characteristics.

We believe our findings and our approach as a complimentary evaluation tool can aid in the pursuit for improving the performance of technoparks in Turkey. Findings of this study also aim to provide an illustration for technopark policies and dynamics in a developing/emerging country context.

1. **PREVIOUS LITERATURE**

We are witnessing the profound transformation from the industrial society into knowledge society, which alters the consumption and distribution processes significantly (Castells, 2005; Bell, 1973; Masuda, 1990; Drucker, 1991). This transformation led “knowledge”, “innovative ideas”, and “technology development and deployment capacity” to become the principal inputs of production and service delivery systems (Harvey, 1997; Kumar, 2013). The bedrocks of this transformation have been the technoparks, which are cluster-based initiatives that agglomerate firms, universities, and research centers together to promote new innovative ideas, production of technologies, and leveraging social and economic capital (Castels, 2005:33). Technoparks are among the major engines that propel socio-economic development process by creating qualified new jobs, deploying qualified human resources, promoting interactions between firms, and triggering new innovative ideas (Saxenian 1994; Chan et al., 2010; Etzkowitz and Leydesdorff, 2000; Almeida et al., 2008; Siegel et al., 2003). For this reason, over 4000 technoparks spanning all over the globe are considered as critical clusters that densely concentrate innovative entrepreneurs (Eren, 2011).

In line with the global emphasis on technoparks, technopark policies in Turkey originated in the beginning of 2000’s and significant levels of subsequent public investments have been made until today in addition to provision of important tax benefits for the member firms. While there we only 3 technoparks existed in 2003, by February 2018 this number have reached to 72; 56 of which are active and remaining ones are under preparation. Turkish technopark system inhabits 4,817 firms and more than 46,000 employees; moreover, total exports from these regions have added up to 3 billion US dollars. Technoparks in Turkey can also be considered as the masternodes of *innovative entrepreneurship* in Turkey (Cansız, 2014). While Turkey has already covered quite a mileage in this area, when we compared it to the accomplishments of the most developed examples in the world aka Silicon Valley we can argue that she is still at the bottom footsteps of the ladder (Cansız, 2014).

Technoparks in Turkey are established and function under the supervision of 4691 coded (amended by 6170) “Technology Development Regions” Law. Main objectives of this law are to promote the collaboration between firms, universities, and government organizations; to make Turkish industry more competitive internationally and export-oriented, to proliferate innovative activities, to create qualified jobs, and to promote innovative-entrepreneurship.

As technoparks in Turkey have such a crucial role in the development process of Turkey, assessment of their performance should be a national priority. The Amending Law coded 6170 therefore prioritizes evaluation of technopark initiatives and for this purpose it envisages that technopark administration conducts an evaluation study of technopark initiatives at the end of every year and send an evaluation report to the Ministry of Science, Industry and Technology. The evaluation reports are prepared according to the format suggested by the mentioned ministry and involve objective data on research projects, employment, exports, patents, etc.

This study proposes and exemplifies a survey based evaluation approach, which shall be seen as a complementary part of a broader evaluation program. Technoparks are supposed to facilitate innovation processes of firms through different mechanisms in action within its borders. Investigation of the degree of benefit perception of entrepreneurs of technoparks firms has great potential to enlighten us if these potential mechanisms are *effectively* in action or not. Entrepreneurs are the only agents that can make the ultimate argument about their own actual level of benefit from mentioned potential technopark externalities. This subjective information shall be considered as a complementary input for evaluation studies that employ objective evaluation criteria.

Complementary use of subjective inputs for evaluation purposes is important since objective criteria are generally more restricted in number; and availability of data on objective criteria cannot always be accomplished. Moreover, subjective perceptions of entrepreneurs can also involve intrinsic, nuanced valuations that are hard to address with objective criteria such as number of R&D projects, number of employees, etc. Indeed, latter are the only types of data collected under the current implementation of evaluation reports.

The most important aspect of any evaluation is to identify a similar enough, hence comparable, group of counterfactuals to our on-hand group of technoparks entrepreneurs and their firms. The major challenge with technopark firms is that because of several attractive incentives and externalities, it is hard to find a comparable group of firms as counterfactuals of them; if they are so similar by background and potential then they are expected to have already jumped into a technopark! Current evaluation reports suffers from this setback, as mentioned reports depicts the picture for the technopark firms’ achievements but does not involve any counterfactual arguments. But as we discussed, it would be quite challenging to do that even responsible bodies intend to do it. In Turkey, Ministry of Science, Industry and Technology aims to procure such studies for restricted-access evaluation purposes and confronts with mentioned limitations (Cansız 2017).

In this study, we approach to mentioned challenge regarding identifying counterfactuals by asking technopark entrepreneurs to think carefully about their own counterfactuals: how would their own unrealized state if they had not been located in a technopark? As we will give in detail in the next section, questions are selected to reflex the potential and expected externalities that shall emanate from of being located in a technopark. Answers to these questions readily shed light into the level of benefits reaped in the perceptions of technopark entrepreneurs. In addition to this, our study aims to explore how these perceived benefits differentiate according to different socio-economic background characteristics of technopark entrepreneurs. This additional evaluation objective is also quite important for designing and fine-tuning tailored policies for different subgroups if the benefits from technoparks varies according to their background characteristics.

The first step of an above-defined approach is to identify the externalities provided by the technoparks that create specific benefits to the firms located within the technoparks. We use the measures of technolark law and the previous literature to identify mentioned externalities.

The major externality provided by the technoparks is that they act as platforms greatly facilitating the interactions and collaborative undertakings between firms and universities (Levy et al, 2009; Turkish Technopark Law coded 4691; Özgüven, 2011; Eroğlu, 2002). In addition to facilitating university-firm interactions, technoparks also provide ample opportunities for firm-to-firm interactions and collaborative initiations (Saxenian, 1990). At the same time, technoparks are located within the boundaries of universities, which creates a large candidate employee pool including both undergraduates and graduate students. Moreover, as technoparks are dense agglomerations of firms, this also creates a pool of qualified researchers who are already employed. Transfers of employees between firms act as a strong know-how disseminating mechanism (Cansız and Ulusoy, 2017). All in all, another important externality associated with the technoparks is that they facilitate access to qualified human resources. Moreover, eligibility criteria for being a member of a technopark depends on a set of challenging criteria and just because of the fact that you are a technopark firm you become entitled to a set of advantages. First of all, the prestigiousness of your firm substantially increases. Also, technopark administration is responsible for providing assistance to the member firms. These all improve the chances of easier access to finance, of benefiting from state support programs, of having access to high-quality consultation services and to new domestic and international markets (Cooke, 2004; Farinelli, 2007). On the other hand, technoparks create tremendous potential for formation and development of social capital among the member firms. Trust formed on top of social capital leads to the formation of networks that cooperate with negligible transaction costs and thus makes technopark firms more competitive (Lorenzen, 2005). All of these also increase the prevalence of new innovative ideas within the technopark (Cansız and Özbaylanlı, 2017).

On the other hand, there is a noticeable surge in both micro and macro level sociological studies focusing on entrepreneurial processes and on the knowledge society workers. The conditions required to be successful for entrepreneurs (Aldrich, 1991; Granovetter 2000, Nee and Opper 2012; Swedberg 2000; Thornton, 1999; Beck 1992; Chen 2015) and the impacts of knowledge society on the innovative entrepreneurs (Thornton et al. 2011;  Ferrary and Granovetter 2009; Saxenian 1994) are among the subjects that require sociological perspective. Only relying on viewpoint of economics for evaluation purposes is not sufficient to grasp subtle interactions and reflections in play.

Social sciences literature tackles entrepreneurship subject along the axis of macro to micro, actor and structure. Macro-scale discussions deals with globalization and mechanisms & processes that construct knowledge-society. At meso-scale cultural, social, political, and economic constituents are focused on. Micro-scale studies on the other hand addresses on the actors. The prominent factors in mentioned studies are observed as gender, age, parental features (like their education, occupation, social status, and do they live together or separate), and living space (Duchesneau and Gartner, 1988; Cooper and Dunkleburg, 1987, Cansız, 2017; Cansız and Ulusoy, 2017). These factors are mostly analyzed in relation to the cultural capital. On the other hand, there is also a literature in line with human capital literature which hones in on role of education of the entrepreneur and on the role of previous entrepreneurial experience (Evans and Leighton, 1989; Honig, 1998; Stuart and Abetti, 1990; Brush and Hisrich, 1991). Moreover, other set of studies are dealing with social capital factors such as partnership structures and networks (Eisenhardt and Tabrizi, 1995; Burt, 1992; DiMaggio, 1992; Birley, 1985; Uzzi, 1999). Firm-specific factors as location, age, employee size, and being a high-growth firm or not are studied under organizational theory and industrial economics (OECD, 2012a, 2012b; Islam et al. 2011; Çırakçı, 1997; Cansız, 2017).

1. **OBJECTIVES OF THE STUDY AND RESEARCH QUESTIONS**

The objective of this study is to propose a survey based evaluation approach to be used as a part of a broader evaluation program for the technoparks. This approach involves asking 12 counterfactual questions presented in the Table 1 Each of the question reflexes a certain potential externality of the technopark. Externalities are expected additional benefit/ added-value that shall stem from being located in a technopark.

**Table 1. Counterfactual Question on Perceived Benefits from Technopark Externalities**

|  |  |
| --- | --- |
| 1 | What would have been realized in terms of the level of R&D capacity if you had not been located in a technopark? |
| 2 | What would have been realized in terms of the level of your interactions with the academicians if you had not been located in a technopark? |
| 3 | What would have been realized in terms of the level of joint project activity conducted with the universities if you had not been located in a technopark? |
| 4 | What would have been realized in terms of the level of interactions and collaborative initiatives between your firm and the other firms if you had not been located in a technopark? |
| 5 | What would have been realized in terms of level of your access to qualified human resources if you had not been located in a technopark? |
| 6 | What would have been realized in terms of level of your access to finance if you had not been located in a technopark? |
| 7 | What would have been realized in terms of level of your access to new customers and markets if you had not been located in a technopark? |
| 8 | What would have been realized in terms of level of your access to consultation and training services if you had not been located in a technopark? |
| 9 | What would have been realized in terms of level of your firm’s prestige if you had not been located in a technopark? |
| 10 | What would have been realized in terms of level of your firm’s social capital you had not been located in a technopark?” |
| 11 | What would have been realized in terms of the level of your firm’s utilization of state resources if you had not been located in a technopark? |
| 12 | What would have been realized in terms of the level of your firm’s economic performance if your firm had not been located in a technopark?”. |

The second group of research questions involved the investigation into how perceived benefits vary according to the background characteristics of the entrepreneur and his/her firm. For each question given in Table 1, we ask the successive questions of if and how this benefit perception varies depending on the different levels of a certain background characteristics while holding other characteristics constant. Mentioned background characteristics include following entrepreneur and firm characteristics: Gender, entrepreneur’s age, entrepreneur’s education level, entrepreneur’s experience as an entrepreneur, firm’s high-growth property, exporter status, employee size of the firm, number of partners of the firm, type of the sector, type of the technopark, and development level of the city. Details about these background characteristics are depicted in the next section.

1. **THE DATA**

The data of the study is sourced from the survey conducted for the “Turkish Technoparks On the Road to 2023” study (Cansız, 2017:59). Survey was conducted at the end of 2015 and covered 26 technoparks spreaded to 15 cities. 1.112 firms out of 3228 were randomly selected. The size of the surveyed firms corresponds to 32 percent of the total firm population in technoparks.

Data involves the answers to the questions given in Table 2 and the answers are formulated as such: {1=Much Worse; 2= Worse; 3=About the Same; 4=Better; 5=Much Better}. Data also includes the background following background information on the entrepreneur and his/her firm:

**Table 2. Descriptive Statistics of Background Properties**



1. **THE METHOD AND THE MODEL**

We use ordered logit model, which is also known as proportional odds ordered logit model (McCullah, 1989; Long and Frees, 2014:chapter 7 and Cameron and Trivedi, 2005: chapter 15; STATA Ologit Manual, 2017). First step in a ordered logit model is to define and tabulate the categorical variables, which for our case start from one representing for strongly harmed to 5 representing for strongly benefited.

Next step is the set-up for the model. The probability of a given observation for ordered logit is



**κ0** is defined as −∞ and **κk** as +∞. For ordered probit, the probability of a given observation is



where Φ(·) is the standard normal cumulative distribution function.

The log likelihood is



In this study **y*j*** stand for different categories of answers of “Much worse”, “Worse”, “About the Same”, “Better”, “Much Better”. **xj** include {Gender, Age of Entrepreneur, Level of Education, Entrepreneurial Expereince, Fast-growing, Size of Exports, Size of Employees, Age of the firm, Number of business partners, Sector, Technopark, City}.

In order to carry out the analysis we applied ologit command of Stata software, which is appropriate to use with survey data and which also supports Hubert/White/sandwich estimator for roubust estimation of variance (STATA Ologit Manual, 2017).

1. **FINDINGS**

The descriptive statistics related to the answer for 12 different counterfactual questions about the perceived benefits obtained from 12 different technopark externalities are reported in Table 3.

**Table 3. Descriptive Statistics for the Answers to Counterfactual Questions**



In the context of 10 counterfactual questions out of 12, we observed an average response indicating statistically significant perceived benefit. In 2 of them, moving to a technopark led to about the same result on average compared to a counterfactual staying out. Hence, in none of the questions a disutility on average is reported. Therefore, in overall, technoparks in Turkey create on average a certain level of benefit through the externalities they provide for their member firms.

We can conclude that from the span of the 95% confidence intervals: For level of interactions with academicians and for participating in state support programs the 95% confidence interval includes 3, which corresponds to “about the same” answer. So we cannot argue that there is a significant benefit at mentioned confidence level. For all other externalities the 95% confidence interval does not include 3 and point estimates are to the lower than 3. So we can argue that there is significant amount of perceived benefits.

On the other hand, location of the point estimates indicate the degree of the benefit. The scale of answers to the counterfactual questions of how would your situation be if you had not moved to techopark was as such: much worse=1, worse=2, about the same=3, better=4, much better=5. For the mentioned 10 questions the location of point estimates fall in between “about the same=3” and “worse=2”.

Under the second objective of the study, ordered logit regression analysis is carried out. Remaining part of this section presents the findings for each counterfactual question. We start with benefits to R&D capacity. The main objective of technopark incentive is to promote R&D activities among the firms. Hence the role of being located in a technopark on the development of the R&D capacity of the firm is the core candidate question of any evaluation study on techopark incentives.

**Table 4. Ordered Logit Regression Results for Increasing R&D Capacity**



In the Table 4, in the first three columns we observe coefficients belonging to the different background characteristics of the firm and their associated z-scores and p-values at %95 confidence level. As ordered logit model is not a linear model, we cannot interpret the magnitudes of the coefficients readily on their own - we also need to specify other parameters as well. However, their signs (positive or negative) indicate the direction of the association of the parameter with the ordered outcome levels. Moreover, the related p-values help us determine if the mentioned association is statistically significant or not. If the p-value is greater than 0.05, then we conclude that there is not enough statistical significance that let us consider that the responses of the interviewed sample to that specific question differs in terms of that certain factor. For example p-value related to association between the background factor of “age of the entrepreneur” with the outcome of “R&D capacity level” is 0.79, which indicates that the answers to the question of “What would have happened to your level of R&D capacity if you had not been located in a technopark?” do not vary significantly according to the different levels of age. On the other hand, p-value related to gender is 0.00; which indicates that the respective answers to the same question significantly differentiate depending on being a male or female entrepreneur. For statistically significant parameters we conduct margin analysis to obtain more conceivable interpretation of the mentioned heterogeneous associations and report within the next five columns. For example, when all other parameters are at their sample average values, it is observed that compared to female entrepreneurs, on average the probability of giving the answer of “Considerably Worse” to the above-mentioned question by the male entrepreneurs is 2.7 percentage points higher. It is 10.3 percentage points higher for the answer of “Worse”; 7.2 percentage points lower in case of “Not changed”, 5 percentage points lower in case of “Better” and 0.8 percentage points lower in case of “Considerably Better”. All of these probability differences indicate that male entrepreneurs have given answers favoring the positive impact of being in a technopark. So overall tendency is such that male entrepreneurs are observed to perceive more benefit from being located in a technopark compared the female ones in terms of improving R&D capacity of the firm.

Under the same line of reasoning, we observe that as the level of education increases the perceived benefit of being a technopark for improving R&D capacity reduces. Similar observation is valid for higher levels of entrepreneurial experience. It is also same in the case of operating in a more sophisticated sector or living in a more developed city. Contrastingly, for firms exhibiting more exportation activity and for firms with higher number of business partners, the perceived benefit of being in a technopark is observed to be higher. On the other hand perceived benefit for improving R&D capacity does not differentiate in terms of different levels of entreprenur’s age, firm’s age or employee size. Moreover it does not also vary between the fast-growing firms and the other firms.

As discussed in the previous sections, the other main objective of technopark incentives is to trigger and develop the relations between firms and universities. We investigate this from two perspectives. First is the interactions with academicians because of the proximity, and the second is carrying out joint, contract based projects with university. The second one requires to develop much stronger social bonds compared to the first one.

**Table 5. Ordered Logit Regression Results for Interactions with Academicians**



First we have the results for answers to the question of “What would have been realized in terms of the level of your interactions with the academicians if you had not been located in a technopark?”. Male entrepreneurs are observed to benefit more from being in a technopark in terms of this perspective as well as entrepreneurs from software/IT sector. The perceived benefit diminishes as the level of education increases and as the technopark becomes more developed. Perceived benefit does not vary with respect to different levels of other parameters.

**Table 6. Ordered Logit Regression Results for Joint Projects with University**



Third question on the university-firms relations is “What would have been realized in terms of the level of joint project activity conducted with the universities?”. Female entrepreneurs as well as firms with more exportation activity and firms involving higher number of business partners are observed to benefit more from being in a technopark in terms of this aspect. Whereas, level of benefit diminishes as entrepreneurial experience is increased, as sector becomes software/IT, as technopark becomes more developed, and city becomes more developed. On the other hand, perceived benefit is inert to remaining factors.

**Table 7. Ordered Logit Regression Results for Cooperation with Other Firms**



Technoparks in essence are cluster-based incentives, which makes firm-to-firm interactions and their colloborative activities quite important in terms of the performance of these incentives. For this purpose we asked “What would have been realized in terms of the level of interactions and collaborative initiatives between your firm and the other firms if you had not been located in a technopark?”. Female entrepreneurs and firms that more intensively involved in exports are observed to benefit more compared to their counterparts. On the other hand, as the level of education, extent of entrepreneurial experience, age of the firm, type of the sector, and the development level of the city gets more advanced, the perceived level of benefit diminishes.

**Table 8. Ordered Logit Regression Results for Access to Qualified Employees**



By being within university campuses, technoparks locate member firms just next to the undergrad and grad students. Moreover current employees of neighbor firms also create a potent pool of potential well-trained and experienced human resources. Hence this is an important externality expected from technoparks. So we asked this question: “What would have been realized in terms of level of your access to qualified human resources if you had not been located in a technopark?” Female entrepreneurs, export-intensive firms, and firms with higher numbers of business partners benefit more compared to male entrepreneurs, to firms that export less, and to firms that involve less numbers of business partners, respectively, *ceteris paribus*. The entrepreneurs with more entrepreneurial experience and firms operating in software/IT sector are observed to benefit less than entrepreneurs with lower experience and firms in less sophisticated sectors. Perceived benefit does not vary with respect to different levels of other parameters.

**Table 9. Ordered Logit Regression Results for Access to Finance**



Acceptance into a technopark and continuing to operate in it successfully signals about the growth and sustainability potential of a firm to the finance institutions; so it is expected that being in a technopark should facilitate the access to finance for its member firms. Moreover, the technopark administration body is expected to conduct activities that facilitate its members’ access to finance. So we have asked: “What would have been realized in terms of level of your access to finance if you had not been located in a technopark?”. Only the firms with higher numbers of business partners reported that they benefit more compared to the firms with less number of firms, *ceteris paribus*. On the other hand, entrepreneurs with higher levels of entrepreneurial experience, firms operating in software/IT sector, firms in more developed technoparks, and in more developed cities are observed to benefit less compared to their counterparts, *ceteris paribus.* Perceived benefit does not vary with respect to different levels of other parameters.

**Table 10. Ordered Logit Regression Results for Access to New Markets and Consumers**



One of prominent expected externalities of cluster-based incentives is the facilitation of access to new customers and markets. Hence we asked: “What would have been realized in terms of level of your access to new customers and markets if you had not been located in a technopark? Female entrepreneurs, exporting firms, and firms with higher numbers of business partners benefit more compared to male entrepreneurs, firms that export less, and firms that involve less numbers of business partners, respectively, *ceteris paribus*. The entrepreneurs with more entrepreneurial experience, firms operating in more software/IT sector, and firms in more developed technoparks are observed to benefit less than entrepreneurs with lower experience, firms in other sectors, and firms in less developed technoparks. Perceived benefit does not vary with respect to different levels of other parameters.

**Table 11. Ordered Logit Regression Results for Consultation Services**



One of the primary roles of technopark administrations is both directly providing and indirectly facilitating the access to the high –quality consultation and training services for the member firms. Thus we asked: “What would have been realized in terms of level of your access to consultation and training services if you had not been located in a technopark? Female entrepreneurs, exporting firms, and firms with higher numbers of business partners benefit more compared to male entrepreneurs, firms that not export, and firms that involve less numbers of business partners, respectively, *ceteris paribus*. The entrepreneurs with more entrepreneurial experience, firms operating in software/IT sector, and firms in more developed cities are observed to benefit less than entrepreneurs with lower experience, firms in other sectors, and firms in less developed cities. Perceived benefit does not vary with respect to different levels of other parameters.

**Table 12. Ordered Logit Regression Results for Prestigiousness of the Firm**



Technoparks are generally perceived as prestigious platforms so it’s expected that their member firms shall conceive being in a technopark make them more prestigious. So we have asked: “What would have been realized in terms of level of your firm’s prestige if you had not been located in a technopark?” Female entrepreneurs, exporting firms, and firms with higher numbers of business partners benefit more compared to male entrepreneurs, firms that export less, and firms that have less number of business partners, respectively, *ceteris paribus*. Firms that have more number of employees, and firms with higher age are observed to benefit less than entrepreneurs with less number of partners, and younger firms.

**Table 13. Ordered Logit Regression Results for Social Capital**



Clusters are considered as highly pertinent platforms to increase social capital of the firms. Being a principal cluster-based incentive, we expect that technoparks contribute significantly to the social capital level of its member firms. Hence we asked: “What would have been realized in terms of level of your firm’s social capital you had not been located in a technopark?” Female entrepreneurs and exporting firms, benefit more compared to male entrepreneurs, firms that export less, and firms that have less number of business partners, respectively, *ceteris paribus*. On the other hand, perceived benefit diminishes as the level of education and the level of entrepreneurial experience of the entrepreneur increases, as well as the sector of the firm becomes software/IT.

**Table 14. Ordered Logit Regression Results for State Support Programs**



It is generally expected that firms located in technoparks carry an advantage in recruiting state funds. In order to investigate how this vary according to background characteristics of the firms we asked: “What would have been realized in terms of the level of your firm’s utilization of state resources if you had not been located in a technopark?”. Firms that have higher number of employees and have higher age are observed to benefit more compared to the firms with lower number of employees and firms having lower age, *ceteris paribus*. Entrepreneurs that have higher entrepreneurial experience and exporting are on the other hand observed to benefit less from being in a technopark in terms of utilization of state funds, *ceteris paribus.*

**Table 15. Ordered Logit Regression Results for Overall Economic Performance of the Firm**



Finally the economic performance of a firm forms the main objective from the firm’s perspective. So we asked: “What would have been realized in terms of the level of your firm’s economic performance if your firm had not been located in a technopark?”. Female entrepreneurs, firms that export, firms with higher number of employees, and firms with higher number of business partners are observed to benefit more compared to their counterparts, *ceteris paribus*. Entrepreneurs with higher level of education and with more entrepreneurial experience are observed to benefit less compared to ones with lower level of education and less entrepreneurial experience, *ceteris paribus*. Also firms located in more developed technoparks and more developed cities benefit less.

1. **DISCUSSION**

In the previous section we have reported the findings from the ordered logit analysis on each mechanism that is expected to be in action to provide benefits to the entrepreneurs operating in technoparks. This section will start with the exposition of the summary table of the findings as seen in the Table 16.

**Table 16. Summary of the Ordered Logit Analysis Findings**



As observed, in the rows of the table potential benefit mechanism is listed and in each column a background property of the entrepreneur or his/her firm is given. Discussion will be structured in terms of the overall elaboration of each background property. The first background property is gender. It is observed that out of 12 benefits mechanisms, female entrepreneurs benefit more in 10 mechanisms and in the remaining 2 mechanisms there is not significant difference between the benefit levels of females and males. So in overall female entrepreneurs benefit more from technopark incentives compared to male entrepreneurs. This is important as it brands technopark initiative a women-friendly and social-inclusion oriented policy instrument. Female entrepreneurs do not have an edge over male entrepreneurs only on access to finance and on recruiting state support programs. We propose technopark administrative bodies to investigate this deeper as they are the main facilitator for these two mechanisms. It shall be an interesting question for them that why female entrepreneurs benefit more from other ten mechanisms significantly more but not for these two. In fact, mentioned two mechanisms are probably the most influential for growth of technopark firms.

The second background property is the age of the entrepreneur, and for all potential 12 benefit mechanisms provided by the technopark, being younger or older does not change the expected level of benefit. So this finding contributes to the literature on the effect of age of the entrepreneur on the entrepreneurial initiatives in a sense that for high tech ventures operating in clusters like technoparks, age is not a significant parameter for benefiting from externalities created by those platforms.

When we look at if the level of education creates a difference in terms of perceived benefits while other factors are controlled for, higher levels of education do not create a significant difference for 7 of the mechanisms while lower perceived level of benefit for the other 5 mechanisms. It is noteworthy that higher levels of education are not associated with higher level of perceived benefits in none of the mechanisms. Hence we can argue that technopark initiatives create more benefits for the entrepreneurs with comparatively lower levels of education. We can argue that entrepreneurs with higher levels of education like master’s or PhD degrees can already conduct rigorous R&D activities, are already interacting with academicians closely, and are already familiar with utilizing university R&D centers because of previous their graduate-level research activities. So it is plausible that their relative level of benefit can be lower than entrepreneurs with lower levels of education from the perspective of those mechanisms. On the other hand, the fact that entrepreneurs with lower levels of education finds technoparks more valuable in terms of these is a pleasing finding as it shows that technoparks fulfills an important task there. It is also interesting that entrepreneurs with lower levels of education perceive more benefit in terms of social capital accumulation from being in a technopark, which indicates higher the level of education, tendency to getting connected socially gets lower. Moreover, perceived benefits for the firm’s overall economic performance is also greater for the entrepreneurs with lower levels of education. Firms founded by academicians, who necessarily hold PhD’s, might be less profit oriented as academicians have already guaranteed salaries from the university and that can be a reason for this result. Another reason might be that entrepreneurs who have spent less time during education had more time to get familiar and operate longer within the challenging market conditions, which makes them more advantageous in exploiting technopark externalities from this perspective.

The following background property is entrepreneurial experience and we observe that 3 of the technopark externalities, longer years of experience does not result in a difference while for 9 of them longer years of experience reduces the perceived benefit. So in overall, longer years of entrepreneurial experience is associated with less benefit from being in a technopark, which from the reverse perspective suggests that technoparks create more value-added for less experienced entrepreneurs. So we can argue that in overall technopark incentives are successful in abating struggles related to the entrepreneurial experience gap. When we scrutinize the technopark externalities do not change according to the different levels of experience, we observe that they are R&D capacity, interactions with academicians, and utilization of university R&D centers, which require more of technical capacity rather than of entrepreneurial experience. So we can argue that technoparks create added value to entrepreneurs with less experience where it really counts like firm-firm interactions, access to qualified workforce, access to finance, access to new customers and markets, etc. which demand much more enterpeenurial experience.

It is among the interesting findings that whether the firm is a high-growth one or not, none of the technopark externalities lead to differentiated perceived benefits. Producing high-growth firms can be regarded as one of the core objectives of technopark incentives. So we desire that tehnoparks produce more high-growth firms by maximum utilization of externalities existing within technoparks by those firms. But what we observe here is that high-growth firms do not benefit more from none of the externalities compared to firms with lagging performance. Based on this finding, we argue that a specific detailed study shall be carried out to understand why this the case and what improvements can be designed in order that the technopark externalities play a much more decisive role in increasing the prevalence of high-growth firms within technoparks.

On the other hand firms that export benefit more than firms that do not export in the context of 8 of technoparks externalities, they benefit less only from 1 externality and benefit about the same from remaining 3 externalities. So in overall we can argue that firms that export benefit more from being in a technopark. As increasing national level of exports in high-technology products and services is one of the core objectives of technopark law, we can suggest that technopark externalities support that objectives fairly. Most of the externalities that create benefit about the same for both the exporters and non-exporters are technical ones such as R&D capacity, interactions with academicians, and utilization of university R&D centers. These externalities are more oriented for initial research undertakings, whereas for exports, a final product and an international market or supply chain integration is a must. On the other hand, it is interesting that exporters perceive less benefit from being in a technopark in terms of access to state support programs. We think that this finding can be a subject of a more detailed analysis in following studies. Exporter firms might already have a good grasp of state support programmes eve before being located in a technopark hence technopark externality might not that additionally important to them. However, it could be also the case that technopark administration’s facilitation services or the current shortcomings in the design of related support programs might be the culprit here.

In terms of number of employees of the firm, we observe that as the labor size of the firm increases, perceived benefits increase for 2 technopark externalities, decrease for 1 and do not significantly change for the remaining 9 externalities. The utilization of university R&D centers increases, which is plausible since more employees mean more potential users. Perceived benefit in terms of prestigiousness of the firm is higher for smaller firms compared to larger sized firms. Firms with higher numbers of employees are already known and respected, while smaller firms might have challenges in receiving traction and trust. Hence technoparks seem to fulfill this gap. On the other hand, in terms of utilizing state support programs, being in a technopark benefits larger firms more compared to smaller ones, which might be indicate some challenges and rigidities in terms of access to state support programs. A focused further study on this finding might be useful. Finally, we observe that larger firms perceive higher benefits from technoparks in terms of overall economic performance compared to smaller firms in labor size. So we can infer that as firms grow bigger in technoparks they would benefit more in terms of economic growth from technoparks.

When we investigate the age of firms as the next background property, we observe that whether the firm is younger or older does not lead to differential benefit perception in 9 of the total 12 potential externalities. Younger firms benefit more from technoparks in terms of firm-firm interaction compared to older firms. This is expected as interactions need time to form and develop. Technoparks seems to accelerate this process. Younger firms also benefit more from technoparks in terms of improving prestigiousness of their firm, which again requires time to develop. On the other hand, older firms perceive more benefit from technoparks for the sake of participating in state support programs. Based on this finding a further focused study can be carried out to understand if younger firms have any challenges in accessing to and participating in state support programs. Moreover, it also indicates that technopark administrative bodies shall more focus on younger firms and develop specific facilitation services.

On the other hand, number of partners is observed to be a background property for which the perceived benefits vary from majority of the technopark externalities. For 7 of the potential technopark externalities, firms with more partners perceive benefit more than firms of less number of partners, for 5 of them there exists no significant difference, and for none of them firms with less number of partners perceive more benefit. So overall existence of more partners is associated with more benefit. Notably, firms with more partners benefit more from technoparks in terms of interacting with academicians and other firms. This is plausible since more partners means less overhead for firm operations per partner and hence more agents to interact with outside. More partners are also observed to benefit from technoparks more in terms of tapping into the qualified work-force within the technopark, in accessing more financial options, in investigating new customers and markets, and in participating in state support programs. Hence having more partners can be seen as an asset.

Perceived benefits also vary extensively according to the type of the sector of the firm. Software firms compared to firms in other sectors benefit more from 2 technopark externalities, benefit less from 7 externalities, and for the remaining externalities there is no significant variation. Software firms are observed to benefit more from technoparks in terms of increasing R&D capacity and interactions with academicians. This is an interesting finding since software is generally is regarded as the least-expected sector to depend heavily on R&D and academician input. Therefore, either this accepted opinion might be wrong or some frictions may be involved in terms of non-software sectors. A focused study on this finding can shed more insight. Other than mentioned two externalities, non-software firms are observed to exploit more benefits from being located in a technopark compared to software firms.

Not all technoparks are at the same level of development. Technoparks within the boundaries of well-established universities and technoparks founded earlier are more developed. We observe that in terms of 6 externalities perceived benefits from technopark diminishes as the technopark gets more developed, whereas in the remaining 6, level of benefit is about the same. It is striking there is no technopark externality that is favored by the firms in more developed technoparks compared to firms in less developed technoparks. So overall firms in less developed technoparks perceive more benefit than firms in more developed technoparks. Noteworthy points are such that perceived benefits from technopark in terms of R&D capacity, interactions with academicians, utilization of university R&D centers, and running of joint R&D projects with university are larger for firms in less developed technoparks. The extent of these four externalities are far greater in developed technoparks but from this finding firms in them benefit from these comparatively less. We think that this finding demands further investigation throughout a focused study. Considering the much larger size of externalities and the size of the research infrastructure and human capital in developed universities, we shall guarantee that technoparks should strongly trigger close relations between the firms and the university, which eventually create world-wide highly competitive star firms.

In terms of the development level of the city that the firm is located within, it’s observed that for 5 technopark externalities the perceived benefits are lower for firms in more developed cities whereas in the remaining 7 technopark externalities there is no significant difference between the both. It is interesting that in terms of none of the technopark externalities, firms within more developed cities perceive higher benefit. This finding is important in the sense that technoparks in less developed cities are doing a great job. This also is a positive finding from the perspective of regional development and convergence policies. Actual externalities that are more beneficial for firms in less developed cities are also interesting. Firm-university joint projects and firm-to-firm collaborative projects indicate that technoparks in less developed cities are successful in triggering linkages, which is also an important objective of regional policy. Also, access to finance is generally regarded as more challenging in less developed localities, and again technoparks in such places seem to help firms well to overcome such limitations. Consultation services are also deemed low in supply in less developed cities and again technopark administrations in less developed cities seem to close that gap. Last but not least, perceived benefit to overall economic performance of the firm is higher for firms in less developed cities, again very positive outcome in terms of regional economic development endeavors.

**8.CONCLUSIONS**

Technoparks are cluster based initiatives which have an important place in national industry and innovation policies. Technoparks potentially can create several types of externalities to the benefit of their member firms and as a result of this, more innovations and qualified new jobs can be triggered, which are considered as the most important sources of economic growth and international competitiveness. Under this assumption, governments provide important incentives, mainly in the type of tax deductions and infrastructure investments, for the technopark firms. However, if the technopark firms do not accrue sufficient benefits from mentioned potential externalities, then forgiven taxes and incurred investment costs would go down the drain. More importantly, a golden opportunity to significantly boost the performance of innovative firms would be lost. This brings the importance of evaluation studies to the front. In order to evaluate if the potential benefits turn into actual benefits, it is most effective to employ a myriad of approaches from quantitative to qualitative, from objective to subjective in a complementary manner under a broader evaluation program.

This study aims to propose a survey based evaluation approach for to reveal the level of benefits derived by the firms from technopark externalities. It involves asking counterfactual questions to the 1.112 entrepreneurs randomly chosen from 26 different technoparks in Turkey about what would happen to them in terms of 12 different types of potential technopark externalities -which are determined from technoparks and clusters literature- if they had not chosen to move to a technopark. In addition to the statistical analysis of the responses, we further investigate how the perceived benefits change with differentiation of background characteristics of the entrepreneurs and their firms. This is important since if benefits differ by those characteristics then specialized policies may be required instead of monotype policies. In this purpose, we conduct ordered logit regression analysis for each of the 12 counterfactual questions using 12 different background characteristics.

In the context of 10 counterfactual questions out of 12, we observed an average response indicating statistically significant perceived benefit. In 2 of them, moving to a technopark led to about the same result on average compared to a counterfactual staying out. Hence, in none of the questions a disutility on average is reported. So in overall technoparks in Turkey on average create certain level of benefits through the externalities they provide for their member firms. On the other hand, location of the point estimates indicate the degree of the benefit. The scale of answers to the counterfactual questions of how would your situation be if you had not moved to techopark was as such: much worse=1, worse=2, about the same=3, better=4, much better=5. For the mentioned 10 questions the location of point estimates fall in between “about the same=3” and “worse=2”. In the future, we suggest that this investigation is repeated and the progress is monitored by the relocation of point estimates to the more left.

We observed from the results of the ordered logit regression analysis that the level of perceived benefits for each externality changes by the variation of certain background characteristics. Significantly larger perceived benefits are generally associated with being a female entrepreneur, having higher numbers of partners, having lower levels of education, having less entrepreneurial experience, being an exporter, being a software firm, being located in a newly developing technopark, and being located in a less developed city. On the other hand, perceived benefits do not generally vary depending on the age of the entrepreneur, on the age of the firm, on the employee size of the firm, and on the fact that the firm is a high-growth one or not. Two prominent conclusions can be derived from these findings. First is that technoparks seem to play an important role from the perspective of inclusive development as we see that women, less educated entrepreneurs with limited experience and firms in less developed technoparks or cities perceive greater level of benefit. On the other hand, one core impact expected to be created by technoparks is to trigger the flourishing of firms that become leaders at international scale, aka “star firms”. High-growth firms are the best candidates for this, and we expect them to utilize the technopark externalities to the outmost degree to achieve this objective. However, our findings indicate that more effort shall be invested by technopark administrations and government organizations to push them forward.

In addition to above-mentioned findings, we propose a special survey-based and subjective evaluation approach in this study. One of the prominent aspects of our approach is that it aims to embrace sociological perspective in addition to economic perspective to the evaluation. This approach shall be seen as one of elements of a broader evaluation perspective. One important challenge with subjective studies as in this study is the risk of reporting bias. Entrepreneurs may feel that if they report low benefit from being in a technopark, they might be dumped out of the technopark. Hence it is crucial that this type of subjective studies are carried out directly by not the technopark administrations or by supervisory organizations like Ministry of Science, Industry, and Technology. The interviews and technical analyses shall be carried out by third parties and with guaranteeing strict anonymity of the responding entrepreneurs. Moreover, it must be well communicating that this study is carried out for the sake of improving the mechanisms and services operating within technoparks; in other words this study does not aim to evaluate the firms in technoparks but aim to identify opportunities to maximize their benefit from technoparks.

The major advantage of subjective studies, when conducted appropriately as described above, is that they can inform us to a good extent about the perceived added value compared to the counterfactual case of not being in a technopark. As technopark incentives are quite appealing, it is challenging to find comparable firms (hat can be considered as depicting appropriate counterfactuals) to technopark firms because those firms shall have migrated into the technoparks already if they are that similar to technopark firms. In Turkey, Ministry of Science, Industry and Technology aims to procure such studies for in-house evaluation purposes and confronts with mentioned limitations. Asking technopark entrepreneurs questions about their counterfactual situation if they had not taken place in a technopark provides us an alternative approach and we suggest that it can be used as a complementary approach to fence of mentioned limitations. However, objective studies has the obvious advantage of producing objective findings and a combined use of both strategies as elements of a broader evaluation program is advised.

All in all, we believe our findings and our approach as a complimentary evaluation tool can aid in the pursuit for improving the performance of technoparks in Turkey. Findings of this study is important as it also provides an example for technopark policies and dynamics in a developing/emerging country context.

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1. ***Mehmet CANSIZ,*** *Dr., Hacettepe Üniversitesi, Mühendislik Fakültesi, Endüstri Mühendisliği Bölümü, Yarı-zamanlı Öğretim Görevlisi.* [↑](#footnote-ref-2)
2. ***Bilgehan ÖZBAYLANLI****, ODTÜ, Sosyal Bilimler Enstitüsü, İktisat Bölümü Doktora Öğrencisi.*

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