PHYSICAL SPACE MATTERS: DEVELOPING SOCIAL CAPITAL FOR INNOVATION IN TECHNOPARK BUILDINGS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AHMET MELİH HORATA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF SCIENCE AND TECHNOLOGY POLICY STUDIES

SEPTEMBER 2019

Approval of the Graduate School of Social Sciences

_____

Prof. Dr. Yaşar Kondakçı
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

_____

Prof. Dr. Mehmet Teoman Pamukçu
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

_____

Prof. Dr. Nazlı Wasti Pamuksuz
Supervisor

Examining Committee Members

Assoc. Prof. Dr. İ. Semih Akçomak (METU, STPS) _____

Prof. Dr. Nazlı Wasti Pamuksuz (METU, BA) _____

Assoc. Prof. Dr. Berna Tarı Kasnakoğlu (TOBB ETÜ, BA) _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: Ahmet Melih Horata

Signature :

ABSTRACT

PHYSICAL SPACE MATTERS: DEVELOPING SOCIAL CAPITAL FOR INNOVATION IN TECHNOPARK BUILDINGS

Horata, Ahmet Melih

M.Sc., Department of Science and Technology Policy Studies

Supervisor: Prof. Dr. Nazlı Wasti Pamuksuz

September 2019, 79 pages

While technoparks are physical spaces where entrepreneurial firms are colocated so that synergies will be borne across them, research about the effects of physical spaces on developing synergies has been scarce. Through semi-structured interview data from employees of firms located in a major Turkish technopark (Technopark M), a grounded theory approach is used to explore the impacts of the physical aspects of technopark spaces on interfirm social capital and its impacts on collaboration. An integrated framework capturing the relationships among physical space, social capital, and innovativeness shows that although there is a positive relationship between physical space and information flow and collaboration, both of which are conducive for the innovativeness of the tenant firms, the physical spaces in Technopark M generally lack in functionality, leading to weak communication and interaction opportunities among the tenant firms, which in turn hinder the collaboration opportunities among them.

Keywords: Technopark, interaction, innovation, social capital, physical space.

ÖZ

FİZİKSEL ORTAMIN ÖNEMİ: TEKNOPARKTA SOSYAL SERMAYE GELİŞİMİNİN İNOVASYON ÜZERİNDEKİ ETKİSİ

Horata, Ahmet Melih
Yüksek Lisans, Bilim ve Teknoloji Politikası Çalışmaları
Tez Yöneticisi: Prof. Dr. Nazlı Wasti Pamuksuz

Eylül 2019, 79 sayfa

Teknoparklar girişimci firmaların aralarında bir sinerjinin doğabilmesi amacıyla bir arada konumlandırıldıkları fiziksel alanlardır. Fakat söz konusu alanların bu sinerjinin oluşturulması sürecindeki etkilerini araştıran çalışmaların sayısı oldukça azdır. Bu çalışmada Türkiye'de yer alan büyük bir teknoparktaki (Teknopark M) firmaların çalışanları ile yapılan yarı yapılandırılmış mülakat verileri kullanılarak, teknopark alanlarının fiziksel yönlerinin firmalar arası sosyal sermaye ve iş birlikleri üzerindeki etkileri gömülü kuram yaklaşımı kullanılarak incelenmektedir. Fiziksel alan, sosyal sermaye ve yenilikçilik arasındaki ilişkileri yansıtmak amacıyla oluşturulan bütünleşik çerçeveye göre fiziksel alan ile firmaların yenilikçiliğine olanak sağlayan bilgi akışı ve iş birliği arasında pozitif bir ilişki olmasına rağmen, Teknopark M'nin fiziksel alanı, genel olarak işlevsellikten yoksun bulunduğu için firmalar arasında iletişim ve etkileşim fırsatlarına yeterince yol açmamakta ve dolayısıyla firmalar arasındaki iş birliği olanaklarını engellemektedir.

Anahtar Kelimeler: Teknopark, etkileşim, yenilikçilik, sosyal sermaye, fiziksel alan.

To My Wife

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor, Prof. Dr. Nazlı Wasti Pamuksuz, not only for her valuable guidance and support throughout the research but also for her priceless contributions to this thesis.

I would also like to thank all participants of the field research for their contributions to the thesis by answering the interview questions.

Finally, I would like to thank my wife and my family for their constant support.

TABLE OF CONTENTS

PLAGIARISM iii

ABSTRACT iv

ÖZ v

DEDICATION vi

ACKNOWLEDGEMENTS vii

TABLE OF CONTENTS viii

LIST OF TABLES x

LIST OF FIGURES xi

LIST OF ABBREVIATIONS xii

CHAPTERS

1. INTRODUCTION 1

2. LITERATURE REVIEW 6

2.1 Social Capital 7

2.2 Relationship of Social Capital and Innovation/Creativity 9

2.2.1 Structural Dimension – Innovation 12

2.2.2 Relational Dimension – Innovation 14

2.2.3 Cognitive Dimension – Innovation 15

2.3 Relationship of Proximity in Physical Space and Social Capital 15

2.4 Innovation / Creativity via Design of the Physical Space 18

2.5 Summary of Relations among the Studied Phenomena 21

3. METHODOLOGY 24

3.1 Research Context 24

3.2 The Grounded Theory Approach 25

3.3 Data Collection and Sampling 29

3.4 Qualitative Analysis 31

4. FINDINGS AND DISCUSSION 33
4.1 Interaction Modes and Patterns 33
4.2 Motivations 39
4.3 Mood 39
4.4 Physical Environment 40
4.5 Enablers of Information and Collaboration 41
4.6 Integrated Framework for the Development of Social Capital and Innovation through the Smart Usage of Physical Space in the Technopark 43
4.7. Comparison of the Grounded Model with Extant Literature 52
5. CONCLUSION 54
5.1 Policy Suggestions 58
5.2 Limitations and Future Research 59
REFERENCES 61
APPENDICIES 69
A. METU HSEC APPROVAL 69
B. TURKISH SUMMARY/TÜRKÇE ÖZET 70
C. TEZ İZİN FORMU/THESIS PERMISSION FORM 79

LIST OF TABLES

Table 1. Differences between the Traditional and Constructivist Approaches 29
Table 2. Informative Summary of Interviews 31
Table 3. Representative Quotations..... 36
Table 4. Representative Quotations (continued) 37

LIST OF FIGURES

Figure 1.a. Social Capital - Innovation / Creativity 22
Figure 1.b. Physical Space - Social Capital ……..…22
Figure 1.c. Physical Space - Innovation / Creativity..... 22
Figure 2. Data Structure 34
Figure 3. Integrated Framework..... 47
Figure 4. Proposed Relationship of the Studied Phenomena …… 53

LIST OF ABBREVIATIONS

R&D	Research and Development
SMEs	Small and Medium Sized Enterprises
STPs	Science and Technology Parks

CHAPTER 1

INTRODUCTION

Science and/or technology parks can be described as property-based organizations with an administrative center focusing on business acceleration with accumulation of knowledge and resource sharing (Phan, Siegel and Wright, 2005). Thus, they can be considered as physical spaces where firms are colocated with the expectations that synergies will naturally be borne across them. One of the main arguments for science/technology parks is that the physical proximity of firms in such clusters eases the development of face-to-face interactions and trust between firms which, in turn, enables the exchange, spillover, and diffusion of knowledge, leading to innovation (Dolfsma and van der Eijk, 2016; Nilsson and Mattes, 2015; Whittington, Owen-Smith and Powell, 2009). Physical proximity plays a significant role for the development of collaboration among actors embedded in a particular area. That is to say, clusters can lay the foundations for the development of social capital (Carmona-Lavado Cuevas-Rodriguez, and Cabello-Medina, 2010).

Although it was originated in sociology and described as an asset owned by an individual or a group, the notion of social capital has increasingly become an attractive concept in the last decades, not only in the field of political science but also among management scholars (Zheng, 2008). While other forms of capital, such as physical and human capital, can simply be defined as tools and training that improve the productivity of actors, characteristics of social organization underlie the notion of social capital. According to Halpern (2005), social capital differs from human capital which only considers the proficiency stock possessed by an actor. On the other hand, social capital is characterized as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relations possessed by an individual or social unit" (Nahapiet and Ghoshal, 1998, p. 243),

which is an outcome of social interaction, and as such, a resource embedded in interpersonal networks (Nahapiet and Ghoshal, 1998).

Research stresses that social capital has a critical role infirm innovation (e.g., Subramaniam and Youndt, 2005; Zheng, 2010) and that it enables firms to access new knowledge through their social relations (Ingram, 2002; Inkpen and Tsang, 2005; Lin, 2001). Innovation is considered to be reached as a result of information exchange and interaction among distinctive actors and not obtained by isolated actors or events (Landry, Amara, and Lamari, 2002). In other words, it is derived through the convergence of discrete knowledge from diverse agents (Landry et al., 2002). As mentioned above, agglomeration policies like science and/or technology parks allow for proximity between business enterprises to facilitate knowledge access and foster the innovation development process (Boschma, 2005).

However, agglomeration is not a sufficient condition for technological innovation to be boosted. It is the network activity between firms that makes these regions work and without these interconnections, it is unlikely that such districts will indeed be (and remain) innovation hotbeds (Ozcan and Eisenhardt, 2009). Substantial communication channels are essential, and only their combination ensures a favorable setting for promoting the degree of accumulation of knowledge, networking, and the possible technological innovations (Antonelli, 2000; Hansson, Husted and Vestergaard, 2005). Therefore, assuring interaction between tenant firms is crucial for technoparks to perform well (Hansson, Husted and Vestergaard, 2005). It is hence important to construct an environment that can increase and maintain social interactions among firms aiming to be entrepreneurial and innovative.

With innovation being a key factor in the success or failure of R&D-based organizations, understanding of the impact of localized social capital and knowledge exchange within a physical space becomes an important issue (Bell and Zaheer, 2007; Laursen, Masciarelli, and Prencipe, 2012). While clusters as a space been a topic warranting some attention, Davis (1984, p. 271) and Dul (2018) note that research on the physical work environment is “one of the most vaguely understood aspects of management and organizational behavior”. Many researchers have stressed that the

physical work environment is crucial for creativity (e.g., Amabile, Conti, Coon, Lazenby, and Herron, 1996; Dul and Ceylan, 2011; Dul, Ceylan, and Jaspers, 2011; Shalley, Zhou, and Oldham, 2004; Whittington et al., 2009; Woodman, Sawyer, and Griffin, 1993).

Workspaces play a vital part in promoting knowledge transfer and innovation (e.g., Kristensen, 2004; Mabey, Wong, and Hsieh, 2015; Moultrie, Nilsson, Dissel, Haner, Janssen, and Van der Lugt, 2007), and Moultrie et al. (2007) have noted the role of physical environments in forming firm innovation strategies. In this thesis, the aim is to investigate the actual physical aspects of the technopark spaces where firms are clustered and how these aspects relate to the development of interfirm social capital for high-technology innovative firms. In this context, this research and its findings can be considered as directive guidelines for technopark administrations in their role of developing innovation hotbeds.

A qualitative methodology is adopted in this thesis and a grounded model is built pursuant to the data obtained through semi-structured interviews to be able to respond to the research questions below:

(i) Does physical space matter in social capital development?
(ii) If so, how do the characteristics of the physical environment affect processes of developing and utilizing social capital in the context of technoparks?
(iii) Can the design of technopark buildings enable synergies to be borne across tenant firms and foster their innovative activities?

To answer these questions is important, especially when the significance of innovativeness in any country's competitiveness is taken into consideration. "Technological innovation is universally considered as an important driver for long-run production and a necessary condition for sustainable economic growth" (Dominics, Florax, and Groot, 2013). Furthermore, there is a considerable concurrence in the literature on the enhancing role of social capital on innovativeness of firms through facilitating resource and knowledge exchange (Nahapiet and Ghosal, 1998; Tsai and Ghosal, 1998; Tötterman and Stan, 2005). Therefore, the answers to

the research questions of this thesis can give significant hints about how to design technoparks organized in order to increase information sharing among firms and enable their innovative activities.

By using a grounded approach for the development and benefits of social capital through the enabling features (or lack thereof) of physical space and by developing an integrated framework which reflects the link between social capital, the physical environment, and innovation in the context of technoparks, this thesis makes several important contributions. First, the thesis reveals the link between the phenomena of social capital, physical space, and innovation, which have been investigated in a dichotomous fashion in extant literature. This study brings a new point of view to the literature by linking these three concepts together.

Second, the thesis aims to make a contribution towards enhancing social capital and firm innovativeness by highlighting the potential of smart usage of physical space characteristics in a technopark context. In extant literature, the relationship between creativity or innovativeness and the physical environment or design of offices is widely studied. This thesis brings a new perspective by investigating and focusing on a technopark as the physical environment. Hence, this study expands on the literature on clusters by highlighting the specific case of technoparks, which are considered seedbeds for innovative activities and synergies. Lastly, the outcomes of this research can be a guide for technopark administrations to plan their physical environment so as to develop and utilize regional social capital and increase collaboration among their tenant firms and thus their innovativeness. These three points can be regarded as the contributions of this thesis.

The thesis consists of five chapters. To capture the relationships among physical space, social capital development, and technopark firms' innovativeness, Chapter 2 introduces the concept of social capital and presents an overview of the relevant literature regarding the relations among these phenomena. Chapter 3 introduces the research context, grounded theory usage, and the processes of data collection and analysis. It also highlights the data structure of the grounded model which emerged from the data obtained through semi-structured interviews. In Chapter 4, the findings

of the research and the conceptual framework capturing the relationships among physical space, social capital development, and the technopark firms' innovativeness are introduced. Chapter 5 comprises the concluding remarks, theoretical contributions of the thesis, and possible policy implications for technoparks.

CHAPTER 2

LITERATURE REVIEW

Social capital enables opportunities to capture the knowledge or information embedded in social relationships, which pave the way for communication or social interactions among individuals to be regarded as a proxy for social capital (Zheng, 2008). When the link between social capital and physical space is taken into consideration, physical proximity emerges as an important factor. The academic discourse emphasizes the enabling role of geographic proximity for knowledge flow as proximity facilitates face-to-face interactions (Cassi, Morrison and Rabellotti, 2015). In other words, physical proximity facilitates repeated and frequent social interaction among actors, which leads to a decrease in the marginal cost of knowledge—especially valuable tacit knowledge—transfer. The relationship between physical environment and social capital has also been studied in the context of clusters. The literature reveals that the cost of knowledge exchange can be minimized via face-to face communication, repeated interaction, and observation among actors with the help of clustering or agglomeration (Phelps, 2010).

Many studies in the literature capture the positive effect of social networks in which firms are embedded on firms' innovative performance (Fukuyama, 1995; Yli-Renko, 2002; Utterback, 1971; Akcomak and Weel, 2009; Zheng, 2008; Molina-Morales and Martinez-Fernandez, 2010; Laursen et al., 2012). The literature states that social capital has a prominent impact on the long, expensive, and risky innovation process by spreading the costs and risks associated with innovation between larger number of actors acquiring different information, knowledge, and technology. Innovativeness is shown to progress indirectly as a consequence of escalated cooperation by social capital, which provides a decrease of information transaction costs (Putnam, 1995;

Fukuyama, 1995). In other words, “[s]ocial capital is regarded as the bedrock of innovation” (Zheng, 2008).

The literature investigating the relationships of social capital, physical space, and innovation is typically fragmented in the form of dyadic relationships of these concepts. In this section, a more detailed review of this literature will be presented in order to have a comprehensive examination of the interrelationships of these concepts.

2.1 Social Capital

Social capital is considered as a concept expressing how information resources are attained through relations in the business literature (Adler and Kwon, 2002; Inkpen and Tsang, 2005; Lin, 2001; Nahapiet and Ghoshal, 1998). It allows companies to acquire new knowledge and information in a structure with less uncertainty as it provides more trustworthy information channels created by social relations. It arises from a social network enabling mutual and strong ties to be created among its members through compact communication (Coleman, 1990). Such networks promote strong relational ties and interaction by means of improvement of trust, a common identity or reciprocity between members.

Although the literature presents several descriptions for social capital, Portes (1998) argues that a consensus on its definition has evolved in the social capital literature and considers social capital as "the ability of actors to secure benefits by virtue of membership in social networks or other social structures". Another notable description in the literature can be stated as “anything that facilitates individual or collective action, generated by networks of relationships, reciprocity, trust and social norms” (Coleman, 1988).

According to Lin (2001), social capital is described as an “...investment in social relations by individuals through which they gain access to embedded resources to enhance expected returns of instrumental and expressive actions”. It occurs in the

form of ties among agents and it is not embedded in the agents themselves or in tangible applications of production (Coleman, 1988).

How to evaluate social capital and determine its sources has been studied extensively in the literature. Nahapiet and Ghoshal's (1998) definition of social capital can be considered as widely adopted in the literature. In their definition, social capital is characterized as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relations possessed by an individual or social unit" (Nahapiet and Ghoshal, 1998).

Nahapiet and Ghoshal's (1998) definition of social capital consists of its relational, cognitive, and structural dimensions. The relational dimension refers to the beliefs and norms that bond people together in a social network; such as respect, friendship, trust, expectations, norms, and obligations. The cognitive dimension refers to "those resources providing shared representations, interpretations, and systems of meaning among parties" (Nahapiet and Ghoshal, 1998). Finally, the structural dimension refers to configurations and patterns of connections between people, which overlaps with the concept of a social network. Social capital's structural dimension, which is defined as "the patterns of the social ties characterizing a group of actors, it concerns the properties of the social system and the network of relations as a whole" (Nahapiet and Ghoshal 1998), is the dimension that has received the most interest in the literature (Filieri and Alguzeaui, 2014) because of the fact that social capital emerges as consequence of communication or interaction among actors sharing their ideas (Subramaniam and Youndt, 2005). So, if there is no interaction among individuals, or in other words, in the case of lack of structural dimension, it would be hard to discuss the relational or cognitive dimensions of social capital. This is why social capital is defined as an outcome of social interaction and is a resource embedded in interpersonal networks (Nahapiet and Ghoshal, 1998).

Like Nahapiet and Ghoshal, Bourdieu notes that social capital pertains to interaction or resides in relations, and that ties are built through exchange (Bourdieu, 1986). "All these chances to share knowledge could improve the collaboration and interaction among people, affecting social capital positively" (Carmona-Lavado et al., 2010).

Anderson and Jack (2002) also describe social capital as the aggregate of relations within a social system and argue that social capital is created on the basis of interactions. Using a parallel approach, Burt (1992) considers a high degree of social relations as the central notion for social capital and indicates that social capital supplies information advantages with regard to access, timing, and referrals. Maurer, Bartsch and Ebers (2011) also follow the view of social capital which is based on agents' social relations. In other words, the agents' chances to get access to resources embedded in their social ties are affected by the content and structure of their social (Maurer et al., 2011).

Social capital differs from the other forms of capital because it occurs in the relationships among individuals, not in the individuals themselves (Adler and Kwon, 2002). As stated before, social capital is also considered by Nahapiet and Ghoshal (1998) as resources created by interpersonal networks which are, therefore, embedded and present within them. Social ties underlie social capital.

In light of this literature, it can be stated that it is the social interactions and their potential benefits that make social capital valuable or important and it can be concluded that social capital comprises resources founded in relationships among actors. Social capital increases chances to capture and gain the knowledge or information embedded in social relationships and this embeddedness makes way for considering communication or social interaction among people as a proxy for social capital, as social capital resides in social connections (Zheng, 2008).

2.2 Relationship of Social Capital and Innovation/Creativity

Innovation is defined as "generation, acceptance, and implementation of new ideas, processes, products, or services" (Van de Ven and Angle, 1989). It is also known to be a long, expensive, risky, and interactive process. Social capital has a prominent impact on this process by spreading the costs and risks associated with innovation among larger number of actors acquiring different information, knowledge, and technology.

Innovation is considered as an interactive event by Utterback (1971) and this is why social capital, together with other kinds of capital, plays an important role on facilitating opportunities to innovate, especially for technology-based firms. Since technology changes frequently and knowledge can be widely distributed, the innovation process becomes a more compelling phenomenon and this situation makes technology-based companies more dependent on organizational networks. Both Fukuyama (1995) and Yli-Renko (2002) emphasize the significance of social capital on the innovative performance of technology-based companies. While Fukuyama (1995) considers informal information exchanges as vital for high-tech ventures, Yli-Renko (2002) finds that the development of social capital is a substantial driver for the international expansion of technology-based firms.

Akcomak and Weel's (2009) empirical study on European regions is among several studies attempting to capture the relationship between innovation and social capital. The authors identify innovation as an important tie through which social capital affects per capita income in a particular region (Akcomak and Weel, 2009). Their study compares the social capital levels of different regions in Europe and highlights that a higher stock of social capital leads to further innovation (Akcomak and Weel, 2009).

There are many studies in the literature capturing the supportive effect of social networks on the firms' innovative performance. Nahapiet and Ghoshal (1998) state that research investigating the impact of social networks on creativity and innovation underlines the benefits obtained from the networks by actors and reveals how these benefits, named as "structural social capital", enables knowledge creation.

Ingram (2002) considers interfirm interactions as an important channel for knowledge exchange because of the highly and heterogeneously spread and diffused nature of knowledge. As the level of social capital in a firm's network increases, not only does the firm's ability and possibility to acquire knowledge possessed by other actors in the network but also the efficiency of information exchange increase, resulting in more sophisticated innovations (Inkpen and Tsang, 2005). According to Rosli and Rossi (2015), knowledge is identified as a dynamically built phenomenon possessing

some amount of tacitness, and this structure of knowledge is the reason why its exchange is essentially considered to be a social and interactive learning process necessitating active participation of different actors.

Collinson (2000) regards the relationship between social capital and innovation from a knowledge-oriented point of view and considers knowledge as a phenomenon composed with social, political, and economic bonds. The integration of these elements reveals knowledge creation, which is shaped through the interaction among different social components (Collinson, 2000). Consequently, social capital can be perceived as a key innovation-inducing and knowledge-creating parameter.

Zheng (2008) reviews the literature on the relationship between social capital and innovation and concludes that social capital has a significant effect on innovation. The main driver of Zheng's study is to find out how innovation is generated and, as in the article of Nahapiet and Ghosal (1998), innovation is considered as a phenomenon encompassing creativity, knowledge creation, and innovation generation and application (Zheng, 2008). The reason why creativity and knowledge creation are involved is the fact that these concepts are highly "ingrained" in studies examining innovation (Zheng, 2008). "An approach to work that leads to generation of novel appropriate ideas, processes, or solutions" is how Amabile (1998) defines creativity and it shows itself in the production process of a new and beneficial product or service. Creativity can be regarded as the early phase of innovation, where the idea generation process is realized, as opposed to other phase of innovation application. Knowledge creation is also considered as a vital part of the innovation process due to the fact that novel products or services result from new ideas (Zheng, 2008).

In the literature, there is a consensus on the enhancing role of social capital on innovativeness of firms through facilitating resource and knowledge exchange (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998; Tötterman et al., 2005). This relationship between social capital and innovation will be discussed in the next sections with regard to the dimensions of social capital. In light of his large-scale

review, Zheng (2008) groups the major concepts from the relevant literature according to the three dimensions of social capital introduced by Nahapiet and Ghoshal (1998). This grouping is important since it presents a brief and concise summary of the channels through which the link of social capital and innovation is shaped.

2.2.1 Structural Dimension – Innovation

As mentioned above, Nahapiet and Ghoshal's (1998) definition of social capital is given in the form of its structural, relational, and cognitive dimensions. The structural dimension refers to configurations and patterns of connections between people, which overlaps with the concept of social network. According to Zheng (2008), there are four major concepts widely researched in social network-innovation studies: ego network size, structural holes, tie strength, and centrality. These concepts are recognized as being related to the structural dimension of social capital (Zheng, 2008).

Ego network size shows the total number of contacts that an agent has in its network and is found to affect innovativeness positively (Zheng, 2008). The mechanism behind the notion, in its simplest form, is that as an agent's network gets larger, the number and diversity of its interactions increase which, in turn, lead to high degree of exposure to external resources. To be able to reach and use external resources and information, it is vital to have a dense social network, which consequently affects innovation capabilities positively (Molina-Morales and Martinez-Fernandez, 2010). Lane and Lubatkin (1998) also indicate that information flow via social interaction among firms fosters opportunities to not only gather new knowledge but also make use of existing knowledge, which in turn feeds the process of product and process innovations. To access new resources and information, Allen (1977) emphasizes communication and argues that agents like engineers or technologists need to have face-to-face interactions in order to exchange information. Kratzer (2001) and DeMeyer (1991) state that the productivity of new product development teams

depends considerably on their members' ability to access the right networks of information and knowledge flows.

The second concept falling into the structural dimension of social capital is the structural hole, which refers to the indirect links among two disconnected or unrelated agents through a third agent in a social network (Burt, 1992). In other words, there are spaces among agents in a network such that these agents do not have a close interaction between them. This results in such actors reaching separate information flows and resources and thus "an opportunity to broker the flow of information between people and control the projects that bring together people from opposite sides of the hole" (Burt, 2000). Landry et al. (2002) argue that innovation is not a process realized through discrete events obtained from insulated inventors but is actualized as a result of knowledge exchanges and communications among a diversity of agents. It is necessary to bring diversified knowledge possessed by different agents together to achieve innovation, and social capital provides this convergence (Laundry et al., 2002).

The other notion associated with structural social capital is network tie strength, which focuses on the nature of relational contact. A strong tie contains dense and frequent relations among actors, and this provides an eagerness for collaboration, reciprocal trust, and social cohesion among actors (Coleman, 1988). Research shows that an actor's tie strength has a positive effect on innovation (Zheng, 2008).

The network centrality notion is the last concept related to the structural dimension of social capital. The position of an agent in its network is the main focus in this concept, which mainly argues that an agent which takes a central part in its network has a favorable position, which enables better exploitation of the information flows in the network. According to Tsai and Ghoshal (1998), actors standing in a central position in their networks have relatively compact and frequent relationships, and this makes them trustworthy. Trust is the channel through which centrality impacts innovation (Tsai and Ghoshal, 1998). Perry-Smith (2006) also shows that agents having a central location are found to be more creative than relatively more peripheral ones in the network.

2.2.2 Relational Dimension – Innovation

Nahapiet and Ghoshal (1998) define the relational dimension of social capital as the beliefs and norms linking individuals together in a social network, such as respect, friendship, trust, expectations, norms, and obligations. Zheng (2008) also shows that research covering the relationship between social capital and innovation highly focus on trust and norms. Norms can be defined as "expectations about what are appropriate and inappropriate attitudes and behaviors" (O'Reilly, 1989) and they latently shape and influence the behaviors of the members of an organization. Russell and Russell (1992) state that norms are considered as the main guiding source in ambiguous processes like innovation, where formal organizational methods and systems might be ineffective.

As mentioned before, innovation is an uncertain and risky process because it generally comprises dealing with unknown issues or making use of pieces of information or methods that have not been put to use together. Trust is argued to decrease transaction costs of knowledge and the uncertainty of the innovative process through open interaction and cooperation (Brelade and Harman, 2000), thus making a positive contribution to innovation.

Laursen et al. (2012) argue that given that it is identified with regard to norms and networks, regional social capital supports innovations since it ensures connecting actors from different organizations and combines particular knowledge components within separate regions. According to Rutten and Boekema (2010), innovation is a phenomenon highly related to networks. Crucial elements of innovation, like diffusion of information and knowledge flow among agents, are more likely to be observed in networks where mutual values, norms, and trust are developed (Rutten and Boekema, 2010).

2.2.3 Cognitive Dimension – Innovation

Social capital's cognitive dimension refers to "those resources providing shared representations, interpretations, and systems of meaning among parties" (Nahapiet and Ghoshal, 1998). It is shaped through a group's characteristics like a shared vision or shared codes which enable communication among agents (Tsai and Ghoshal, 1998). These cognitive structures play a determinant role for agents during processing, forming, using, and giving meaning to information, which are crucial for different phases of innovation like knowledge creation, problem-solving, or gathering and making use of different resources. Zheng (2008) argues that a shared vision is regarded as highly important in the limited literature showing the tie between shared cognition and innovation, and notes that while there are several studies concluding a positive relationship between shared vision and innovation, especially organizational innovation, there is also some research not showing a substantive impact.

To conclude, a general trend in the innovation studies literature is that social capital is one of the significant elements triggering creativity, knowledge creation, and innovation. Carmona-Lavado et al. (2010) consider innovation as an effort of collaboration and highlight the important role of social capital for innovation. Their paper analyzes the impact of organizational and social capital on firms' product innovation and they conclude that social capital can lead to more product innovation. Laursen et al. (2012) also indicate that being situated in a region having a high level of social capital stirs up a higher tendency of innovation.

2.3 Relationship of Proximity in Physical Space and Social Capital

It is more likely for units or people physically close to each other to communicate and get to know each other better. Actors sharing the same physical environment have the opportunity to establish much more informal and formal relationships, and it will be easier for them to develop trust among them by means of face-to-face communication.

Geographical proximity is defined by Boschma (2005) as the spatial or physical distance between agents and argues that it eases the tacit knowledge exchange through dense and immediate interactions, which is considered in the literature as the significant role of geographical proximity (Knoben and Oerlemans, 2006). Boschma (2005) also argues spatial proximity should not be considered separately from the other dimensions of proximity (organizational proximity, institutional proximity, social proximity, cognitive proximity), and expresses that since geographical proximity facilitates communication and interactive learning among actors, it also intensifies the other dimensions of proximity. Along the same lines, Capone and Lazzeretti (2018) investigate the role of spatial proximity and other dimensions of proximity on network formation in an Italian cluster. Their analysis shows that compared to other dimensions of proximity, geographical proximity comes into prominence in firms' relationship development and their results highlight that especially tacit knowledge transfer is realized through this dimension (Capone and Lazzeretti, 2018).

In his pioneering study about the patterns of interaction and knowledge transfer in a laboratory, Allen (1977) states that physical distance between actors can hinder the knowledge exchange and it may cause them to not come together to learn about each other's experience and information. According to Akerlof (1997), the distance between actors plays a vital role on whether they will make interactions with each other to exchange knowledge. It is also indicated that as the distance among actors rises, they are more unlikely to establish relationships and exchange information (Akerlof, 1997). Nelson and Winter (1982) also highlight the importance of geographical proximity for development the of social capital. They consider tacit knowledge as an important and sticky component and indicate that it is hard and complicated to separate it from its context (Nelson and Winter, 1982). This knowledge transfer and social capital development can be realized easier through face-to-face communications nurtured by physical proximity (Nelson and Winter, 1982).

Bell and Zaheer (2007) state that geographic distance makes it difficult to transmit knowledge between individuals in organizations because of its contextual, uncertain, and sticky nature, and that geographic proximity can facilitate knowledge transmission by providing face-to-face communication opportunities and potentially building trust between individuals. Breschi and Lissoni (2001) argue that physical proximity can pave the way for learning phases through knowledge spillover mechanisms, most particularly for tacit knowledge. They indicate that the flow of new information occurs more smoothly among agents located in the same physical environment (Breschi and Lissoni, 2001). Nilsson and Mattes (2015) also focus on face-to-face interactions and trust among actors and state that physical proximity cannot be singly considered as sufficient for social interaction or establishing trust, but it is "highly facilitative". Similarly, Stuart and Sorenson (2003) indicate that geographical proximity eases the occurrence of not only informal but also formal networks and that the dissemination of knowledge or information transfer emerges through these networks (Stuart and Sorenson, 2003). Dolfsma and van der Eijk (2016) point out that the physical distance between actors influences the opportunity for knowledge transfer.

There are also several studies examining the relationship between physical proximity and social capital in the context of clusters and science and technology parks. Carmona-Lavado et al. (2010) indicate that interaction and collaboration among actors, which affects social capital positively, can be improved with opportunities to share knowledge. Therefore, physical space, which can be considered as a platform for social interaction and knowledge exchange, should be taken into consideration as a social capital enabling factor. Science and technology and clusters and parks can be regarded as examples of such platforms.

A cluster can be defined as an industrial body based on mutual competence of several firms founded within the same geographic boundaries (Porter, 1998). Like clusters, science and technology parks (STPs) are also founded to encourage close and dense social interactions and knowledge exchange among companies. An STP can be described as a property-based institution that focuses on business acceleration with

knowledge accumulation and resource sharing (Phan, Siegel and Wright, 2005). In order to perform well, it is crucial for STPs to supply interaction between tenant companies, since their role requires an effective networking to induce knowledge and resource transfer between the companies (Hansson, Husted and Vestergaard, 2005).

One of the main arguments in the context of clusters or STPs is that clusters not only facilitate knowledge spillovers but also support interactive learning within social networks (Lazzereti and Capone, 2016). According to Audretsch and Feldman (1996), chances for repeated interactions, which also lead to development of social capital, increase with clustering. The authors indicate that colocation generates an environment enabling trust, fast diffusion of information, and therefore knowledge spillovers among actors (Audretsch and Feldman, 1996). Thus, there is a concurrence on the enabling role of geographic proximity on knowledge flow as proximity facilitates face-to-face interactions and enables tacit knowledge transfer (Cassi et al., 2015). In other words, physical proximity facilitates repeated and frequent social interaction among actors, and this leads to a decrease in the marginal cost of knowledge--especially valuable tacit knowledge--transfer (Phelps, 2010).

2.4 Innovation / Creativity via Design of the Physical Space

Several scholars have stressed the role of physical spaces on creativity and innovation at work (e.g, Amabile, 1998; McCoy and Evans, 2002; Moultrie, Nilsson, Dissel, Haner, Janssen and Van der Lugt, 2007; Dul and Ceylan, 2011; Dul, Ceylan and Jaspers, 2011; Dul, 2018). According to Kristensen (2004), creativity can be enabled by the careful and smart usage of the physical space. Physical environments (e.g., adequate space, location, equipment, furniture) are essential for enabling high creativity and innovation performance (e.g., Dul, 2018; Moultrie et al., 2007). Harrington (1999) also argues that the physical working space which consists of inner design elements, inner architectural surroundings, and ambient conditions have differing effects on a creative ecosystem.

The study of McCoy and Evans (2002), which investigates the possible impacts of interior design factors on creativity, shows that the physical space has notable components perceived to affect creativity performance. Dul and Ceylan (2011) present a framework capturing the effects of personal, social, and physical elements on individual creativity and by using this conceptual framework, they find that physical environment has a significant influence on creativity. McCoy's (2005) comprehensive literature review presents several examples of research which demonstrate the effect of physical environment on creativity. The study suggests that teamwork creativity can be improved or hindered by characteristics of the physical working space. The study shows that "[s]patial organization, architectonic details, resources, views, and ambient conditions appear to have the potential to support and enhance social behavior relevant to creative achievement in teams" (McCoy, 2005).

Recent research has demonstrated that adequate spatial arrangements such as proximity and accessibility that facilitate social interaction, communication, and privacy can be supportive for creativity (e.g., Vithayathawornwong, Danko and Tolbert, 2003; Hoff and Öberg, 2015). Vithayathawornwong et al. (2003) examined the role of physical work environment in promoting freedom and dynamism which are psychosocial factors related to creativity. While dynamism is associated with the working environment's capability of assisting social interaction and exchange of information, the freedom factor is captured by elements like sense of control over work, structure of breaks, and work rhythm. Vithayathawornwong et al. (2003) show that the physical space supports creative performance through these psychosocial factors. Along a similar line, Gertner (2012) argues that an organization should plan its physical space in order to increase the number of encounters among employees if it aims to develop more innovation. It is stated that increasing encounters provide an environment for knowledge exchange and collaboration vital for innovative activities. Resources (e.g., coffee corners, cafeterias, cafes, seminar or meeting rooms, sitting areas, libraries, photocopy machines, shared computers, teller machines, recreational spaces, smoking zones, mailboxes, administrative offices, and corridors) can facilitate interaction and knowledge exchange. High foot traffic areas may increase interactions with more people (Davis, 1984). According to Sa and Lee

(2012), the centralized position of mutual equipment (e.g., photocopier) and amenities (e.g., coffee shop) caused frequent opportunities for the tenants in a Canadian incubator to engage in informal discussions.

Coradi, Heinzen and Boutellier (2015) observe unplanned social encounters between co-workers mostly in the kitchen and coffee zones. These outcomes go to show that space design targeting more innovativeness assists people's inspiration, capability, and chance to share knowledge and experiences, such as having shared rooms where one can contribute to events arranged by others, are vital for stepping in the community and acquiring new information, possible links, and comments (Oksanen and Stahle, 2013).

According to Dul (2018), the physical environment has the ability to reveal, facilitate, or advance creativity, and this relationship shows up via three possible paths: functionality, meaning, and mood. Dul (2018) argues that these paths can be considered as drivers for creativity at any level of the physical environment (element, space, building, location). It is stated that a functional physical environment should be instrumental, adaptable, and distraction-free. This functionality of physical space is enabled through favorable ambient conditions like light, sound, smell, color, and indoor climate, having favorable artifacts such as plants, materials, furniture, information sources, technology, décor, and a favorable spatial organization (Dul, 2018).

As per architectonic details, the presence of furniture (e.g., chairs, couches, flowerpots, coffee tables) with sociopetal arrangement influence social interaction by providing flexibility, eye contact with others, appropriate interpersonal distances, and physical comfort during conversations (e.g., Davis, 1984; McCoy and Evans, 2002; Anjum, Paul, Ashcroft, 2005; Appel-Meulenbroek, de Vries and Weggeman 2016). The distance separating actors is also called as proxemics; e.g., if seats in a room are located close together, two people in the room appear to be working together (Hartman, 2002).

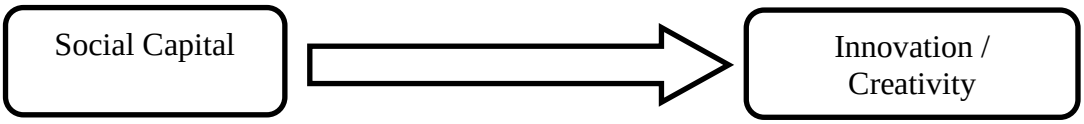
Bollingtoft et al. (2005) state that the construction of incubators and the physical arrangements of the offices are critical in successful incubation programs. Appel-Meulenbroek et al. (2016) argue that when innovation is considered as a primary target, managers or planners should intend to promote short and informal interactions among the staff via spatial design, as knowledge sharing facilitates innovation. Fayard and Weeks (2007) state that elements like ease of entry, accessibility, scope of the shared places, and enclosure (proportion of windows to walls) constitutes the architecture of the space, and they are also influential in generating networks. The respondents in Sa and Lee's (2012) study state that the design of the incubator building assisted them in interacting and building connections. For instance, because the tenants are distributed through the building, people are allowed to come across each other more often and this leads to the increase in the frequency of interactions. The incubator's scope is also important, because as the number of tenants declines, the chance of being acquainted with each other rises. In conclusion, extant literature stresses the important role of physical space on innovation and creativity. In light of these findings, it is possible to propose that physical space dimensions are vital to the effective functioning of technoparks.

2.5 Summary of Relations among the Studied Phenomena

As it is presented in this chapter, extant literature investigating social capital, physical environment and innovation have mainly investigated in the form of dyadic relationships of these phenomena. Figures 1a, 1b, and 1c summarize the literature researching the relationships between the studied phenomena by highlighting the ties and the studies presenting them.

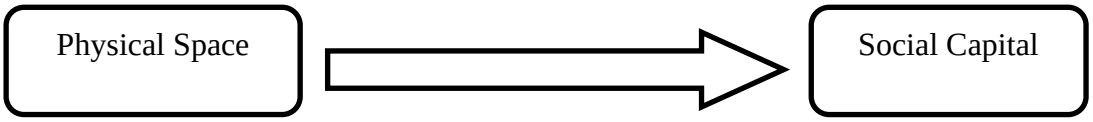
In the first part of this chapter, the concept of social capital, its sources and dimensions were investigated in detail. Extant literature highlights the enabling role of social capital on innovation/creativity through its three dimensions. Next, the relationship between the physical space and social capital was investigated through the literature on physical proximity and clustering.

Figure 1.a Social Capital – Innovation / Creativity



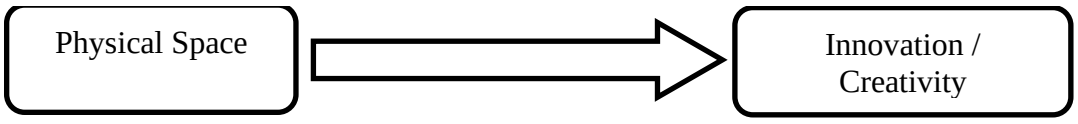
Utterback (1971)	Yli-Renko (2002)
Allen (1977)	Ingram (2002)
DeMeyer (1991)	Tötterman (2005)
Fukuyama (1995)	Inkpen and Tsang (2005)
Nahapiet and Ghoshal (1998)	Zheng (2008)
Tsai and Ghoshal (1998)	Akçomak and Weel (2009)
Lane and Lubatkin (1998)	Molina-Morales and Martinez-Fernandez (2010)
Burt (2000)	Rutten and Boekma (2010)
Collinson (2000)	Carmona-Lavado et al. (2010)
Brelade and Harman (2000)	Laursen et al. (2012)
Kratzer (2001)	Rosli and Rossi (2015)

Figure 1.b. Physical Space – Social Capital



Allen (1977)	Bell and Zaheer (2007)
Akerlof (1997)	Cassi et al. (2015)
Nelson and Winter (1982)	Nilsson and Mattes (2015)
Breschi and Lissoni (2001)	Dolfsma and van der Eijk (2016)
Stuart and Sorenson (2003)	Lazzeretti and Capone (2016)
Boschma (2005)	Capone and Lazzeretti (2018)
Knoben and Oerlemans (2006)	

Figure 1.c. Physical Space – Innovation / Creativity



Amabile (1998)	Dul and Ceylan (2011)
Harrington (1999)	Dul et al. (2011)
McCoy and Evans (2002)	Gertner (2012)
Vithayathawornwong et al. (2003)	Hoff and Öberg (2015)
Kristensen (2004)	Coradi et al. (2015)
McCoy (2005)	Appel-Meulenbroek (2016)
Bollingtoft (2005)	Dul (2018)
Moultrie et al. (2007)	

It can be concluded that physical environment can play a significant role on social capital development. The last part discusses the connection between physical space and innovation/creativity and reveals that physical space can also be considered as an important factor in firm's innovativeness/creativity. This literature review not only highlights the detailed relationships among the phenomena subject to this thesis but also helps to develop the data gathering and the analysis process. The survey questions are generated in light of extant literature in order to capture as many aspects as possible about the physical environment, social capital development and the interaction and collaboration patterns in the technopark.

CHAPTER 3

METHODOLOGY

This chapter presents the research context and research process. Initially, the general characteristics and reasons for the selection of the technopark as the research setting is introduced briefly. The second section gives information about the qualitative methodology chosen for the thesis. In the following section, the data collection process is highlighted, and the sample is described. The last section of the chapter introduces the data analysis process.

3.1 Research Context

The technopark investigated in the research will be called "Technopark M" for the purposes of this study. Technopark M was established at the beginning of the 2000s in one of the major cities of Turkey. It is located on the campus of one of the leading Turkish universities with the objective of establishing incubation centers for technology development by drawing on the infrastructure and know-how presented by the university and government incentives provided to the enterprises.

Technopark M plays host to more than 300 tenant firms, 60% of which were established in its premises, and 5,500 employees, with its more than 130,000 square meters of closed area reserved for R&D operations. More than half of the companies operating in Technopark M are involved in R&D activities in software and information technologies, approximately 20% of them are in electronics, and 15% are in mechanics and design. Tenant companies operating in energy, advanced materials, automotive, medical technologies, food, environment, agriculture, aviation and space industries account for the remaining 14%.

One of the main reasons why Technopark M is chosen as the research setting of this thesis is its layout. Technopark M had started its operations in 2000 with the opening of the building F. It has continued its development with the openings of the buildings B, D, E, A, G and C, respectively, and it has reached to 135,000 square meters of closed area in 2014. There are approximately 10 unconnected buildings in the technopark area and tenant companies are located in these buildings. While some buildings host only one company, most of them have multiple tenant firms. This layout of the technopark enables the chance to observe, compare, and contrast the varying physical environments of different buildings and their possible effects on the communication patterns and interaction opportunities among tenant firms. Therefore, technopark buildings hosting several tenant firms will be the main focus of the study.

3.2 The Grounded Theory Approach

In order to capture the underlying relationships among physical environment, social capital, and firms' innovativeness, and to identify the patterns and processes among these phenomena in the technopark context, a grounded theory approach is employed as the methodology of the thesis. Not only the quantity but also the quality of interaction patterns is important for the purposes of this study. To be able to capture all aspects of social phenomena like communication and social capital development is why grounded theory is chosen as the methodological approach of thesis. Another reason for the methodology is that it is important to observe and discover not only formal but also informal relationships when analyzing the concepts like regional social capital development, interaction, and collaboration, since they serve as a significant channel for knowledge flow among actors (Martin-Rios and Erhardt, 2016). According to Capone and Lazzeretti (2018), there are many quantitative studies in the literature taking formal ties like R&D projects, patents, or publications into account because of the difficulties in data collection about informal social interactions. However, analyzing social relationships with a quantitative approach can have some limitations because they may neglect informal relationships. Therefore, to draw a comprehensive picture of interaction patterns of the technopark

is the other important motive for the selection of the grounded theory as the method of this thesis. Moreover, since most of the firms in Technopark M are small and medium sized enterprises (SMEs), it will be hard to observe all innovative activities of firms using a quantitative approach and examining only traditional innovation indicators like number of patents or R&D expenditures. Therefore, a more flexible method needs to be applied in this study to modify the data collection process and method of analysis more quickly to respond to context-specific constraints (Lee, 2009).

Grounded theory, which is one of the qualitative research designs, was introduced by Barney G. Glaser and Anselm L. Strauss in their book called "The Discovery of Grounded Theory: Strategies for Qualitative Research" published in 1967. Glaser and Strauss state that previous sociological studies focus on how a theory should be verified. It is claimed that many sociologists test existing theories, which only reveal the known realities and do not produce any new theory (Glaser and Strauss, 1967). Glaser and Straus (1967) argue that rather than the verification of a theory or designing a theory through logical deduction, a theory should be developed from the experimental data itself.

Glaser's "Theoretical Sensitivity" published in 1978 is also considered another original text of Grounded Theory, together with "The Discovery" (Gibson and Hartman, 2014). After their first study in 1967, Glaser and Strauss followed different methods in their other texts (Glaser 1978, 1992, 1998; Strauss and Corbin, 1990, 1994, 1998). When their subsequent approaches are compared, it can be stated that they differ in the data collection and analysis processes, at what stage and how to use the literature, and the use of induction, deduction, and verification methods as a theory development process (Heath and Cowley, 2004). Gibson and Hartman (2014) express grounded theory's five core tenets as follows:

- The openness of grounded theory
- Explanatory power of grounded theory
- Generation vs. justification of grounded theory
- Theory structure in grounded theory

- The research process in grounded theory.

In the openness tenet, the important difference between using and having preconceived concepts for researchers, data collection, and hypothesis are emphasized. It is argued that it is a must to have preconceived ideas about the research subject, but researchers should look beyond these preconceived ideas and let the concepts emerge from the data (Gibson and Hartman, 2014). Another important point regarding the openness of grounded theory is that everything should be considered and used as data. The last important aspect of the openness tenet is that hypotheses should emerge from the data. "The openness of grounded theory is designed to protect the theory-building process from becoming preconceived and forced" (Gibson and Hartman, 2014).

With the second tenet, explanatory power, it is assumed that people experience different issues and since social life is organized around these issues, this organization can be captured and conceptualized (Gibson and Hartman, 2014). On the other hand, the third tenet, generation vs. justification, implies that since grounded theory aims to propose a systematic way of developing a theory and produce new hypotheses, it is used for theory generation rather than justification of a theory.

Another core aspect of grounded theory is its specific theory structure. On one hand, when grounded theory is regarded as a method, it guides researchers on how to define categories, how to link them, how to designate a core category, and how to constitute relationships among them. On the other hand, when it is regarded as a theory, it is the last product which provides an explicative framework about the phenomenon under examination. "A grounded theory is composed of categories and propositions about these categories. It is also composed of propositions that relate categories to each other to produce an integrated whole. This is achieved by having a core category which acts as the integrating idea for the theory" (Gibson and Hartman, 2014).

The fifth and the last core tenet of grounded theory is its research process. Gibson and Hartman (2014) consider the research process as "Neither deductive nor inductive, but interactive. A simple process of truth tracking". Basically, the process

starts with data collection. Then the data obtained is analyzed to generate concepts, and this data collection and analysis process continues in order to obtain more concepts and the evolving theory is modified when necessary.

In the literature, there are several different approaches of grounded theory. After the work of Glaser and Strauss, which can be defined as the first generation of grounded theory, a second generation of theorists emerged. These theorists not only analyzed and interpreted the methodology of Glaser and Strauss, but also put forward their own approaches. Among them Charmaz's constructivist grounded theory approach is one of the most quoted expression in the literature (Charmaz, 2000; Bowers and Schatzman, 2009; Gibson and Hartman, 2014). In 2000, Charmaz published her article "Grounded Theory: Objectivist and Constructivist Methods" and referred to a distinction between "traditional (objectivist) grounded theory" and "constructivist grounded theory" (Charmaz, 2000).

Charmaz defines grounded theory as a systematic but flexible guide for the analysis and production of qualitative data. It is used to construct theories that are embedded in the data itself (Charmaz, 2006). Her method and approach to grounded theory can be associated with symbolic interactionism and the Chicago school and her constructivist grounded theory is founded on a pragmatist basis (Charmaz, 2005). According to Charmaz, constructivist grounded theory "aims toward interpretive understanding of subject's meaning" and she claims that a "focus on meaning while using grounded theory furthers, rather than limits, interpretative understanding" (Charmaz, 2000). Traditional grounded theory derives its foundations from positivism and accordingly wants to explore the data in an external way. The data are independent of the eye of the observer and without bias. Constructivist grounded theory, on the other hand, is based on multiple truths and multiple perspectives about reality. Data cannot be separated from what is observed or from the observer. Instead, the data are generated by mutual interaction. Table 1 shows some basic differences in assumptions and analysis processes of objectivist and constructivist grounded theories.

Table 1. Differences between the Traditional and Constructivist Approaches

Traditional (Objectivist) Grounded Theory	Constructivist Grounded Theory
Assumptions	
External reality and discovery of data.	Multiple realities and multiple constructions through mutual interaction.
Conceptualization is derived from data.	The researcher builds the categories.
Considers that the observer is objective, impartial, and passive.	Assumes that the observer's values, priorities, position and actions affect observation.
Analysis Process	
Considers data analysis as an objective process.	Accepts subjectivity throughout the data analysis.
Considers the emerging categories as the shaping of the analysis.	Accepts the joint construction of the data as the shaper of the analysis.
Prioritizes the analytic categories and sound of the researcher.	Prefers to present participants' views and presents them again as an integral part of the analysis.

Source: Charmaz, 2006.

Charmaz's constructivist grounded theory approach is adopted in this thesis because this study focuses on social phenomena like social capital, collaboration, and perceptions of the technopark buildings by people working in Technopark M. These are interactive and subjective concepts and their many aspects of should be captured in order to better highlight patterns in the technopark in terms of interaction and collaboration. Therefore, a methodology assuming that the observer's values, priorities, position, and actions affect observation and focusing on participants' views is considered to be a better fit for this study.

3.3 Data Collection and Sampling

Semi-structured interviews are used to collect data for the present research. Before a full-scale data collection, a pilot study was executed in order to get a feel about the

technopark and its dynamics. During the pilot phase four interviews were conducted, which played an important role in designing the later interviews and the coding process. As Strauss and Corbin (1990) note, theoretical sensitivity, an awareness of the subtleties of meaning of data, is an important quality for researchers employing grounded theory. Hence the pilot study gave us the chance to make better comparisons and ask the right questions, which made the coding process more effective.

Together with the pilot phase, 11 interviews in total were conducted with employees of firms in Technopark M, using the snowballing technique to reach respondents. The interviewees were asked questions regarding the physical characteristics of the building hosting their companies, the general physical environment of Technopark M, their firms' collaboration with other firms, and the interaction patterns among the tenant firms of their building. There were also some questions regarding some control variables such as firm size, its operation time in the technopark, number of tenant firms in their building, and the job positions and experience of the interviewees. The interviewees were asked to pick the site for the interview. The reason for this particular selection was also questioned in order to get insights about the respondents' physical space preferences. The interviews were held in different places and times with eleven people working in seven different companies located in four separate buildings. Three firms are located in a building hosting several tenant firms, one's building hosts three companies, two firms' buildings host four companies, and the last firm is the only one in its building.

Compared to the other firms located in Technopark M, the persons we interviewed can be said to come from relatively large (220-600 employees), experienced, and self-sufficient technopark companies in their own sectors. Six of the interviewees had worked in more than one technopark company (2-4) and five of them had worked in different buildings (2-4). This mobility is common in Technopark M and it supplied us with deeper, comparative information. Even though the number of respondents in the sample is 11, we had the chance to investigate 20 different working experiences in the technopark through this mobility.

Table 2. Informative Summary of Interviews

Respondents	Gender	Profession	Current Building the Respondent Works In	Respondent's Experience in Technopark M	# of Technopark M Firms Worked in by Respondent	# of Buildings Worked in by Respondent	Duration of Interview
1	M	Engineer	D	10 years	1	1	
2	M	Engineer	D	10 years	1	1	
3	F	Mathematician	C	10 years	1	1	
4	M	Engineer	B	1-2 years	1	1	
5	M	Engineer	D	4-5 years	2	1	29 minutes
6	M	Engineer	B	7-8 years	2	2	31 minutes
7	M	Engineer	A	14 years	4	4	48 minutes
8	M	Engineer	A	4-5 years	2	2	24 minutes
9	M	Engineer	A	13-14 years	2	2	27 minutes
10	F	Statistician	A	7-8 years	3	3	23 minutes
11	F	Engineer	A	9-10 months	1	1	13 minutes

3.4 Qualitative Analysis

All interviews, except for the ones done in the pilot phase, were digitally recorded with the required formal research permission of the technopark administration. The average duration of interviews was approximately 28 minutes. After the completion of the data collection, the analysis of the data started with a full transcription of the interviews, and in the next step the coding process began in order to analyze the data within the grounded theory approach.

Charmaz (2006) considers coding as "the generator of the bones of the analysis" and states that there are at least two coding phases in building process of the grounded theory: an initial and a focused coding (Charmaz, 2006). The logic of initial coding is to be open to searching every theoretical probability that can be extracted from the data (Charmaz, 2006). Strauss and Corbin (1990) also indicate that everything should

be considered and used as data in order not to make use of preconceived ideas and to let concepts emerge from the data.

Initial coding analysis was started with line-by-line coding, which can be described as labeling each line of the interview transcriptions (Glaser, 1978). By line-by-line coding, each sentence of the interviews was coded and the relevant concepts with potential research substance were identified. The underlying dynamics and themes shaping the relationships among the research phenomena in the technopark were highlighted through this breaking down of the data. These formed the first-order concepts of the grounded theory.

In the second phase, the analysis was continued with focused coding which is more directed, selective, and conceptual compared to the initial coding phase (Glaser, 1978). It can be defined as "using the most significant and/or frequent earlier codes to sift through large amounts of data" (Charmaz, 2006). In this phase, the first-order concepts were reassessed and refined into more discrete and general groupings. These formed the second-order themes.

Finally, these second-order themes were organized in order to constitute the theoretical dimension underlying them and the grounded theory for the relationship dynamics between the physical environment and the development and utilization of social capital in Technopark M was presented by forming aggregate dimensions. In the last part of the analysis, the patterns and ties among the aggregate dimensions were described to develop an integrated framework through interview statements, their interpretations, and the relevant literature.

CHAPTER 4

FINDINGS AND DISCUSSION

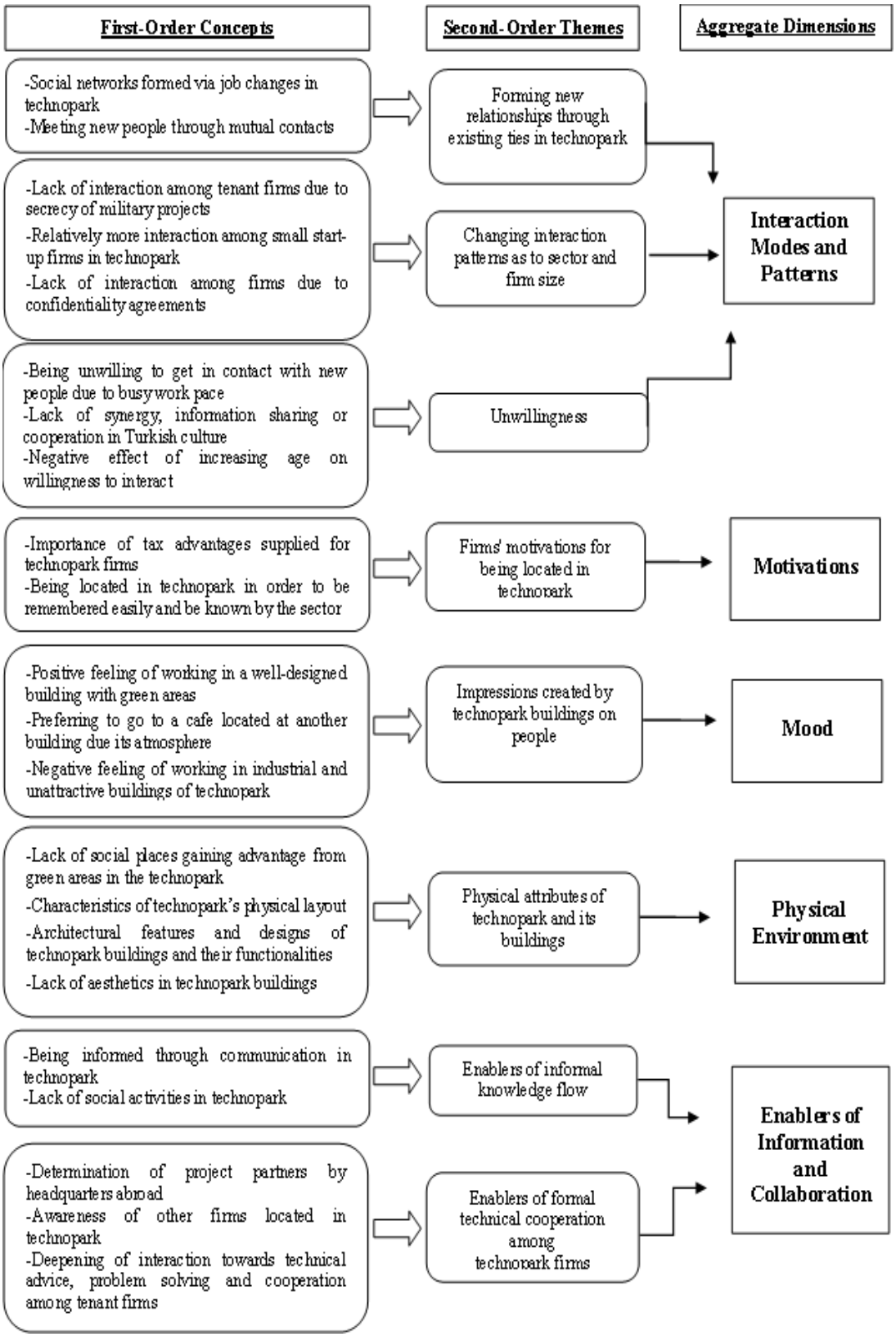
The data structure (Figure 1) leads to a grounded model emerging from the data gathered for Technopark M. This theoretical model contains five core components, aggregate dimensions, which are *interaction modes and patterns, motivations, mood, physical environment,* and *enablers of information and collaboration* with respect to ties between the technopark's physical space and the development of social capital of technopark firms. In this chapter, these theoretical aggregate dimensions and their emergent linkages in Technopark M will be introduced. Representative quotations are also presented in Table 3 in order to highlight the analysis process.

4.1 Interaction Modes and Patterns

Interaction modes and patterns show the ways in which the firms located in Technopark M communicate and interact with each other. They also underlie the emergent factors affecting the interaction among these agents. There are three second-order themes under this theoretical dimension.

The first theme focuses on the role of existing relationships in the technopark informing new relationships. It is found that people working in the technopark generally interact with new people through their existing relationships. Furthermore, the number of relationships established in the technopark through other ways are limited. Thus, the first element (first-order concept) is social networks formed via job changes/staff mobility in the technopark.

Figure 2. Data Structure



The interviews show that employee mobility is very common in Technopark M. More than a half of the sample has worked at more than one firm (ranging from two to four firms) located in the technopark (Table 1). Findings suggest that this job mobility plays an important part for actors in forming their social networks. The respondents stated that they usually meet and interact with new people who are friends of their contacts from their former companies, when they come across their former colleagues in the technopark.

The other first-order concept captures the role of mutual friends in meeting new people in the technopark. As mentioned before in the research context part, Technopark M is located on the campus of one of the leading Turkish universities and there are firms from several sectors, such as software and information technologies (more than half of the total companies located in Technopark M). As a consequence, it is observed that there are a considerable number of people working in the technopark having contacts and mutual friends from their university days and their sector. This also emerges as another important channel for technopark firms and employees regarding the interaction and social capital formation in Technopark M.

The second theme of the first aggregate dimension, interaction modes and patterns, is the variety in interaction patterns as to sector and firm size. As mentioned before, characteristics including firm size were used as control variables in the analysis, but it is seen that the sector in which the technopark firm operates and firm size emerged as significant concepts affecting interaction patterns in Technopark M. There are three first-order concepts under this theme. The first element here is mainly related to military/defense projects. There are many firms in Technopark M operating in the defense industry. It is found that there is a lack of interaction among the technopark firms working on military projects because these firms get their projects from the government and work under confidentiality clauses. This causes them to build barriers towards other tenant firms which, in turn, hinders interaction.

Table 3. Representative Quotations

AGGREGATE	SECOND-ORDER	FIRST-ORDER	REPRESENTATIVE QUOTATIONS
INTERACTIONMODES AND PATTERNS	Forming new relationships through existing ties in technopark	Social networks formed via job changes in technopark	"There are so many job changes among firms. When I meet one of my friends, I can tell them we need someone in this position and ask them whether they want to be included. By doing so we can pull someone from our social network to our company." (Interviewee #10)
		Meeting new people through mutual contacts	"When I come across my friends whom I know through my former company, I also meet with their friends hanging out with them." (Interviewee #7)
	Changing interaction patterns as to sector and firm size	Lack of interaction among tenant firms due to military projects	"The project we worked on at that time were all military projects. Everybody works closely of necessity and we actually are not informed about each other. Firms also become introverted." (Interviewee #8)
		Relatively more interaction among small start-up firms in technopark	"There is relatively more interaction among small start-up firms, because they need it. Big firms do not need such an interaction anyway." (Interviewee #6)
		Lack of interaction among firms due to confidentiality of projects	"Due to the confidentiality agreements, there is almost no communication with the other firms. Even if there is, we don't talk about any job-related issue or technical details." (Interviewee #4)
	Unwillingness	Being unwilling to get in contact with new people due to busy work pace	"…I was working so hard at that time. I didn't have enough time to get in contact and meet with people…" (Interviewee #8)
		Lack of synergy, information sharing or cooperation in Turkish culture	"Our people do not possess synergy. We don't have habits like presentation, meeting, and sharing in our culture." (Interviewee #6)
		Negative effect of increasing age on willingness to interact	"...the reason for that is actually, we are old now and we don't make new relationships." (Interviewee #7)
MOOD	Impressions created by technopark buildings on people	Negative feeling of working in industrial and unattractive buildings of technopark	"The designs of the buildings seem different, but they are all the same actually. They are so industrial and ugly." (Interviewee #1)
		Positive feeling of working in a well-designed building with green spaces	"This new landscape in the building makes me feel like I'm on a holiday; being there makes me feel comfortable, peaceful, and free." (Interviewee #3)
		Preferring to go to a cafe located at another building due its atmosphere	"A new coffee shop has opened in Building E and it has become the meeting place for people. Many people go there for its good atmosphere, to spend their time there. I also take a walk there with my friends; we can have a chat and a coffee together." (Interviewee #9)

Table 4. Representative Quotations (continued)

AGGREGATE	SECOND-ORDER	FIRST-ORDER	REPRESENTATIVE QUOTATIONS
MOTIVATIONS	Firms' motivations for being located in technopark	Importance of tax advantages provided for technopark firms	"I think the most important reason for companies to be in technopark is the tax advantages provided here." (Interviewee #4)
		Being located in technopark in order to be remembered easily and be known by the sector	"The aim of firms clustering in the technopark maybe to stick in the minds. The firm located near me is remembered easily. The sector sees you here and someone talks with somebody; he/she tells another; someone hears it and you can learn what that technopark firm is working on." (Interviewee #7)
PHYSICAL ENVIRONMENT	Physical attributes of techno park and its buildings	Characteristics of technopark's physical lay out	"Technopark M has a horizontal layout compared to the other technopark."(Interviewee #6)
		Lack of aesthetics in technopark buildings	"The architecture of the buildings in the technopark, in general, are not aesthetical at all. They don't seem pleasant and joyful." (Interviewee #3)
		Lack of social places gaining advantage from green spaces in the technopark	"Now we are in the university campus and we have the forest everywhere. This nature and open air can be made useable through places having benches and tables selling tea and sandwiches." (Interviewee #7)
		Architectural features and designs of technopark buildings and their functionalities	"My former building (Building F) was made up of two separate wings and we rarely went to the other wing; we didn't even know which firms were located in that wing". (Interviewee #6)
ENABLERS OF INFORMATION AND COLLABORATION	Enablers of informal knowledge flow	Being informed through communication in technopark	"You hear what has been going on in the technopark during the conversations. We can call this as a flow of news. There is such a thing in the technopark." (Interviewee #5)
		Lack of social activities in technopark	"There are not many social activities in the technopark and there are also not too many notifications about the activities taking place in the technopark". (Interviewee #1)
	Enablers of formal technical cooperation among technopark firms	Determination of project partners by headquarters abroad	"We have certified partners determined by the headquarters and we cooperate with them when it is needed."(Interviewee #2)
		Deepening of interaction towards technical advice, problem solving and cooperation among tenant firms	"I heard that they (employees of other tenant firms) talk about work and give technical advice. My company even made a service procurement agreement with another company by way of such a conversation among managers." (Interviewee #5)
		Awareness of other firms located in technopark	"I don't think every company in the technopark knows about what do the other companies work on." (Interviewee #10)

The second element focuses on the role of firm size in interaction patterns. From the interview data, it is observed that there is relatively more interaction among the small start-up firms located in Technopark M. Possible knowledge spillovers or flow of information pieces through these interactions can play an important role for such companies. It is also seen in the data that the opposite situation can also be valid. Relatively big, self-sufficient, and strong firms in their sectors establish relatively fewer relationships with other technopark firms, especially for the purposes of problem solving or receiving technical advice.

The last first-order concept is the lack of interaction among firms due to confidentiality agreements. This seems similar to the first element covering military projects but the distinction here is the prevalence of confidentiality agreements regardless of the sector in which the technopark firm operates. It is found that companies often sign confidentiality agreements with their employees, and this causes interactions to be limited to only the social context.

Unwillingness is the last second-order theme that emerges from the data under the theoretical dimension of interaction modes and patterns. This can be considered as an interaction hindering theme because it is noted that people in the technopark hesitate to communicate with others due to several reasons. The first concept here emerged as being unwilling to get in contact with new people due to busy work paces. It is observed that employees working in technopark tenant firms generally have a hectic schedule, so they do not have enough time for social interactions in the technopark and they express that this impedes their social relations. Cultural motives underlie the second first-order concept. It is stated in some interviews that there is a lack of cooperation and interaction in the Turkish culture and Turkish people do not have a tendency to share ideas and build relationships with each other, hindering synergies to be borne among actors. The third concept which focuses on age had been considered as a control variable but ended up being a first-order concept. It is found that the age of the interviewees was an important factor generating unwillingness to communicate with others in the technopark. As actors grow older, their willingness to widen their social networks and meet new people decreases. This may be

associated to decreasing working or career ambitions as an employee grows older, which in turn leads to a diminishing desire to build relationship with others in the technopark.

4.2 Motivations

A second aggregate dimension in the emergent data structure is motivations and its only second-order theme, firms' motivations for being located in the technopark, captures important factors explaining why tenant firms decide to be located in Technopark M. The first element in this context focuses on the tax advantages provided for firms in techno parks in Turkey. Companies located in technoparks have advantages like corporate and income tax exemptions for research and development operations and activities related to software development, value added tax exemptions in some business expenditures, and insurance premium supports for their employees. It is found that these tax advantages show up as an important motivation for companies to take part in Technopark M.

The other first-order concept is being located in the technopark in order to be remembered easily and be known/visible in the sector. In several interviews, it was indicated that there are several clusters of different sectors in Technopark M and to be able take part in these clusters is another significant motivation for tenant firms. Firms feel they can be known by not only the other firms in their sector but also possible customers with the help of the physical proximity provided in the technopark.

4.3 Mood

The other aggregate dimension is mood, which can be defined as “a relatively diffuse, generalized affective state that typically lacks a particular object relation that stimulates an action orientation” (Davis, 2009). Impressions created by technopark buildings on people is the only second-order theme and captures how people feel

about the physical spaces located in Technopark M and the technopark buildings they work in. Under the second-order theme, there are three first-order concepts. The first two concepts are the positive feeling from working in a well-designed building with green spaces, and the negative feeling from working in the industrial and unattractive buildings of the technopark. It is found that working in a well-designed building, in a building having green spaces outside, or a building having a decorative pool inside can make people feel free or like on a holiday. On the other hand, buildings having too industrial-looking architectural designs can induce people with a negative feeling and make them consider these buildings as ugly or unattractive. The last first-order concept emphasizes the atmosphere of the buildings. It is indicated that people prefer to spend their time in one of the buildings (Building E) for its relatively nicer atmosphere. It is observed that a cafe in a building can be preferred by people working at another building due its good ambience, even if the distance between these buildings is notable. This "good" atmosphere makes people feel better and such feelings play an important role on individuals' decisions regarding which space to spend their time in the technopark.

4.4 Physical Environment

The fourth theoretical dimension that emerged from the data is physical environment. The only second-order theme, physical attributes of the technopark and its buildings, reflects architectural properties, layouts, artifacts inside and outside the building, spatial organizations, and ambient aspects of the buildings. There are four first-order concepts in this dimension. The first concept is the lack of social places that benefit from green spaces in Technopark M. It is indicated from the data that even though Technopark M is a campus having vast green areas, there are no social places located in or around these spaces and people cannot spend time to enjoy the greenery. The second element is the characteristics of Technopark M's physical layout. It is found that Technopark M has a horizontal layout and there is a strong legislation of technopark that prohibits the construction or revision of the buildings by tenant firms. It is difficult for a tenant firm which wants to make an alteration in its working space

or building in order to make it more efficient or functional, even if it pays from its own pocket. The third concept emerging from the data is the architectural features and designs of technopark buildings and their functionalities. This first-order concept captures the physical differences of technopark buildings. It is found that spatial organizations and artifacts differ among buildings. While some buildings have only one main entrance, there are separate doors for tenant firms in several buildings. Some buildings have several wings with wide corridors, whereas some have a common space. The existence of windows or balconies, cafes, sitting areas inside or outside the buildings, company signboards, sufficient air conditioning or lighting, smoking areas, etc. are the emergent differences and characteristics across the buildings of Technopark M. The buildings are generally considered to be lacking in functionality and their architectural designs as inconvenient. Commercial concerns are thought to be one of the reasons for these negative aspects by some interviewees.

The last first-order concept of this theoretical dimension is the lack of aesthetics in the technopark buildings. It is found that buildings located in Technopark M are generally considered as lacking in aesthetics and insufficient in terms of architecture. Interviewees generally use terms like *industrial*, *ugly*, *cold*, and *formal* for the technopark buildings. There are buildings that some interviewees liken to a prison, a factory, or a government office.

4.5 Enablers of Information and Collaboration

The last aggregate dimension of the data structure is the enablers of information and collaboration. Second-order themes of this dimension emerged as enablers of informal knowledge flow and enablers of formal technical cooperation among technopark firms.

Informal knowledge flow theme has two first-order concepts. The first one is being informed through communication in the technopark. It is indicated that people can learn about other firms' work through their unplanned and spontaneous conversations

with people working in technopark firms. Furthermore, they have the chance to be informed about some activities going on in their sector through their social networks.

The second concept emerging from the data is the lack of social activities in the technopark. Social events and meetings can be considered as good platforms for informal networks to occur or be developed. There are organizations arranged in the technopark where there is a lack of formal communication structures. People have no boundaries there and feel free. Therefore, it is easier and quicker to transfer knowledge through interpersonal communications in such events.

However, it is found that the number of social activities and events organized in the technopark is low. It is stated that the technopark administration organizes one or two activities like a spring festival or New Year parties and this is not considered to be enough for people working in the technopark. It is also understood that the announcements by the technopark administration for these social events are not sufficient.

Enablers of formal technical cooperation among technopark firms is the other second-order theme. This theme captures relatively more formal interactions and cooperation patterns among technopark firms. The first concept here is the determination of project partners by the firm's headquarters abroad. There are many foreign-owned or partnered companies in Technopark M and the headquarters of these firms are located abroad. It is noted that when a supplier or partner is needed in a new project for problem-solving, technical advice, or service procurement, the decision is made abroad. It is also observed that foreign-owned firms or firms abroad are generally chosen as project partners when the need arises, which limits the focal firm's interaction with other firms in the technopark.

The second first-order concept emerged as an awareness of other firms located in the technopark. In order to construct formal relationships and create possible cooperation chances with other firms of Technopark M, a firm must be aware of the existence of these firms. It is seen that while firms are generally informed about others operating in the same sector with them, there is a considerable number of firms who do not

know about other firms located in the technopark. There are some firms who even do not know other firms located in their own buildings. This can be considered as hindering for cooperation among tenant firms of technopark.

The last concept of the second-order theme, enablers of formal technical cooperation among technopark firms, is the deepening of interaction for technical advice, problem solving, and cooperation among tenant firms. It is observed that there is interaction among the actors in the technopark, but the content of this interaction is mostly social. When conversations involving problem solving or technical advice issues are taken into consideration, a similar frequency or quantity cannot be seen. Nevertheless, there are some cases where the deepening of social conversations into technical cooperation between tenant firms of Technopark M are observed.

4.6 Integrated Framework for the Development of Social Capital and Innovation through the Smart Usage of Physical Space in the Technopark

In this section, another step is taken in the analysis and evaluate the emergent aggregate dimensions and themes in order to develop an integrated framework for the development of social capital and innovation through the smart usage of physical space in the technopark. This framework describes the ties between the theoretical aggregate dimensions of the data structure and the linkages generated by means of the data obtained from the interviews (Figure 2).

Through further investigation on the possible linkages of the aggregate dimensions, it is found that the physical space has some indirect and direct effects on interaction modes and patterns. The direct link is seen as the fostering, hindering, and shaping effects of the physical space on interaction modes and patterns. It is found that the varied spatial organization and attributes of physical environment of different technopark buildings can affect the interaction patterns there, which in turn influence the development of social capital of the tenant firms. For example, Interviewee #5 stated the following:

> *There is a big central hall in my building (Building B) and the doors of the most companies open out to this hall. It is kind of a tradition here to spend the coffee breaks and have a chat in this hall. The companies in the building don't have windows or balconies, on the other hand, the central hall is wide, spacious, long, and tall. People generally take a walk in small groups in the hall, and people from different companies make contact with each other.*

Similarly, Interviewee #10 also noted:

> *There is a coffee shop in Building E, and I sometimes go there alone and come across people working in my sector. It gives a chance to meet new people and increase the socialization of the sector.*

The impact of spatial characteristics of physical space on interaction was also pointed out by Interviewee #9:

> *… my building actually has a bridge connecting its two parts and there is also an aquarium inside the bridge and a balcony facing inwards. Our friends used to smoke here; smoking indoors was allowed back then. There were also benches at the corners and we often saw several clusters of people and a smoke cloud above them, too.*

On the other hand, there were several statements regarding the negative effect of physical space on interaction. Interviewee #6 stated:

"*My former building (Building F) was made up of two separate wings and we rarely went to the other wing; we didn't even know which firms were located in that wing."*

The following sentence of Interviewee #4 also had a similar point:

> *My company has its own separate entrance to the building, so we don't have the chance to see and communicate with our neighbor companies.*

Interviewee #2 mentioned the external environment of his building and noted:

> *We have a sitting area with some benches in front of the building and we go there when the weather is nice. But these areas are generally not planned well, and they are all cold. People do not use these areas that much to spend their time.*

Physical space in this study refers to a building's indoor and outdoor constructed environment which can encourage or hinder face-to-face communication, interaction, and exchange of knowledge among people. When all the data gathered from the interviews are taken into consideration, it can be stated that the hindering effect of

the technopark's physical environment on interaction has a stronger influence, as is also explained in the data structure. On the other hand, physical spaces have not only a hindering but also a fostering effect on interaction patterns, and they can also shape the modes of interaction through the spatial organization (e.g. the positions of main entrances of the building, the existence of a café), or through the design of physical layout (like in the case of the wide hall or separate wings of the buildings). This is also in line with the relevant literature. According to Hartman (2002), despite evidence regarding the relationship between buildings and behavior, an often overlooked and underutilized intangible asset is how an organization's physical environment influences communications. In his study investigating the relationship between physical space and creativity, Dul (2018) states that the characteristics of the physical environment affect creativity via the paths of functionality, mood, and meaning, and argues that these paths can be considered as drivers for creativity at any level of the physical environment.

As noted earlier, according to Dul (2018), a functional physical environment should be instrumental, adaptable, and distraction-free. This functionality of the physical space is provided with favorable ambient conditions like light, sound, smell, color, and indoor climate, having favorable artifacts such as plants, materials, furniture, information sources, and technology, and décor, and a favorable spatial organization.

The indirect impact of the physical environment on interaction modes and patterns is seen to take place in Technopark M through the aggregate dimension of mood, as can be seen in Figure 2. Mood is defined as “a relatively diffuse, generalized affective state that typically lacks a particular object relation that stimulates an action orientation” (Davis, 2009). It is found that ambient conditions of the physical space like light, indoor climate, color, and decor, artifacts such as plants, furniture, and materials influence people and create impressions on them. These influences and impressions, in turn, result in people’s mood induced by the physical environment, which may or may not be conducive for communication and interaction. Interviewee #3 illustrated this connection by emphasizing the changing ambient conditions in one of the technopark buildings:

> *Building F became much more dynamic with the opening of a cafe in the building and the addition of a small botanical garden and decorative pool. This new landscape in the building makes me feel like I'm on holiday; being there makes me feel comfortable, peaceful, and free. I can say that this allows people to hang out there and have a chat more than before*

Interviewee #1 also indicated:

> *I don't like the coffee served in my building, so I go to the cafe in Building E. But the taste is not the only reason why I go there. The cafe in Building E is a more social place for me since it is comfortable, and I feel relaxed there. We walk there in ten minutes and enjoy the coffee.*

The cafe in the above statement was also mentioned by another interviewee. Interviewee #9 indicated his preference to spend time at this cafe due to its atmosphere even though it is located at another building. This situation was also observed in some other interviews.

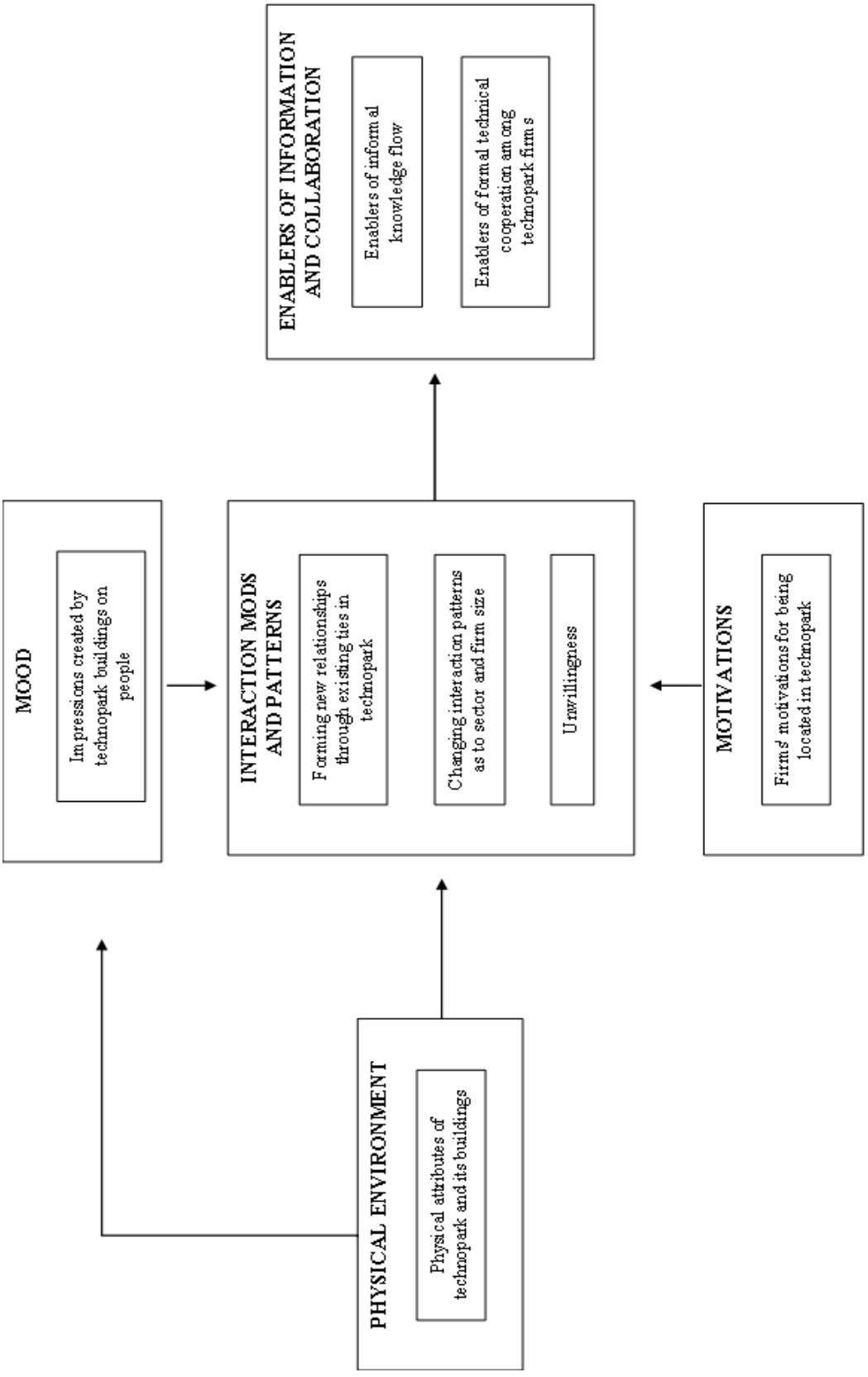
> *A new coffee shop has opened in building E and it has become the meeting place for people. Many people go there for its good atmosphere, to spend their time there. I also take a walk there with my friends; we can both have a talk and a coffee together.*

The positive feeling induced by the physical working environment on interviewee #7 was also narrated as follows:

> *I would use the word 'nature' or 'forest' if I wanted to describe my building in one word. There is a green space in the middle of it and several benches are placed here. All corridors are designed facing this area and have windows so that you can see this green space. The existence of such a green space makes you feel happy...There would be more liveliness and interaction if the benches had been placed better.*

On the contrary, several negative feelings induced by the physical spaces, which cause a negative mood on people, were also extracted. These can be considered as a more common trend when compared to the positive impressions created by the physical environment in Technopark M. It is observed that a great number of interviewees have negative impressions about the buildings located in Technopark M, which are regarded as industrial, serious, and cold, and this, in turn, leads to people working in Technopark M having a negative mood. The following statements can be given as examples for this situation:

Figure 3. Integrated Framework



> *Our building gives me the feeling that I'm in a hotel or a jail.* (Interviewee #6)
>
> *The architecture of the buildings in the technopark, in general, are not aesthetical at all. They don't seem pleasant or joyful.* (Interviewee #3)
>
> *The designs of the buildings seem different, but they are all the same actually. They are so industrial and ugly.* (Interviewee #1)

This indirect relation between physical space and interaction via mood observed in Technopark M is also parallel to the "meaning" path of Dul's (2018) framework, which refers to the perceived "symbolic meaning concealed in a set of physical properties." It is the psychological meaning that people attach to the objective physical environment, such as freedom, interaction, and relaxation.

Oksanen and Stahle (2013) find that "interesting space attracts interesting people", noting that creative people resent working just anywhere, that creating a space that people feel comfortable in is highly important, and that attractive spaces are comforting. These aspects, when favorable, will serve to lengthen time spent talking and socializing as they encourage people to have longer and more satisfying conversations (Coradi et al., 2015).In a similar way, it was also seen that and the feelings like happiness and comfort and a positive mood induced by the physical space are conducive for communication, and encourages and intensifies interaction opportunities among tenant firms in Technopark M. A relatively more common pattern underlying the negative impressions and feelings induced by the technopark's physical environment, which can be linked together with the weak communication and interaction among tenant firms, was also noted.

The other connection presented in the integrated framework of Technopark M is the link between the aggregate dimensions of motivation and interaction patterns and modes. As explained above, firm size emerged as an underlying concept of one the first-order concepts of interaction patterns and modes. It is indicated that there is relatively more interaction among the small start-up firms located in Technopark M, whereas relatively big, self-sufficient, and strong firms in their sectors establish generally fewer relationships with other technopark firms, especially for problem solving or technical advice.

It is argued that these changes in interaction modes of tenant firms can emerge through their motivations for being located in the technopark. The majority of the respondents can be said to come from technopark companies that are relatively large in terms of number of employees (220-600), and also quite experienced and self-sufficient in their own sectors. When these characteristics of the sample are considered, the emergence of tax advantages as the primary motivation to take a part in Technopark M signals a link between the aggregate dimensions, motivation, and interaction patterns and modes. The following statements belong to three employees working in three different technopark firms:

> *There are not so many social areas in the technopark and I also don't think that the technopark administration has or should have a purpose of bringing people together and increasing the interaction among them. The biggest issue for firms in choosing to be here in the technopark is the tax advantages provided here.* (Interviewee #4)

> *The aim of firms clustering in technopark may be to stick in the minds. The firm located near me is remembered easily. The sector sees you here and someone talks with somebody; he/she tells another; someone hears it and you can learn what that technopark firm is working on.* (Interviewee #7)

> *...Tax advantages are not the only motivation. It is an important fact, of course, but on the other hand there are many firms from the defense industry located here and I get the chance to be close to them. As I already mentioned, the sector knows each other very well, because the managers here are friends, as well as the employees. At the same time, you have many small companies here that you can touch. These are also important motivations to be here.* (Interviewee #9)

While Interviewee #4 is a senior engineer working in a big and self-sufficient foreign owned company having branches in other countries in the software sector, Interviewees #7 and #9 are engineers working in relatively small companies operating in the defense and software sectors. These statements highlight the perspectives of technopark firms differing in size and self-sufficiency and are examples of how motivations can be effective in feeding or limiting the interaction possibilities among tenant firms of Technopark M.

The motivations dimension of the emergent grounded model can also be seen in the literature regarding the concept of open innovation, which was first introduced by

Chesbrough (2003). Open innovation is defined as "purposeful inflows and outflows of knowledge to accelerate innovation internally while also expanding the markets for the external use of innovation" (Chesbrough, 2006). In an open innovation environment, firms expand beyond their boundaries and try to reach and exploit external resources in order to increase their innovativeness and be more productive and competitive. Therefore, collaboration and knowledge sharing are considered as the key open innovation practices (Chesbrough, 2006; Yström, Aspenberg and Kumlin, 2015).

In this context, it also important to determine and eliminate the factors that hinder the opportunity to collaborate and to share knowledge. According to Battistella and Nanino (2012), motivations are regarded as one of the primary factors for actors to be a part of the "open and social community". The authors argue that motivation is what makes a collaborative innovative process prospering or failure (Battistella and Nanino, 2012). If the actors in an open innovation environment are not motivated to share knowledge, it is difficult to expect any synergy to be borne in such an environment. This is also in line with the emergent grounded model of this thesis. The relationship between the dimensions, motivations and the interaction mods and patterns, is in line with extant literature. It is observed in Technopark M that being a part of a collaborative innovation system is not the primary motivation for most of the firms. It is mostly the tax advantages that motivates firms to decide to be located in the technopark and this can be considered as one of the important reasons for the weak interaction and collaboration in Technopark M.

The last linkage that was observed through the investigation is the one between interaction patterns and modes and enablers of information and collaboration. It was found that interaction among tenant firms can feed and intensify the information flow and collaboration opportunities, which are conducive for innovativeness as an outcome of collaboration.

Interviewee #5 illustrated a process of cooperation among two tenant firms located in the same technopark building through communication:

> *...the central hall is wide, spacious, long, and tall. People generally take a walk in small groups in the hall, and people from different companies make contact with each other...This is kind of tradition here, nobody walks alone in the hall and the interaction is high here...I know that my company made a service procurement agreement in a project with our neighbor company through the conversations and meetings of the two managers in this corridor. I even changed my job and switched to the firm next to us to work in a project through the relations established in the hall.*

Interviewee #10 also highlighted an example for information exchange through informal interaction:

> *...If our company was located outside of the technopark, we could not get social with our sector. Let's say we are searching for something about a project, for example, information about incentives. When we run into one of my contacts from another firm somewhere in technopark and talk to him/her about the issue, we can do a kind of a mind exercise and reach something together, or sometimes we can transfer him/her to our company for the project. These are all among the advantages of the technopark.*

As it can be seen, interaction actualized among tenant firms in the technopark can foster information flows among actors and lead to collaboration among these firms. These findings are also in line with relevant literature. There are many studies in the literature capturing the enhancing effect of social networks, where firms are embedded, on firm's innovative performance (Ingram, 2002; Inkpen and Tsang, 2005; Lin, 2001).

Nahapiet and Ghoshal (1998) state that research investigating the impact of social networks on creativity and innovation underlines the interests obtained from the networks by actors and reveals how these interests, which is quoted as "structural social capital", affects knowledge creation. Ingram (2002) considers interfirm interactions as an important medium for knowledge exchange because of the highly and heterogeneously spread and diffused nature of knowledge. As the level of existence of social capital in a firm's network increases, not only the firm's ability and possibility to acquire knowledge possessed by other actors in the network, but also the efficiency of information exchange increase and these result in more sophisticated and thriving innovations (Inkpen and Tsang, 2005). Concrete examples of innovation in data could not be observed per se, but it is known from the literature that knowledge

flow, information transfer, and collaborations are considered as innovation enablers and are important phenomena shaping the innovation process. Laursen et al. (2012) argue that innovation is supported by social capital as actors across different organizations are bonded through social capital which combines particular knowledge pieces within several areas. According to Rutten and Boekema (2010), innovation is a phenomenon highly related to networks, because crucial elements of innovation like diffusion of information and knowledge flow among agents are more likely in networks where mutual values, norms, and trust are developed (Rutten and Boekema, 2010).

Even though several cases illustrating the enabling impact of interactions on information exchange and cooperation among tenant firms were observed, the linkage between the enablers of information and collaboration and interaction patterns and modes should be considered as weak in Technopark M. It is also seen that there are several cases where we observed problems in the deepening of interactions towards technical advice, problem solving, and cooperation among tenant firms, and that the content of interactions remained primarily social. It is also pointed out that many firms referred to the technopark administration to get information about other tenant firms and make contact with them. This also shows the weakness of the linkage between these two aggregate dimensions of the data structure.

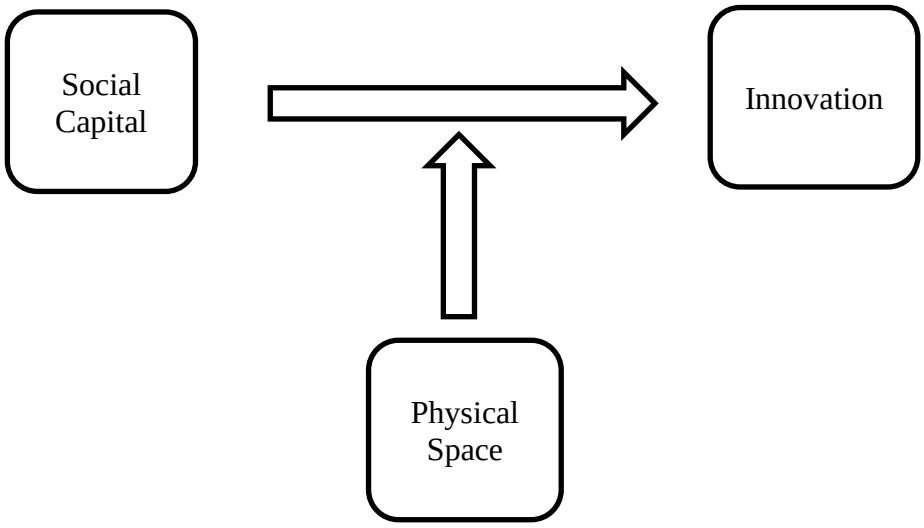
4.7. Comparison of the Grounded Model with Extant Literature

As presented in Chapter 2, extant literature about physical space, social capital and innovation/creativity shows dyadic relationships among these concepts (Figures 1a, 1b and 1c). However, the analysis in this thesis emphasizes a moderating role of physical space in Technopark M and the emergent grounded model highlights a relationship including all three phenomena (Figure 4).

It is observed that physical space moderates interaction patterns in Technopark M and it effects the communication among the tenant firms. The attributes of the

physical environment play a moderating role in social capital development in the technopark. This relationship is shaped directly according to the different physical characteristics of the buildings and indirectly through the mood induced by the physical space. Then, it is also observed that the interactions moderated by the physical space leads to collaboration opportunities among the tenant firms, which is conducive for the innovativeness of them.

Figure 4. Proposed Relationship of the Studied Phenomena



Therefore, physical space is found to be an important factor that moderates the relationship between social capital and innovation. That is to say, social capital has an enabling role on innovativeness and physical space moderates this relationship. Thus physical space can affect the strength of the social capital → innovativeness relationship or hinder it. In the case of Technopark M, it was generally observed that the perceived ineffectiveness and dysfunctionality of the physical environment of the technopark negatively affect the relationship between social capital and innovativeness by hindering the interaction and collaboration opportunities and the social capital development in Technopark M.

CHAPTER 5

CONCLUSION

In today's world, innovation is regarded to be one of the key boosters of economic development. Together with increasing globalization, competition and transformation have become so intense and lifecycles of products and processes have decreased. In order to survive and remain competitive in such an economic system innovativeness has become vital more than ever. In other words, competitiveness of a company hinges on not only its capability to adapt to frequently changing market conditions, but also its ability to dominate and direct the market by innovating, especially considering how economy has become knowledge intensified. Therefore, developing a knowledge base, understanding the enhancing motives of innovativeness and designing and implementing national or firm-based innovation strategies accordingly are significant for desired economic performance.

As mentioned before, extant literature considers innovation as a costly, risky, uncertain, and interactive phenomenon. "No company today, no matter how large or how global, can innovate fast enough or big enough by itself. Collaboration—externally with consumers and customers, suppliers and business partners, and internally across business and organizational boundaries—is critical" (Tapscott and Williams, 2006). Innovativeness, and thus competitiveness, depends on not only a firm's endogenous resources but also critical exogenous resources which can be captured through external interaction with the actors outside of the borders of the firm. Research suggests that through interaction and collaboration, firms have the chance to learn from each other and to obtain new knowledge, and the combination of existing and new knowledge enables firms to generate new ideas and to innovate. Since knowledge is spread heterogeneously, its transfer from one actor to another is vital for innovativeness. By interaction and collaboration, firms can reach new

information and learn new technologies, perspectives, and solutions which decrease the uncertainty and riskiness of the innovation process.

Extant literature considers relationships among firms as an important vehicle for information exchange, and social capital is considered to be a strong theory expressing how knowledge is accessed through relationships. The importance of both formal and informal ties between firms becomes much more critical when the role of the tacit and embedded nature of knowledge in innovativeness is taken into consideration. Social capital, which is defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relations possessed by an individual or social unit" (Nahapiet and Ghoshal, 1998, p. 243), is a product of both social interaction and formal collaboration and it enables innovation through its impacts on information flows.

Research has shown the significant influence of social capital on organizational learning, knowledge transfer and thus, innovativeness. Social capital enables opportunities to capture the knowledge or information embedded in social relationships, which paves the way for communication or social interactions among individuals to be considered as a proxy for social capital (Zheng, 2008). “Social capital is the goodwill available to individuals or groups. Its source lies in the structure and content of the actor’s social relations. Its effect flows from the information, influence, and solidarity it makes available to the actor” (Adler and Kwon, 2002, p. 23).

Physical distance plays a key role in social relationships and social capital development, as social capital resides in social relations (Zheng, 2008). As presented in the previous chapters, extant literature highlights that geographical proximity among organizations increases the opportunities for social encounters, enhances face-to-face interactions, and eases knowledge diffusion by decreasing the transport costs of information. Tacit knowledge transfer, a key facilitator for innovativeness, is considered to be one of the fundamental mechanisms in geographical proximity. Physical spaces like clusters and science and technology parks (STPs) can be considered as platforms for social interaction and knowledge exchange. One of the

primary motivations for constituting clusters and STPs is to facilitate knowledge spillovers and to create and feed interactive learning environment. Therefore, it is vital to provide interaction among tenant firms for STPs in order to accomplish these main objectives.

From this point of view, this thesis tries to understand the impacts of the characteristics of physical spaces on the processes of developing social capital and innovation in the context of technoparks. A grounded model is developed to capture the relationships among physical space, social interactions/capital, and creativity/innovativeness with the help of the data obtained through semi-structured interviews conducted with employees of several firms located in Technopark M. The study also illustrates the linkages among emergent aggregate dimensions within an integrated framework presenting how the design of the physical space influences the information flow and collaboration patterns among tenant firms via intensifying interaction and communication opportunities among them.

The findings of the thesis generally point out a weak interaction among the tenant firms of Technopark M. The study shows that employee mobility is very common in Technopark M and people working in the technopark generally interact with new people through their existing relationships. It is also found that there is a lack of interaction among the technopark firms due to confidentiality agreements and military projects. While there is relatively more interaction among small start-up firms, bigger, self-sufficient, and stronger firms in their sectors establish relatively fewer relationships with other technopark firms. When motivations of firms to take part in the technopark are taken into consideration, it is understood that the tax advantages provided in the technopark are considered to be a more powerful factor than the possible cooperation opportunities delivered by the technopark.

The grounded model highlights that the physical environment of Technopark M considered to be ineffective and dysfunctional. It is found that although technopark buildings have different spatial layouts, they are generally lacking in social areas and aesthetics and insufficient in terms of architecture. It is also seen that there are a few

buildings inducing a positive mood on people and that these buildings are the ones which are preferred by most of the people to spend their time.

The field study stresses that interaction among the actors in technopark is mostly social. Problem solving or technical advice issues cannot be seen at a similar frequency as social interactions occurring in Technopark M. It is also observed that tenant firms are generally informed about others operating in the same sector with them, but there is also a considerable number of firms who do not know about other firms located in the technopark, which leads to infrequent collaborations among tenant firms. Furthermore, foreign-owned or partnered companies located in Technopark M generally collaborate with other foreign-owned firms or firms abroad for problem-solving, technical advice, or service procurement because the decision regarding partnering firms is made abroad.

The emergent integrated framework (Figure 3) presents both the direct and indirect enabling/hindering impacts of the physical environment on interaction, and in turn cooperation, among tenant firms. Even though there is a positive relationship between the physical environment and enablers of information flow and collaboration, which are conducive for innovativeness of the tenant firms, the research also reveals that the physical spaces in Technopark M generally lack in functionality, leading to weak communication and interaction opportunities among the tenant firms, which in turn hinder the collaboration opportunities among them.

The significant contribution of this paper to the extant literature is to highlight the importance of the role of smart design of physical space on knowledge flow and cooperation opportunities among firms by shaping the interaction patterns among them in the context of technoparks, where entrepreneurial firms are colocated with the expectations that synergies will naturally be borne across them. It is thought that this study is also important due to its potential role as a guideline for technopark administrations, and with a macro point of view, for emerging countries as well.

Entrepreneurs in emerging countries need to innovate to survive in the long term, and innovations made by entrepreneurs provide emerging countries the opportunity of

fueling their economies by enhancing their industry structures (Yu et al., 2013). It is anticipated and desired to observe higher social capital in technoparks and in turn its benefits, since the physical proximity engenders interaction among the tenant firms (Laursen, Masciarelli, and Prencipe, 2012; Szulanski, 1996). This affects the density of communication among the organizations, which in turn fosters innovation (Allen et al., 2016). Therefore, it can be noted that technoparks work as an important mechanism of support for emerging country startups to gain access to outside knowledge and other resources. The findings of this research indicate that utilizing the smart design of physical spaces, effective usage of artifacts, and ensuring favorable ambient conditions, technoparks can physically be organized with higher functionality to provide the necessary conditions better.

5.1 Policy Suggestions

In light of the findings of the thesis, it is possible to give some policy suggestions specific to Technopark M in order to provide a more interactive, collaborative, and thus innovative business environment. The main aim of the policies presented below is to increase interaction and communication opportunities in Technopark M in order to create a learning ecosystem and to enhance social capital development and collaboration among the tenant firms. The first policy tool in order to achieve this goal is to increase social areas and social events in the technopark. Social areas close to green spaces should be designed in Technopark M so that people will have more chance to spend their free time and interact with each other in the technopark. This can also be realized by the technopark administration through organizing both social activities and business-related seminars and symposia. The second policy tool regards the redesign of the buildings located in Technopark M. The buildings' physical layouts in Technopark M should be arranged in a way that tenant firms can see each other more frequently. One main door for the building entrance, wide and spacious hallways, or lounges to which all doors of tenant firms open can make the buildings livelier and more interactive. To equip buildings with decorative artifacts and to

provide them with efficaciously placed sitting areas or cafes can also serve the same purpose.

Another important aim should be increasing tenant firms' awareness of each other, because if an actor does not know anything about the other in the same ecosystem, it would be tough to expect any synergies among them and this will hinder collaboration and in turn, innovativeness of the tenant firms. As mentioned before, there are many firms who are unaware of their neighbors in their own buildings and this hinders the possibilities of collaborations among the tenant firms. A possible policy tool to achieve the goal of awareness is that the technopark administration should make it necessary for firms to hang signs of their company titles on their doors and inform all the tenant firms about firms' fields of activity via periodic informative e-mails. Moreover, sector-themed meetings, seminars, and organizations can be arranged by the technopark administration in order to create a platform for information exchange in the sector.

Above all, it is important to design and build technoparks at the beginning with a perspective aspiring to create an interactive and collaborative ecosystem, because it will probably be more costly to redesign these clusters afterwards. It is really important to note that innovation should not be considered as a linear process that can be modeled as the transformation of some inputs to an output. It can be realized in an interactive ecosystem hosting several actors having different knowledge bases and experiences. As extant literature highlights, knowledge transfers can be realized more easily in such an ecosystem, where actors can learn from each other, and this environment enhances the innovative activities of firms.

5.2 Limitations and Future Research

The main limitation of the study can be stated as having a small sample. Because of the busy working environment in technopark, it was hard to reach more people and to increase the sample size. For the same reason, this thesis was unable to gather information about each and every building located in Technopark M. The analysis

could have been more comprehensive and detailed, if each technopark building could be researched and the thesis could have reflected a better picture of interaction and collaboration patterns in Technopark M by comparing each building's physical environments. In addition to these, it can also be noted that the study did not measure the conceptual differences or nuances between social capital and communication and between creativity and interaction and approached these phenomena as proxies for each other.

For future studies, a social capital generativity index for each technopark building can be developed together with physical environment and collaborative innovation measures for each building. If relative indicators can be measured with a qualitative methodology and such measures can be created, the effect of physical environment on social capital development and innovativeness can be put forward. Moreover, instead of gathering self-reported information about interactions occurring in the technopark, a long-term observation and/or respondents' keeping a periodical journal can be more beneficial to provide a better reflection of the research context. It can also be really useful and rewarding for further studies to analyze different technoparks in terms of physical space, interaction, and innovativeness to enhance generalizability.

REFERENCES

Adler, P. S. and Kwon, S. W. (2002). “Social capital: Prospects for a new concept”. *Academy of Management Review*, 27(1): 17-40.

Akçomak, İ.S. and Weel, B. (2009). “Social Capital, Innovation and Growth: Evidence from Europe”. European Economic *Review*, 53(5): 544-567.

Akerlof, G. A. (1997). "Social Distance and Social Decisions". *Econometrica*, 65(5): 1005-1027.

Allen, T.J. (1977). *Managing the Flow of Technology*. Cambridge, MA: MIT Press.

Allen, T.J., Gloor, P., Colladon, A.F., Woerner, S.L. and Raz, O. (2016). "The power of reciprocal knowledge sharing relationships for startup success". *Journal of Small Business and Enterprise Development*, 23(3): 636-651.

Amabile, T. (1998). “How to Kill Creativity”. *Harvard Business Review*, September/October Issue: 77-87.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996). “Assessing the work environment for creativity”. *Academy of Management Journal*, 39(5): 1154-1184.

Anderson, A.R. and Jack, S. (2002). “The articulation of social capital in entrepreneurial networks: A glue or a lubricant?”. *Entrepreneurship and Regional Development*, 14(3): 193-210.

Anjum, N., Paul, J. and Ashcroft, R. (2005). “The changing environment of offices: A challenge for furniture design”. *Design Studies*, 26(1): 73-95.

Antonelli, C. (2000). "Collective Knowledge Communication and Innovation: The Evidence of Technological Districts". *Regional Studies*, 34(6): 535-547.

Appel-Meulenbroek, R., de Vries, B. and Weggeman, M. (2016). “Knowledge Sharing Behavior: The Role of Spatial Design in Buildings”. *Environment and Behavior*, 49(8): 874-903.

Battistella, C. and Nanino, F. (2012). “Open innovation web-based platforms: The impact of different forms of motivation on Collaboration”. *Innovation: Management Policy and Practice*, 14(4): 557-575.

Bell, G.G. and Zaheer, A. (2007). *"Geography, Networks, and Knowledge Flow"*. *Organization Science*, 18(6): 955-972.

Birks, M. and Mills, J. (2015). *Grounded Theory: A Practical Guide, 2nd Edition*. London: Sage.

Bollingtoft, A. and Ulhoi, J.P. (2005). "The Networked Bussiness Incubator: Leveraging Entrepreneurial Agency)". *Journal of Business Venturing*, 20(2): 265-290.

Boschma, R. (2005). "Proximity and Innovation: A Critical Assessment". *Regional Studies*, 39(1): 61-74.

Bourdieu, P. (1986). "The Forms of Capital". In Richardson, J., *Handbook of Theory and Research for the Sociology of Education*. Westport, CT: Greenwood.

Bowers, B.J. and Schatzman, L. (2009). "Dimensional Analysis". In Morse, J.M., Stern, P.N., Corbin, J.M., Charmaz, K., Bowers, B., Clarke, A.E., *Developing Grounded Theory: The Second Generation (Developing Qualitative Inquiry).* Walnut Creek, CA: Left Coast Press.

Brelade, S. and Harman, C. (2000). "Using human resources to put knowledge to work". *Knowledge Management Review*, 3(1): 26-29.

Breschi, S. and Lissoni, F. (2001). "Knowledge Spillovers and Local Innovation Systems: A Critical Survey". *Industrial and Corporate Change*, 10(4): 975-1005.

Burt, R.S. (1992). *Structural Holes*. Cambridge, MA: Harvard University Press.

Burt, R.S. (2000). "The Network Structure of Social Capital", *Research in Organizational Behavior*. 22(1): 345-423.

Capone, F. and Lazzeretti, L. (2018). "The different roles of proximity in multiple informal network relationships: evidence from the cluster of high technology applied to cultural goods in Tuscany". *Industry and Innovation*, 25(9): 897-917.

Carmona-Lavado, A., Cuevas-Rodriguez, G. and Cabello-Medina, C. (2010). "Social and organizational capital: Building the context of innovation". *Industrial Marketing Management*, 39(4): 681-690.

Cassi, L, Morrison, A. and Rabellotti, R. (2015). "Proximity and scientific collaboration: evidence from the global wine industry". *Journal of Economic & Social Geography*, 106(2): 205-219.

Charmaz, K. (2000). *Grounded Theory: Objectivist and Constructivist Methods*. In Denzin, N.K., Lincoln, Y.S., *Handbook of Qualitative Research, 2nd Edition*, London: Sage Publications.

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*. London: Sage Publications.

Chesbrough, H. W. 2003. *Open innovation: the new imperative for creating and profiting from technology.* Boston, MA: Harvard Business School Press.

Chesbrough, H. W. 2006. Open Innovation: A New Paradigm for Understanding Industrial Innovation. In: Chesbrough, H. W., Vanhaverbeke, W. & West, J. (eds.*) Open innovation: researching a new paradigm*. Oxford University Press.

Coleman, J.S. (1988). "Social Capital in the Creation of Human Capital". *The American Journal of Sociology*, 94(1): 95-120.

Coleman, J.S. (1990). *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.

Coradi, A., Heinzen, M. and Boutellier, R. (2015). "A longitudinal study of workplace design for knowledge exploration and exploitation in the research and development process". *Creativity and Innovation Management*, 24(1): 55-71.

Davis, T. R. V. (1984). "The influence of the physical environment in offices". *Academy of Management Review*, 9(2): 271-283.

Davis, M. A. (2009). "Understanding the Relationship between Mood and Creativity: A Meta-Analysis". *Organizational Behavior and Human Decision Processes*, 108(1): 25-38.

DeMeyer, A. (1991). "Tech Talk: How managers are stimulating global R&D communication". *Sloan Management Review*, 32(3): 49-58.

Dolfsma, W. and van der Eijk, R. (2016). "Distances in organizations: Innovation in an R&D lab". *British Journal of Management*, 27(2): 271-286.

Dominics, L., Florax, R. and Groot, H. (2013). "Regional clusters of innovative activity in Europe: are social capital and geographical proximity key determinants?". *Applied Economics*, 45(17): 2325-2335.

Dul, J., Ceylan, C. (2011), "Work environments for employee creativity", Ergonomics, 54, 12–20.

Dul, J., Ceylan, C. and Jaspers, F. (2011). "Knowledge workers' creativity and the role of the physical work environment", *Human Resource Management*, 50(6): 715–34.

Dul, J. (2018). "The physical environment and creativity: A theoretical framework". *Cambridge Handbook of Creativity (2nd Edition),* J.C. Kaufman, R.J. Sternberg (Eds.): Cambridge University Press.

Fayard, A.L. and Weeks, J. (2007). “Photocopiers and Water-coolers: The Affordances of Informal Interaction”. *Organization Studies*, 28(5): 605-634.

Filieri, R. and Alguezaui, S. (2014). “Structural social capital and innovation. Is knowledge transfer the missing link?”. *Journal of Knowledge Management*, 18(4): 728-757.

Fukuyama, F. (1995). *Trust: The social virtues and the creation of prosperity*. New York: Free Press.

Gertner, J. (2012). *The Idea Factory: Bell Labs and Great Age of American Innovation*. New York, NY: The Penguin Press.

Gibson, B. and Hartman, J. (2014). *Rediscovering Grounded Theory*. London: Sage Publications.

Glaser, B.G. (1978). *Theoretical Sensitivity*. Mill Valley, the Sociology Press, CA.

Glaser, B.G. (1992). *Basics of Grounded Theory Analysis*. Mill Valley, CA: Sociology Press.

Glaser, B.G. (1998a). *Doing Grounded Theory. Issues and Discussions*. Mill Valley, CA: Sociology Press.

Glaser, B.G. and Strauss, A.L. (1967). *Discovery of Grounded Theory*. Mill Valley, CA: Sociology Press.

Halpern, D. (2005). *Social Capital*. Cambridge, MA: Polity Press.

Hansson, F., Husted, K. and Vestergaard, J. (2005). “Second generation science parks: From structural holes jockeys to social capital catalysts of the knowledge society”. *Technovation*, 25(9): 1039–1049.

Harrington, D. M. (1999). “Conditions and settings/environment”. In Runco, M. A. and Pritzker S. R. (Eds.), *Encyclopedia of Creativity* (pp. 323– 340). San Diego, CA: Academic Press.

Hartman, J. L. (2002). “Physical communication: An organizational asset”. *Measuring Business Excellence*, 6(4): 12-19.

Heath, H. and Cowley, S. (2004). “Developing a grounded theory approach: a comparison of Glaser and Strauss”. *International Journal of Nursing Studies*, 41(2): 141-150.

Hoff, E. and Öberg, N. (2015). "The Role of the Physical Work Environment for Creative Employees: a Case Study of Digital Artists". *International Journal of Human Resource Management*, 26(14): 1889-1906.

Ingram, P. (2002). "Interorganizational learning", J. A. C. Baum, ed. *The Blackwell Companion to Organizations*. Blackwell, Malden, MA, 642–663.

Inkpen, A. and Tsang, E. W. K. (2005). "Social capital networks and knowledge transfer". *Academy of Management Review*, 30(1): 146–165.

Knoben, J. and Oerlemans, L.A.G. (2006). "Proximity and inter-organizational collaboration: A literature review". *International Journal of Management Reviews*, 8(2): 71-89.

Kratzer, J. (2001). "Communication and Performance: An Empirical Study in Innovation Teams". Amsterdam: Tesla Thesis Publishers.

Kristensen, T. (2004), "The physical context of creativity". *Creativity and Innovation Management*, 13(2): 89-96.

Landry, R., Amara, N. and Lamari, M. (2002). "Does social capital determine innovation? To what extent?". *Technological Forecasting and Social Change*, 69(7): 681-701.

Lane, P.J. and Lubatkin, M. (1998). "Relative absorptive capacity and interorganizational learning". *Strategic Management Journal*, 19(5): 461-477.

Laursen, K., Masciarelli, F. and Prencipe, A. (2012). "Regions Matter: How Localized Social Capital Affects Innovation and External Knowledge Acquisition". *Organization Science*, 23(1): 177-193.

Lazzereti, L. and Capone, F. (2016). "How proximity matter in innovation networks dynamics along the cluster evolution. A study of the technology applied to cultural goods". *Journal of Business Research*, 69(12): 5855-5865.

Lee, T. W. (1999). *Qualitative methods in organizational research*. Thousand Oaks, CA: Sage.

Lin, N. (2001). *Social Capital: A Theory of Social Structure and Action (Structural Analysis in the Social Sciences)*. Cambridge: Cambridge University Press.

Mabey, C., Wong, A. L. Y. and Hsieh, L. (2015). "Knowledge exchange in networked organizations: does place matter?". *R&D Management*, 45(5), 487-500.

Martin-Rios, C. and Erhardt, N. (2016). "Small business activity and knowledge exchange in informal interfirm networks". *International Small Business Journal*, 35(3): 285-305.

Maurer, I., Bartsch, V. and Ebers, M. (2011). "The value of intra-organizational social capital: How it fosters knowledge transfer, innovation performance, and growth". *Organization Science*, 32(2): 157–185.

McCoy, J. M. (2005). "Linking the physical work environment to the creative context". *Journal of Creative Behavior*, 39(3): 167–189.

McCoy, J. M. and Evans, G. W. (2002). “The potential role of the physical environment in fostering creativity”. *Creativity Research Journal*, 14(3): 409-426.

Molina-Morales, F.X. and Martínez-Fernández, M.T. (2010). “Social Networks: Effects of Social Capital on Firm Innovation”. *Journal of Small Business Management*, 48(2): 258-279.

Moultrie, J., Nilsson, M., Dissel, M., Haner, U-E, Janssen, S. and Van der Lugt, R. (2007). “Innovation spaces: Towards a framework for understanding the role of the physical environment in innovation”. *Creativity and Innovation Management*, 16(1): 53-65.

Nahapiet, J. and Ghoshal, S. (1998). “Social capital, intellectual capital and organizational advantage”. *Academy of Management Review*, 23(2): 242-266.

Nelson, R. R. and Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*. Belkman Press, Boston.

Nilsson, M. and Mattes, J. (2015). “The spatiality of trust: Factors influencing the creation of trust and the role of face-to-face contacts”. *European Management Review*, 33(4): 230-244.

Oksanen, K. and Stahle, P. (2013). “Physical environment as a source for innovation: Investigating the attributes of innovative space”. *Journal of Knowledge Management*, 17(7): 815-827.

O'Reilly, C. (1989). “Corporations, Culture and Commitment: Motivation and Social Control in Organizations”. *California Management Review*, 31(4): 9-25.

Ozcan, P. and Eisenhardt, K.M. (2009). "Origin of Alliance Portfolios: Entrepreneurs, Network Strategies, and Firm Performance". *Academy of Management Journal*, 52(2): 246-279.

Perry-Smith, J. E. (2006). “Social Yet Creative: The role of social relationships in facilitating individual creativity”. *Academy of Management Journal*, 49(1): 85-101.

Phan, P. H., Siegel, D. S. and Wright, M. (2005). “Science parks and incubators: Observations, synthesis and future research”. *Journal of Business Venturing*, 20(2): 165-182.

Phelps, C. C. (2010). "A Longitudinal Study of the Influence of Alliance Network Structure and Composition on Firm Exploratory Innovation". *Academy of Management Journal*, 53(4): 890-913.

Porter, M.E. (1998). *On Competition*. Cambridge, Mass.: Harvard Business School Press.

Portes, A. (1998). "Social Capital: Its Origins and Applications in Modern Sociology". *Annual Review of Sociology*, 24(1): 1-24.

Putnam, R. D. (1995). “Bowling Alone: America’s declining Social Capital”. *Journal of Democracy*, 6(1): 65-78.

Rosli, A. and Rossi, F. (2015). “What indicators to assess universities’ knowledge transfer performance? Problems in the transition from theory to practice”. In U. Hilpert (Ed.), *Handbook on politics and technology*, London: Routledge.

Russell, R.D. and Russell, C.J. (1992). "An examination of the effects of organizational norms, organizational structure, and environmental uncertainty on entrepreneurial strategy". *Journal of Management*, 18(4): 639-57.

Rutten, R., Westlund, H. and Boekema, F. (2010). "The spatial dimension of social capital". *European Planning Studies*, 18(6): 863-871.

Rutten, R., Benneworth, P. S. (Ed.), Irawati, D. and Boekema, F. (Ed.) (2014). *The* Social Dynamics of Innovation Networks *(Regions and cities)*. Hoboken: Routledge.

Sa, C. and Lee, H. (2012). “Science, business and innovation: Understanding networks in technology-based incubators”. *R&D Management*, 42(3): 243-253.

Shalley, C. E., Zhou, J. and Oldham, G. R. (2004), “The effects of personal and contextual characteristics on creativity: Where should we go from here?”. *Journal of Management*, 30(6): 933–958.

Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage Publications, Inc.

Strauss, A. and Corbin, J. (1994). “Grounded Theory methodology: An overview", In N. K. Denzin, and Y.S. Lincoln, (Eds), *Handbook of Qualitative Research*, London: Sage Publications, Inc.

Strauss, A. and Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, CA: Sage Publications, Inc.

Stuart, T. and Sorenson, O. (2003). "The Geography of Opportunity: Spatial heterogeneity in founding rates and the performance of biotechnology firms". *Research Policy*, 32(2): 229-253.

Subramaniam, M., and Youndt, M. A. (2005). “The influence of intellectual capital on the types of innovative capabilities”. *Academy of Management Journal*, 48(3): 450−463.

Szulanski, G. (1996). "Exploring internal stickiness: Impediments to the transfer of best practice within the firm". *Strategic Management Journal*, 17 (winter special issue): 27–43.

Tapscott, D. and Williams, A.D. (2006). *Wikinomics*. New York: Penguin Group.

Tötterman, H. and Sten, J. (2005). "Start-ups: Business Incubation and Social Capital". *International Small Business Journal*, 23(5): 487-511.

Tsai, W. and Ghosal, S. (1997). "Social Capital and Value Creation: The Role of Intrafirm Networks". *Academy of Management Journal*, 41(4): 464-476.

Utterback, J. M. (1971). "The Process of Technological Innovation within the Firm". *Academy of Management Journal*, 14(11): 75–88.

Van de Ven, A. H. and Angle, H. L. (1989). *Suggestions for Managing the Innovation Journey*. Strategic Management Research Center: University of Minnesota.

Vithayathawornwong, S., Danko, S., and Tolbert, P. S. (2003). "The role of the physical environment in supporting organizational creativity". *Journal of Interior Design*, 29(1-2): 1-16.

Whittington, K. B., Owen-Smith, J. and Powell, W. W. (2009). "Networks, propinquity, and innovation in knowledge-intensive industries". *Administrative Science Quarterly*, 54(1): 90–122.

Woodman, R. W., Sawyer, J. E. and Griffin, R. W. (1993). "Toward a theory of organizational creativity". *Academy of Management Review*, 18(2): 293–321.

Yli-Renko, H., Autio, E. and Sapienza, H. J. (2001). "Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms". *Strategic Management Journal*, 22(6): 587–613.

Yström, A., Aspenberg, H. and Kumlin, A. (2015). "Exploring the creative climate in an open innovation arena", *European Journal of Innovation Management*, 18(1): 70 - 85.

Yu X., Tao Y., Tao X., Xia F. and Li, Y. (2018). "Managing uncertainty in emerging economies: The interaction effects between causation and effectuation on firm performance". *Technological Forecasting & Social Change*, 135(1): 121-131.

Zheng, W. (2008). "A social capital perspective of innovation from individuals to nations: Where is empirical literature directing us?". *International Journal of Management Reviews*, 12 (2): 151-183.

Zheng, J. (2010). "The "The 'Entrepreneurial State' in 'creative industry cluster' development in Shanghai". *Journal of Urban Affairs*, 32(2): 143-170.

APPENDICIES

A. METU HSEC APPROVAL

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI 06800
ÇANKAYA ANKARA/TURKEY
T: +90 312 210 22 91
F: +90 312 210 79 59
ueam@metu.edu.tr
www.ueam.metu.edu.tr

Sayı: 28620816 / 140

27 ŞUBAT 2018

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Prof.Dr. Nazlı Wasti PAMUKSUZ ;

Danışmanlığını yaptığınız yüksek lisans öğrencisi Ahmet Melih HORATA ***"İnovatif kümelenmeler olan teknoparklarda fiziksel çevre, iletişim ve sosyal sermaye ilişkisi"*** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **2018-SOS-019** protokol numarası ile **07.03.2018 - 30.12.2019** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Ş. Halil TURAN
Başkan V

Prof. Dr. Ayhan SOL
Üye

Prof. Dr. Ayhan Gürbüz DEMİR
Üye

Doç. Dr. Yaşar KONDAKÇI
Üye

Doç. Dr. Zana ÇITAK
Üye

Yrd. Doç. Dr. Pınar KAYGAN
Üye

Yrd. Doç. Dr. Emre SELÇUK
Üye

B. TURKISH SUMMARY / TÜRKÇE ÖZET

Bilim ve/veya teknoloji parkları, bilgi birikimi ve kaynak paylaşımı ile iş ivmesini artırmaya odaklanan, idari bir merkeze sahip kuruluşlar olarak tanımlanmaktadır (Phan, Siegel ve Wright, 2005). Bu çerçevede bilim/teknoloji parkları firmalar arasında sinerjilerin oluşacağı beklentisi ile bir araya getirildiği fiziksel alanlar olarak düşünülebilir. Bilim/teknoloji parkları için ortaya atılan ana savlardan birisi bu tür kümelenmelerdeki firmaların fiziksel yakınlıklarının söz konusu firmalar arasında yüz yüze etkileşim ile güvenin tesis edilmesine yardımcı olacağı; bu sayede firmalar arasında bilgi alışverişinin sıklaşacağı ve bilginin dağılması ve yayılması sonucunda inovasyonun artacağıdır (Dolfsma ve van der Eijk, 2016; Nilsson ve Mattes, 2015; Whittington, Owen-Smith ve Powell, 2009). Fiziksel yakınlık belirli bir alana gömülü aktörler arasındaki iş birliğinin geliştirilmesinde önemli bir rol oynamaktadır. Diğer bir deyişle, bu tür kümelenmeler sosyal sermayenin gelişebilmesi için önemli birer ortam olarak değerlendirilebilir (Carmona-Lavado Cuevas-Rodriguez ve Cabello-Medina, 2010).

Fiziksel ve beşeri sermaye gibi diğer sermaye türleri sadece aktörlerin verimliliğini artıran eğitimler ve araçlar olarak tanımlanırken sosyal sermaye kavramında öne çıkan unsur sosyal organizasyon ve özellikleridir. Halpern'e (2005) göre sosyal sermaye yalnızca kişinin sahip olduğu yeterlilik stoğunu dikkate alan beşeri sermayeden farklıdır. Sosyal sermaye "bir birey ya da sosyal bir birimin sahip olduğu ilişkiler ağında gömülü olan, ağ içerisinde ulaşılabilen ve ağdan kaynaklanan mevcut ve potansiyel kaynaklarının toplamıdır" (Nahapiet ve Ghoshal, 1998, s. 243). Sosyal sermaye sosyal etkileşimin bir sonucu olarak ortaya çıkmakta ve bu nedenle kişilerarası ağlara gömülü bir kaynak olarak nitelendirilmektedir (Nahapiet ve Ghoshal, 1998).

Araştırmalar sosyal sermayenin yenilikçilik üzerinde kritik bir role sahip olduğunu (ör. Subramaniam ve Youndt, 2005; Zheng, 2010) ve firmaların sosyal ilişkileri

yoluyla yeni bilgilere erişebilmelerini sağladığını vurgulamaktadır (Ingram, 2002; Inkpen ve Tsang, 2005; Lin, 2001). Yenilikçiliğin farklı aktörler arasındaki bilgi alışverişi ve etkileşimin bir sonucu olarak elde edildiği ve izole edilen aktörler veya olaylar yoluyla elde edilemeyeceği düşünülmektedir (Landry, Amara ve Lamari, 2002). Yenilikçilik farklı aktörlerden elde edilen farklı bilgilerin yakınsaması yoluyla türetilir (Landry vd., 2002). Yukarıda bahsedildiği üzere bilim ve/veya teknoloji parkları gibi kümelenme politikaları bilgi erişimini kolaylaştırmak ve inovasyon geliştirme sürecini teşvik etmek amacıyla işletmeler arasındaki fiziksel yakınlığı oluşturmayı amaçlamaktadır (Boschma, 2005).

Diğer taraftan sadece kümelenmenin oluşturulması inovasyonun artırılması için yeterli değildir. Söz konusu bölgelerin etkin bir biçimde çalışmasını sağlayan unsur firmalar arasındaki ağ faaliyetidir ve bu ara bağlantılar olmadan bu bölgelerin gerçekten inovasyon yatakları olmaları (ve bu şekilde kalmaları) muhtemel değildir (Ozcan ve Eisenhardt, 2009). Bu etkileşimin sağlanabilmesi için birkaç önemli iletişim kanalının etkinleştirilmesi elzemdir ve yalnızca bunların birleşimi ilişkileri ağının oluşturulması, bilgi birikiminin sağlanması ve teknolojik yeniliklerin ortaya çıkması için elverişli bir ortam sağlar (Antonelli, 2000; Hansson, Husted ve Vestergaard, 2005). Bu nedenle teknoparkların kiracı firmaları arasındaki etkileşimin sağlanması bu kümelenmelerin daha iyi performans göstermesi için çok önemlidir (Hansson, Husted ve Vestergaard, 2005). Bu çerçevede, girişimci ve yenilikçi olmayı hedefleyen firmalar arasındaki sosyal etkileşimi artırabilecek ve devamlı kılabilecek bir ortamın tesis edilmesi gerekmektedir.

Ar-Ge temelli örgütlerin başarı veya başarısızlığında yenilikçiliğin kilit bir etken olması nedeniyle yerelleştirilmiş sosyal sermaye ve bilgi değişiminin fiziksel bir alan içindeki etkisinin anlaşılması önemli bir husus haline gelmektedir (Bell ve Zaheer, 2007; Laursen, Masciarelli ve Prencipe, 2012). Kümelenmeler bir alan olarak ele alındığında dikkat çeken bir konu olmakla birlikte Davis (1984, s. 271) ve Dul (2018) fiziksel çalışma ortamı ile ilgili araştırmaların "yönetim ve örgütsel davranışın net bir şekilde anlaşılamayan yönlerinden biri" olduğunu belirtmektedir. Birçok araştırmacı fiziksel çalışma ortamının yaratıcılık için oldukça önemli olduğunu vurgulamaktadır

(örneğin, Amabile, Conti, Coon, Lazenby ve Herron, 1996; Dul ve Ceylan, 2011; Dul, Ceylan ve Jaspers, 2011; Shalley, Zhou ve Oldham, 2004; Whittington ve diğerleri, 2009; Woodman, Sawyer ve Griffin, 1993).

Çalışma alanları bilgi aktarımının sağlanması ve inovasyonun teşvik edilmesinde hayati bir rol oynamaktadır (örneğin, Kristensen, 2004; Mabey, Wong ve Hsieh, 2015; Moultrie, Nilsson, Dissel, Haner, Janssen ve Van der Lugt, 2007). Moultrie ve ark. (2007) ise fiziksel ortamların firma inovasyon stratejileri oluşturmadaki önemli rolünü ortaya koymuşlardır. Bu çerçevede, bu tezin amacı firmaların kümelendiği teknopark alanlarının fiziksel yönlerini ve bunların ileri teknolojili ve yenilikçi firmalar arasındaki sosyal sermayenin gelişmesi ile nasıl ilişkili olduğunu araştırmaktır. Bu bağlamda, bu araştırma ve bulgularının teknoparkların birer inovasyon yatağı olabilmeleri için bir rehber ya da yönerge olarak değerlendirilebileceği düşünülmektedir.

Bu tezde nitel bir yöntem benimsenmiş ve aşağıdaki araştırma sorularına cevap verebilmek için yarı yapılandırılmış mülakatlar yoluyla elde edilen veriler ışığında gömülü bir model oluşturulmuştur:

i. Sosyal sermayenin gelişiminde fiziksel alan önemli midir?
ii. Eğer öyleyse, fiziksel çevrenin özellikleri teknoparklar bağlamında sosyal sermayenin geliştirilmesi ve kullanılması süreçlerini nasıl etkiler?
iii. Teknopark binalarının tasarımı, kiracı firmalar arasında belli sinerjilerin oluşmasını sağlayabilir/engelleyebilir ve yenilikçi faaliyetlerini teşvik edebilir mi?

Fiziksel alanın sosyal sermayenin gelişimini sağlayan ve faydalarını ortaya çıkartan (ya da engelleyen) niteliklerini gömülü model yaklaşımı ile araştıran ve bunlar ışığında sosyal sermaye, fiziksel çevre ve yenilik arasındaki ilişkiyi teknoparklar bağlamında yansıtan entegre bir çerçeve geliştiren bu çalışmanın akademik yazına birkaç önemli katkı sağladığı düşünülmektedir. İlk olarak, bu tez mevcut yazında ikili ilişkiler biçimde incelenen sosyal sermaye, fiziksel alan ve yenilik olguları arasındaki

bağı ortaya koymaktadır. Böylece bu üç kavram birbirine bağlanarak yazına yeni bir bakış açısı getirilmektedir.

İkincisi, çalışma fiziksel alan özelliklerinin teknopark bağlamında akıllı kullanım potansiyelini vurgulayarak, sosyal sermayenin ve firma yenilikçiliğinin artırılmasına katkıda bulunmayı amaçlamaktadır. Mevcut yazında yaratıcılık veya yenilikçilik ile fiziksel çevre veya çalışma ortamlarının tasarımı arasındaki ilişki yaygın bir biçimde incelenmektedir. Bu tez teknoparkı fiziksel çevre olarak ele alarak yeni bir bakış açısı getirmektedir. Dahası bu çalışma teknoparkları yenilikçi faaliyetlerin geliştirilmesi ve belli sinerjilerin ortaya çıkarılmasını sağlayacak bir yetiştirme ortamı ya da fidelik olarak değerlendirerek kümelenmeleri konu alan yazını genişletmektedir. Son olarak, bu araştırmanın sonuçlarının teknoparkların fiziki ortamlarının bölgesel sosyal sermayenin geliştirilmesi ve kullanılması ile kiracı firmalar arasındaki iş birliğinin ve dolayısıyla yenilikçiliğin arttırılması amacıyla teknopark yönetimleri için bir yönerge olarak değerlendirilebileceği düşünülmektedir.

Araştırma konusu teknopark, yani "Teknopark M", 2000'li yılların başında Türkiye'nin büyük şehirlerinden birinde kurulmuştur. Teknopark M üniversitenin sunduğu bilgi ve devletin sağladığı altyapıyı kullanarak teknoloji geliştirebilmek için kuluçka merkezleri oluşturmak amacıyla önde gelen Türk üniversitelerinden birinin yerleşkesinde bulunmaktadır. %60'ı bünyesinde kurulmuş 300'den fazla kiracı firma ile 5.500 çalışanı ev sahipliği yapan Teknopark M, Ar-Ge operasyonlarına ayrılmış 130.000 metrekarelik kapalı alana sahiptir. Teknopark M'de faaliyet gösteren şirketlerin yarısından fazlası yazılım ve bilişim teknolojileri alanında, yaklaşık %20'si elektronik ve %15'i ise mekanik ve tasarım alanlarında faaliyette bulunmaktadır. Enerji, ileri malzemeler, otomotiv, tıp teknolojileri, gıda, çevre, tarım, havacılık ve uzay endüstrilerinde faaliyet gösteren şirketler ise %14'lük bir paya sahiptir.

Teknopark M'nin bu tezin araştırma ortamı olarak seçilmesinin ana nedenlerinden birisi yerleşimidir. Teknopark yerleşkesinde yaklaşık 10 tane bağımsız bina bulunmakta ve kiracı şirketler bu binalarda yer almaktadır. Bazı binalar sadece bir ya da birkaç şirkete ev sahipliği yaparken, çoğunda birden fazla firma bulunmaktadır. Teknoparkın bu yerleşimi farklı binaların farklı fiziksel ortamlarını, firmalar

arasındaki iletişim ve etkileşim kalıplarını ve bunların iş birliği fırsatları üzerindeki olası etkilerini gözlemleme ve karşılaştırma yapmayı olası kılmaktadır. Bu nedenle birden çok kiracı firmaya ev sahipliği yapan teknopark binaları çalışmanın ana odak noktası olmuştur.

Fiziksel çevre, sosyal sermaye ve firmaların yenilikçilikleri arasındaki ilişkileri ortaya koymak ve teknopark bağlamında bu kavramlar arasındaki kalıpları ve süreçleri tanımlayabilmek için çalışmada gömülü kuram yaklaşımı kullanılacaktır. Daha önce bahsedilen araştırma sorularına yanıt bulabilmek için etkileşim biçimlerinin sadece niceliklerinin değil, niteliklerinin de dikkate alınması oldukça önemlidir. İletişim ve sosyal sermaye gibi sosyal kavramları bütün yönleri ile ortaya koyabilmek için gömülü kuram araştırmanın yöntemi olarak daha uygun olmaktadır.

Yöntem seçiminde rol oynayan diğer husus ise bölgesel sosyal sermaye gelişimi, etkileşim ve iş birliği gibi kavramları analiz ederken sadece resmi değil, aktörler arasındaki bilgi akışında önemli bir kanal görevi gören gayrı resmi ve sosyal ilişkilerin de gözlemlenmesinin oldukça kritik olmasıdır (Martin-Rios ve Erhardt, 2016). Capone ve Lazzeretti'ye (2018) göre yazında gayri resmi, sosyal etkileşimler hakkında veri toplanmasındaki zorluklar nedeniyle Ar-Ge projeleri, patentler veya yayınlar gibi resmi ilişkileri dikkate alan pek çok nicel çalışma bulunmaktadır. Fakat gayri resmi ve sosyal ilişkileri dikkate almadığı için sosyal ilişkilerin nicel yaklaşımlar ile analiz edilmesi bazı kısıtlara yol açabilmektedir. Bu nedenle teknoparktaki etkileşim biçimlerinin kapsamlı bir resmini çizebilmek için nicel bir yöntem olan gölümü teori yaklaşımı tercih edilmiştir. Dahası, Teknopark M'deki firmaların çoğu küçük ve orta ölçekli işletmeler (KOBİ'ler) olduğu için firmaların yenilikçi faaliyetlerinin tamamının nicel bir yaklaşım kullanarak gözlemlemek ve sadece patent veya Ar-Ge harcamaları gibi geleneksel inovasyon göstergelerini kullanarak ortaya koymak eksik bir analize yol açacaktır. Dolayısıyla veri toplama sürecinde daha esnek olabilmek ve içeriğe özgü kısıtlara daha hızlı yanıt vermek için bu çalışmada daha esnek bir yöntemin uygulanması gerekmektedir (Lee, 2009).

Çalışmada veri toplamak için yarı yapılandırılmış mülakatlar yapılmıştır. Tam ölçekli bir veri toplama işleminden önce teknopark ve dinamikleri hakkında fikir sahibi

olmak için pilot çalışma yürütülmüştür. Pilot aşama ile birlikte, katılımcılara ulaşmak için kartopu tekniğini kullanılarak Teknopark M'deki firma çalışanları ile toplamda 11 mülakat yapılmıştır. Görüşülen kişilere şirketlerini barındıran binaların fiziksel özellikleri, Teknopark M'nin genel fiziksel ortamı, diğer firmalarla iş birliği ve binalarındaki diğer firmalar ile etkileşim şekilleri hakkında sorular sorulmuştur. Görüşmeler sırasında katılımcılara firma büyüklüğü, teknoparkta çalışma süresi, binalarındaki kiracı firma sayısı ve görüşülen kişilerin iş pozisyonları ve deneyimleri gibi bazı kontrol değişkenleri ile ilgili sorular da sorulmuştur. Ayrıca katılımcıların fiziksel mekân tercihleri hakkında fikir edinebilmek için katılımcılardan görüşme yerlerini kendilerinin belirlemeleri istenmiştir.

Veri toplama işleminin tamamlanmasının ardından mülakatların tamamı metne dökülmüş ve bir sonraki adımda verileri analiz etmek için gömülü kuram yaklaşımı çerçevesinde kodlama aşamasına geçilmiştir. İlk kodlamanın mantığı verilerden çıkarılabilecek her kuramsal olasılığı aramaya açık olmaktır (Charmaz, 2006). Strauss ve Corbin (1990) önyargılı fikirlerden faydalanmamak ve kavramların verilerden ortaya çıkmasını sağlamak için her şeyin veri olarak düşünülmesi ve kullanılması gerektiğini belirtmektedir. İlk kodlama analizine mülakat metinlerinin her bir satırının etiketlenmesi olarak tanımlanan satır-satır kodlama işlemi ile başlanmıştır (Glaser, 1978). Satır-satır kodlama ile mülakatların her bir cümlesi kodlanmış ve araştırma konusu ile ilgili olabilecek kavramlar belirlenmiştir. Araştırma konusu kavramlar arasındaki ilişkileri şekillendiren temel dinamikler ile temalar verilerin parçalarına ayrılması ile ortaya çıkartılarak gömülü modelin birinci derece kavramları (kategorileri) oluşturulmuştur.

Analizin ikinci aşamasına ilk kodlama aşamasına kıyasla daha yönlendirici, seçici ve kavramsal olan odaklanmış kodlama ile devam edilmiştir (Glaser, 1978). Bu süreç "büyük miktarda veriyi tetkik etmek için en önemli ve/veya en sık kullanılan kodları kullanmak" olarak tanımlanabilir (Charmaz, 2006). Bu aşamada birinci derece kavramlar yeniden değerlendirilmiş ve daha ayrık ve genel gruplara ayrılarak ikinci derece temalar elde edilmiştir. Bir sonraki aşamada ikinci derece temalar temeldeki kuramsal boyutları ortaya çıkarmak için yeniden düzenlenmiş ve Teknopark M'nin

fiziksel çevresi ile sosyal sermayenin gelişimi ve kullanımı arasındaki ilişki dinamiklerini gösteren gömülü kuram, son kategoriler (bütünleştirilmiş boyutlar) oluşturularak sunulmuştur. Söz konusu gömülü model *etkileşim biçim ve kalıpları, motivasyon, mod, fiziksel ortam ve bilgi akışı* ve *iş birliğinin kolaylaştırıcıları* olmak üzere beş ana bileşenden oluşmaktadır. Analizin son aşamasında ise mülakatlarda yer alan ifadeler, bunların yorumlanması ve ilgili yazın dikkate alınarak son kategoriler arasındaki ilişki biçimlerini yansıtan bir bütünleşik çerçeve ortaya konulmuştur.

Çalışmanın bulguları Teknopark M'nin kiracı firmaları arasında genel olarak zayıf bir etkileşime işaret etmektedir. Yapılan saha çalışması çalışan hareketliliğinin Teknopark M'de çok yaygın olduğunu ve teknoparkta çalışan kişilerin genellikle mevcut ilişkileri yoluyla yeni insanlarla etkileşime girdiğini göstermektedir. Ayrıca gizlilik anlaşmaları ve askeri projeler nedeniyle teknopark firmaları arasında etkileşim eksikliği olduğu tespit edilmiştir. Küçük işletmeler arasında nispeten daha fazla etkileşim olsa da sektörlerinde görece büyük, kendi kendine yetebilen, güçlü firmaların diğer teknopark firmaları ile daha az ilişki kurdukları gözlemlenmiştir. Firmaların teknoparkta yer alma motivasyonları dikkate alındığında teknoparkta sağlanan vergi avantajlarının teknopark tarafından sunulan olası iş birliği fırsatlarından daha güçlü bir etmen olduğu belirlenmiştir.

Mülakat verilerinin analizi sonucu ortaya çıkan gömülü model Teknopark M'nin fiziki ortamının etkisiz ve işlevsiz olduğunu göstermektedir. Teknopark binalarının farklı mekânsal yerleşimlere sahip olmalarına rağmen genellikle sosyal alan ve estetikten uzak oldukları ve mimari açıdan yetersiz oldukları mülakatlarda belirtilmiştir. Diğer taraftan, insanlar üzerinde olumlu bir ruh hali uyandıran birkaç bina olduğu ve teknoparkta çalışan kişilerin zamanlarını geçirmek için bu binaları tercih ettiği görülmektedir.

Saha çalışması teknoparktaki aktörler arasındaki etkileşimin çoğunlukla sosyal olduğunu göstermektedir. Teknik anlamda sorun çözme ya da tavsiye verme gibi daha iş odaklı etkileşimlerin sosyal etkileşimler kadar sık yaşanmadığı gözlemlenmiştir. Firmalarının genellikle kendileri aynı sektörde faaliyet gösteren diğer firmalar hakkında bilgi sahibi olduğu, fakat teknoparkta yer alan diğer firmalar

hakkında fazla bilgi sahibi olmayan önemli sayıda firmanın da olduğu görülmüştür. Ayrıca Teknopark M'de yer alan yabancı sermayeli veya ortaklı şirketlerin teknik danışmanlık veya hizmet alımı için genellikle yabancı sermayeli şirketler veya yurtdışındaki firmalar ile iş birliği yaptıkları ve firma seçimine ilişkin kararların genellikle yurt dışında bulunan merkezlerden verildiği tespit edilmiştir.

Ortaya çıkan bütünleşik çerçeve fiziksel çevrenin firmalar arasındaki etkileşim ve dolayısıyla iş birlikleri üzerindeki doğrudan ve dolaylı kolaylaştırıcı/engelleyici etkilerini ortaya koymaktadır. Fiziksel ortam ile firmaların yenilikçiliğini artıran bilgi akışı ve iş birliğinin kolaylaştırıcıları arasında olumlu bir ilişki olmasına rağmen, çalışma aynı zamanda Teknopark M'deki fiziksel alanların genellikle işlevsellikten yoksun olduğunu, zayıf iletişime sebep olduğunu ve firmalar arasındaki etkileşim--ve dolayısıyla işbirliği--fırsatlarını engellediğini ortaya koymaktadır.

Özellikle gelişmekte olan ülkelerdeki girişimcilerin uzun vadede hayatta kalabilmeleri için inovasyona ihtiyaçları vardır ve girişimciler tarafından hayat geçirilen inovasyonlar gelişmekte olan ülkelerin sanayi yapılarını geliştirerek onlara ekonomilerini körükleme fırsatı sunmaktadır (Yu ve diğ., 2013). Fiziksel yakınlığın firmalar arasında daha çok etkileşime yol açması ile teknoparklarda daha yüksek bir sosyal sermaye oluşması ve faydalarının daha çok görülmesi beklenmekte ve istenmektedir (Laursen, Masciarelli ve Prencipe, 2012; Szulanski, 1996). Bu da aktörler ya da örgütler arasındaki iletişimin yoğunluğunu etkilemekte ve dolayısıyla da inovasyonu artırmaktadır (Allen ve ark., 2016).

Bu çerçevede teknoparkların dışarıdaki bilgiye ve diğer kaynaklara erişebilmek için gelişmekte olan ülkelerdeki firmalar için önemli bir destek mekanizması olarak çalıştığı ifade edilebilir. Bu araştırmanın bulguları fiziksel ortamların akıllı tasarlanması, ortamdaki eşyaların etkin kullanılması ve uygun ortam koşullarının sağlanması ile teknoparkların görevlerini yerine getirebilmeleri için fiziksel olarak daha işlevsel bir şekilde düzenlenebileceğini göstermektedir. Henüz planlama aşamasındayken teknoparkların etkileşimli ve işbirlikçi bir ekosistem oluşturmayı amaçlayan bir bakış açısıyla tasarlanması ve bu şekilde inşa edilmeleri oldukça önemli görünmektedir.

İnovasyon birtakım girdilerin bir çıktıya dönüşümü olarak modellenebilecek doğrusal bir süreç olarak düşünülmemelidir. Çünkü inovasyon farklı bilgi tabanlarına ve deneyimlerine sahip birçok aktöre ev sahipliği yapan etkileşimli bir ekosistemde ortaya çıkar. Mevcut yazının da vurguladığı gibi, bilgi transferi aktörlerin birbirlerinden öğrenebildikleri bir ekosistemde daha kolay bir şekilde gerçekleştirilir ve böyle bir ortamın tesisi firmaların yenilikçi faaliyetlerini geliştirmelerinde bir hayli önemlidir.

C. TEZ İZİN FORMU / THESIS PERMISSION FORM

ENSTİTÜ / INSTITUTE

Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences	
Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences	X
Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics	
Enformatik Enstitüsü / Graduate School of Informatics	
Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences	

YAZARIN / AUTHOR

Soyadı / Surname : Horata

Adı / Name : Ahmet Melih

Bölümü / Department : Bilim ve Teknoloji Politikası Çalışmaları

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English) : PHYSICAL SPACE MATTERS: DEVELOPING SOCIAL CAPITAL FOR INNOVATION IN TECHNOPARK BUILDINGS

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master [X] **Doktora** / PhD [ ]

1. **Tezin tamamı dünya çapında erişime açılacaktır. /** Release the entire work immediately for access worldwide. [X]
2. **Tez iki yıl süreyle erişime kapalı olacaktır.** / Secure the entire work for patent and/or proprietary purposes for a period of **two years. *** [ ]
3. **Tez altı ay süreyle erişime kapalı olacaktır.** / Secure the entire work for period of **six months**. ***** [ ]

***** *Enstitü Yönetim Kurulu kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir.*

A copy of the decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.

Yazarın imzası / Signature ..... **Tarih** / Date 20/09/2019