

DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

**INTERNAL AND EXTERNAL FACILITATORS
OF OPEN INNOVATION FOR COMPANIES IN
TURKEY**

by
Gül ÖZKAN

March, 2017
İZMİR

INTERNAL AND EXTERNAL FACILITATORS OF OPEN INNOVATION FOR COMPANIES IN TURKEY

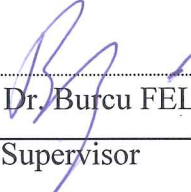
**A Thesis Submitted to the
Graduate School of Natural and Applied Sciences of Dokuz Eylül University
In Partial Fulfillment of the Requirements for the Degree of Master of
Degree in Industrial Engineering**

**by
Gül ÖZKAN**

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İZMİR**

M.Sc. THESIS EXAMINATION RESULT FORM

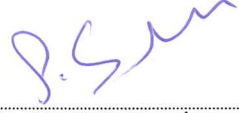
We have read the thesis “INTERNAL AND EXTERNAL FACILITATORS OF OPEN INNOVATION FOR COMPANIES IN TURKEY” completed by GÜL ÖZKAN under supervision of ASST. PROF. DR. BURCU FELEKOĞLU and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.


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INTERNAL AND EXTERNAL FACILITATORS OF OPEN INNOVATION FOR COMPANIES IN TURKEY

ABSTRACT

Open innovation refer to an innovation approach where new ideas and new knowledge inflow and outflow through organizational boundaries by a collaboration with customers, suppliers, research centers, competitors, strategic alliances etc. Open innovation is becoming a widely used approach since it provides agility, flexibility, concentration on core competencies, identifying and diversifying risk and sharing uncertainty. The aim of this thesis, firstly, is to identify the Internal and External facilitator factors of open innovation from a comprehensive review of the literature. Secondly, the aim is to analyze and rank the most important facilitators of the open innovation for companies in Turkey. Several varied methods as exploratory factor analysis, Kruskal-Wallis H and Mann-Whitney U Nonparametric tests and Score-based analysis of rank-ordered data are used during the analysis. Findings indicate that companies should give importance, attention, rigor to the factors “company’s culture”, “open innovation funding”, “open innovation technological resources”, “effective communication with direct customers”, “open innovation oriented new product or process development” and “government or European Union incentives” while planning, applying, executing and controlling open innovation approaches and activities. Yet, there has not been any study that comprehensively analyzing open innovation facilitator factors for the companies in Turkey. This study contributes to the literature by determining facilitator factors and their importance for open innovation. This study also has several implications for the practitioners. For instance, existing business owners or new entrepreneurs can easily analyze market conditions, accomplish main goals and destinations of their companies, decrease risk and decrease uncertainty while implementing and managing open innovation approaches and activities by considering the findings of this study. Moreover, this study also acknowledges and informs the impediment factors for open innovation. Future research directions are also suggested.

Keywords: Open innovation, internal facilitator factors, external facilitator factors, nonparametric tests, score-based analysis of rank-ordered data



TÜRKİYE’DEKİ FİRMALARDA AÇIK İNOVASYONU KOLAYLAŞTIRICI İÇ VE DIŞ MEKANİZMALAR

ÖZ

Açık inovasyon, müşteriler, tedarikçiler, araştırma merkezleri, rakipler, stratejik ortaklar vb. paydaşlarla işbirliği ile yeni fikir ve bilgilerin organizasyonel sınırlarda içeriden dışarıya ve dışarıdan içeriye doğru hareket ettiği bir inovasyon yaklaşımıdır. Firmaya çeviklik, esneklik, temel yetkinliklere odaklanma, riskleri belirleme ve çeşitlendirme, ve belirsizlikleri paylaşma imkanı sağlaması sayesinde açık inovasyon yaygın biçimde kullanılır hale gelmiştir. Bu tezin amacı ilk önce kapsamlı literatür araştırması sayesinde açık inovasyonun iç ve dış kolaylaştırıcı faktörlerini tanımlamak ve çeşitlendirmektir. İkinci olarak, Türkiye’deki firmalar için açık inovasyonu kolaylaştıran faktörler arasından en önemli kolaylaştırıcı faktörleri analiz etmek ve sıralamak amaçlanmaktadır. Analiz sırasında açıklayıcı faktör analizi, Kruskal-Wallis H ve Mann-Whitney U parametrik olmayan testleri ve sıralanmış verinin puana dayalı analizi yöntemleri kullanılmıştır. Sonuçlar, açık inovasyon yaklaşım ve faaliyetlerini planlarken, uygularken, yürütürken ve kontrol ederken firmaların “firmanın açık inovasyon kültürü”, “dış kaynaklı açık inovasyon bütçesi”, “açık inovasyonun teknolojik kaynakları”, “direk müşterilerle etkin iletişim”, “açık inovasyon kapsamında yeni ürün veya süreç geliştirme” ve “devlet teşviki ya da Avrupa Birliği teşvik program ya da paketleri” kolaylaştırıcı faktörlerine önem vermeleri, dikkat ve titizlik göstermeleri gerektiğini göstermektedir. Türkiye’deki firmalarda açık inovasyonu kolaylaştıran faktörlerle ilgili şu ana kadar herhangi bir çalışma yapılmamıştır. Bu çalışma, açık inovasyonu kolaylaştıran faktörleri ve bu faktörlerin önem düzeylerini belirleme açısından literature katkıda bulunmaktadır. Bu çalışma uygulayıcılar için çeşitli çıkarımlara sahiptir. Örnek olarak, mevcut iş sahipleri ya da yeni girişimciler bu çalışmanın bulgularını dikkate alarak açık inovasyon yaklaşımını kullanırken daha etkin şekilde pazar şartlarını analiz edebilir, firmalarının temel hedef ve istikametlerini belirleyebilir, risk ve belirsizlikeleri azaltabilir. Ayrıca bu çalışma açık inovasyonu engelleyen faktörleri de tanımakta ve bildirmektedir. Gelecek araştırma alanları ile ilgili öneriler de ayrıca sunulmuştur.

Anahtar kelimeler: Açık inovasyon, iç kolaylaştıran faktörler, dış kolaylaştıran faktörler, parametrik olmayan testler, sıralanmış veriye puana dayalı analiz



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CHAPTER ONE

INTRODUCTION

1.1 Innovation and Open Innovation

Innovation is a broad concept. According to Oslo Manual 3rd ed. 2005, “innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD and Eurostat, 2005, p. 46). There are many types of innovation such as closed innovation, disruptive innovation, incremental innovation, radical innovation, open innovation and so on. In this thesis, one of these types, open innovation is investigated and its facilitators are analysed using data from companies in Turkey.

The boundaries between a firm and its environment have become more permeable; innovations can easily transfer inward and outward. In an open innovation(OI) approach, projects, works, or any other regulation are arranged taking care of collaboration with others such as competitors, firms or institutes in terms of ideas, inventions, technology, or other work regulations. In 1960s the term of open innovation is promoted by Chesbrough (2003). The main aim in an OI approach is collaboration. Risk and reward sharing with partners can also be accepted as one of the OI fundamentals.

A more formal definition is made by Kankanhalli and Ye (2013); OI is the way for opening up of internal research and development (R&D) by leveraging and enhancing both inflow and outflow of knowledge. Brocco and Groh (2009) define OI (open innovation) with disparate words; it is the associating external knowledge, information and sources in organizations dealing with innovation. Gallagher and West (2006), conceive OI with same manner as above, however they explicate a more detailed definition. According to their point of view, OI combines wide range of internal and external resources to get opportunities and integrate that knowledge with firm

capabilities and resources. Then, OI exploit this knowledge to external multitude firms or other channels.

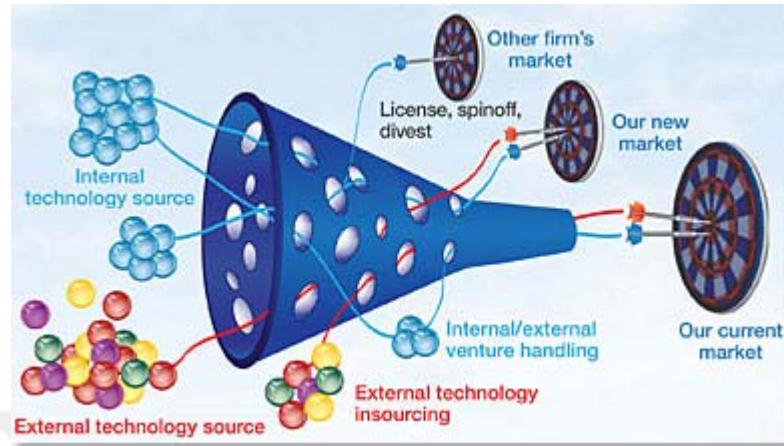


Figure 1.1 An example of open innovation schema (Chesbrough & Eichenholz, 2013)

Figure 1.1 shows the OI's basic approach. The knowledge is flowing inside-out as well as outside-in. According to the Figure 1.1, the knowledge moves between company's market, technology source and venture handling and other firm's market, technology and venture handling. For instance, a specific OI project can start in firm's internal technology source, continue in internal venture handling and complete its journey in other firm's market. Blue lines indicate firm's internal OI activities. Red lines indicate other firm's (external) OI activities. Obviously, it can be seen that the boundary between the company and its surrounding environment is porous enabling innovations to move more easily between the two. Therefore, the useful and required knowledge becomes widespread and shared easily between firm and other outside members.

1.2 Importance, Advantages and Disadvantages of Open Innovation

Referring to the work of Chesbrough, West and Vanhaverbeke (2005), OI is claimed to aim making "value" for the adaptors, such as firms, institutions, government etc.

Gassmann (2006), states in his paper that “The ‘do it yourself’ mentality in technology and R&D management is outdated” (p. 223). He emphasizes that OI provides agility, flexibility and concentration on core competencies of the firms, universities or institutions. Opening companies’ boundaries ensure radically new and different innovation in case of product, service or idea. OI has direct effects on internal R&D by getting maximum advantage from inflow and outflow of knowledge. Licensing-in or co-creation of innovation with external partners can also be a good option to identify and diversify risk as well as to share uncertainty (Kankanhalli & Ye, 2013).

Dodgson, Gann & Salter (2006) claims organizations require opening themselves for external networks to have advantage in the sector. By this way, they can gain full potential in their investments. Another author, Sanderhoff (2014), affirms the content of the cultural heritage, when set free, can greatly enhance the opportunities of the creative industries, research communities, and the tourism sector and so on. OI is important because it’s a fantastic opportunity to let companies’ collections, knowledge and data become an integrated part of the larger ecosystem of cognitive and creative surplus that is connected on the internet. Also, lots of learning can be achieved from people outside of the institutions, about how innovation can be nurtured by developers, startup companies, citizen scientists, crowdsourcing projects and young creatives.

OI has many advantages. These advantages are summarized below.

- **Reduced cost of conducting research and development.**

This is provided by the open and accessible source of information and knowledge in the operation of OI. This reduces the cost of R&D (Çubukçu, 2011).

- **Potential for improvement in productivity.**

Kibekbaev (2013) says in his master thesis,

“The open innovation is understood as a highly interactive and collaborative process involving two or more parties in exchange of ideas, knowledge and information flows and co-creation of new products. Organizations, in particular business enterprises, are connected in a variety of complex networks with partners, suppliers, customers, governments and other public institutions” (p. 4).

Therefore, so many different partners and networks involved and make contributions in the OI processes and this provides improvement in productivity for new product/process development.

- **Incorporation of customers and other relevant parties early in the development process.**

OI ensures not only incorporation of customers, but also researchers, suppliers, intellectual property rights (IPR) experts, universities and other external partners in the product/process/ innovation development process (Ayaz, 2015).

- **Increase in accuracy for market research and customer targeting.**

OI has influence to increase market research and customer targeting. Ayaz (2015) explains that new business opportunities can be formed by OI. He asserts that OI accelerate the operations in market research. Moreover, OI eliminates most of the risks in customer targeting. So that, uncertainty in market research and customer targeting reduces, whereas accuracy increases.

- **Potential for synergism between internal and external innovations.**

As a result of OI activities, Ayaz (2015) refers to the term synergism for both internal and external OI network partners and collaborations. This synergism ensures advantages to combine both internal and external innovations for the company's requirements.

- **Potential for viral marketing.**

“Viral marketing” is a term used in marketing strategy that focuses on spreading information and opinions about a product or service by internet or e-mail (Adamic, Huberman, & Leskovec, 2008). OI directly nested and joined with new technological developments as information technologies and communication technologies. OI structure and actions can provide potential for viral marketing as well as ability for achieving and sustaining viral marketing.

While having many advantages, OI might have some disadvantages and difficulties depending on how it is managed. These include,

- Possibility of revealing information not intended for sharing.
- Potential for the hosting organization to lose their competitive advantage as a consequence of revealing intellectual property.

- Increased complexity of controlling innovation and regulating how contributors affect a project.
- Realigning innovation strategies to extend beyond the firm in order to maximize the return from external innovation.

1.3 Aim and Importance of This Thesis

There are stages in open innovation process which is going to be explained in Chapter three. Effectively and efficiently accomplishing all open innovation process stages is very important for all companies. Many different factors intervene to the OI process. These factors can facilitate or impede, or, both facilitate and impede open innovation activities. The fundamental aim in this work is to identify the internal and external factors that facilitate open innovation with a comprehensive literature review and analyzing the most important factors for the companies in Turkey. The word “facilitator” here refers to providing advantage, benefit, profit or executing in less time (taking short time) for open innovation actions or activities. Consequently, determining open innovation facilitators are important for all OI user companies, governments, foundations or institutions.

1.4 Outline of This Thesis

This thesis involves seven chapters including this chapter. The remainder of this thesis is as follows. In the second chapter, OI is explained in more detail. Types of OI, contributions of OI to companies, popular sectors and major companies using OI in the world and Turkey are explained. Moreover, literature on factors that effect OI is reviewed and summarized. In the third chapter, problem definition and thesis structure are mentioned. In the fourth chapter, internal and external OI factors are identified and grouped into facilitators and also both facilitators and impediments. These factors are explained in detail. In chapter five a comprehensive survey instrument is constituted for the companies in Turkey. The content, structure and aim of the survey are explained in detail. Moreover, sample and data collection processes are explained. The data from the survey is analyzed using exploratory factor analysis, Mann-Whitney U and Kruskal Wallis H as nonparametric statistical tests and score-based evaluation of rank-ordered

data in chapter six and the findings are discussed in detail. In chapter seven the contribution of the findings of this study to the literature and the implications for practitioners are discussed and and future work directions are suggested.



CHAPTER TWO

OPEN INNOVATION

2.1 Types of Open Innovation

According to Huizingh (2011) and Bianchi, Cavaliere, Chiaroni, Chiesa, & Frattini (2011) OI can be classified into three groups. These are:

- ❖ Inbound Open Innovation
- ❖ Outbound Open Innovation
- ❖ Both Inbound and Outbound Open Innovation

To explain these types, inbound OI is the usage of knowledge coming from external partners of the company whereas outbound OI refers to exploitation of internal knowledge to external partners of the company. Both inbound and outbound OI, as can be seen by its name, uses both inbound and outbound OI characteristics simultaneously.

Busarovs (2013) extends OI types into four groups. He divides OI by exact lines, there is no type combining two or three of them. These are indicated in Table 2.1 below.

Table 2.1 Open Innovation Types' Matrix (Busarovs, 2013)

	Inbound open innovation	Outbound open innovation
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

Acquiring (pecuniary inbound OI) refers buying innovation of a company from its external partners through licensing, or other procedures, involving payment. The company knows what it pays for acquiring innovation, stability exist in monetary terms as an advantage. The disadvantage is its difficulty to determine which particular innovation should be acquired.

Sourcing (non-pecuniary inbound OI) designate obtaining innovation from external partners of the company free of charge. The advantage of this OI type is to be non-monetary. The company should monitor and analyze the uncertain and complicated environment. This represents a disadvantage. R&D plays significant role in this point of view to determine external innovations for internal needs.

Selling (pecuniary outbound OI) represents commercializing innovation of the company to its external partners. This can be achieved by selling or licensing technology to external partners. Advantage of this type is the increase of the company's revenue and R&D returns. Some companies use this approach next to their normal selling procedure as selling patents or licenses. One of the disadvantages of this approach is the "disclosure paradox". The supplier (here the company) reluctantly display information about their innovation to buyer, because they are afraid that the buyer will take advantage of them and will use their innovation without paying immediately total price. Moreover, buyers reject to pay for an innovation, until they have all the information available regarding this innovation, which is normal purchaser behaviour.

Revealing (non-pecuniary outbound OI) indicate sharing the company's innovation to external partners freely with no charge. The advantage of this type is development of the technology in the area the innovation is made. External partners get benefit from this approach. Besides, co-operations and collaborations are enhanced with company and its external partners. Unfortunately, profit retaining does not exist as it shows a disadvantage for the company.

2.2 Why Should Companies Use Open Innovation?

As mentioned above, advantages of open innovation are more than its disadvantages. Global world economy, continuously developing technology and cultural values affect companies in all areas. To keep up in these conditions, companies should adopt and use open innovation activities.

Chesbrough et al. (2009) says with the open innovation “the company or the institution uses every available tool to create successful products and services faster than their competitor and at the same time fosters the building of core competencies and protects their intellectual property” (p. 312). Besides, Chesbrough et al. (2006) claims in his book that companies can combine both external and internal ideas; consequently, can easily constitute their business model in the market with the aid of open innovation.

Not only in leader countries, who are the locomotives of economy but also in emerging economy countries OI is valuable. Forsans and Kafouros (2012) tested this suggestion in India where inbound open innovation is crucial in helping firms to catch-up and move towards the technological frontier. Moreover, they asserted that external knowledge gained with OI helps companies on their R&D projects. Laursen and Salter (2006) confirmed this assertion by stating that some resources can only appear outside boundaries of the company. If the companies are too internally focused, they may lose profitable opportunities. Huizingh (2011) adds that OI enables inflow and outflow of knowledge and ideas to the company to accelerate internal innovation and provide easier market expansion. According to Elmquist, Fredberg, & Ollila (2009) the continual change in industry and society have led to an increased mobility of knowledge workers and the need for open innovation adaptation for companies. This shift can only be made by open innovation paradigm.

2.3 Open Innovation User Countries

Many countries are now using OI activities in today's world. Different authors explain this subject as top 10, top 5 OI user countries. According to recent data provided by Harwood (2014) the list of countries is sorted from the biggest to smallest with regard to the usage amount as:

1. USA; 2. UK; 3. Germany; 4. France; 5. Netherlands; 6. Denmark; 7. New Zealand; 8. Japan; 9. Switzerland; 10. South Korea; 11. Finland; 12. Canada; 13.

Colombia; 14. Sweden; 15. Australia; 16. Indonesia; 17. Malaysia; 18. Brazil; 19. Singapore; 20. India

Unfortunately, Turkey has not been in this top 20 list yet. May be in the future, if the country struggle and endeavour, can enter to the list.

2.3.1 Popular Open Innovation User Industrial Sectors and Companies in the World

OI approach popular area is widely used by computer software and hardware producers. According to Chesbrough et al. (2006), IBM and Intel are the companies for this example. The innovations or knowledge are flowing either outside-in or inside-out or both outside-in and inside-out in these companies. Other companies in the same area are Microsoft and SAP. Gallagher and West (2006) also consider Microsoft and Intel using OI and add Cisco according to their efforts. Chesbrough et al. (2010) point out them in OI paradigm. These companies apply inbound OI by starting to build decentralized research labs on university campuses to enhance their corporation capacity for outside-in innovation flow.

OI is used also in food care, agricultural products, chemicals, safety equipment, industrial biotechnology and electronics. One example is Du Pont. Abulrub and Lee (2012), focus on this company about their outbound open innovation amount. Open innovation efforts of this company exceeded half of its total net income in 2009. Today still, more stronger outbound OI activities continue in Du Pont. They have “innovation delivery system”. One side is market need the other side is Du Pont with researchers and engineers. They increase their revenues with this outbound OI (Du Pont, n.d.). Other example is GE in industrial sectors as electronics, and also aviation, white goods, home improvement, healthcare, appliances for business, transportation and energy (The world's premier digital industrial company, n.d.). Lindegaard (2012) speaks of 34 companies which are using OI. He mentions that there are more than 34 OI user companies obviously in the world. The ones mentioned are the most popular. GE is one of this user groups. GE has adapted an OI program called “Ecoimagination Challenge”. It is a good product research tool. Its type is “crowdsourcing”, the aim of

which is to obtain information or input into a particular task or project by enlisting the services of a number of people, either paid or unpaid, typically (generally) via the Internet. OI user companies are listed in the Table 2.2 below according to Lindegaard (2012).

Table 2.2 Some famous open innovation user companies in the world (Lindegaard, 2012)

<u>Name of the OI user company</u>
Audi
Akzo Nobel
BASF
Beiersdorf
Bombardier
Cisco
Clorox
Dell
DHL
DSM
Fiat
GE
General Mills
HP
IBM
Intuit
Lego
LG
Local Motors
Lufthansa
MeadWestvaco
Medtronic
Nokia
P&G
Philips
Psion
Quirky
SAP
Shell
Starbucks
Toyota
Unilever
Xerox
Weyerhaeuser

2.3.2 Popular Open Innovation User Industrial Sectors and Companies in Turkey

In Turkey open innovation is less popular, moreover, unknown, comparing with other developed countries. However, even so there are companies applying and using OI in Turkey. Çubukcu (2011) explain this subject with starting the telecommunication companies Turkcell and Avea in his master thesis. Çubukcu (2011) states Turkcell has technology center which does not only achieve R&D operations but also make technology collaboration with its other network member companies. Turkcell call this as “ecosystem” structure. In 2007 Turkcell accomplishes an attack with joining universities to this network and change the name as “Univercell” program. Here, the related academic researchers and students bring out innovations using web and communication services as sms, mms, gprs and wap. Through this project, approximately ten OI projects are elected according to their promising future potential.

On the other hand, Çubukcu (2011) specifies Avea OI as “ideavea” project. In this project students from different areas of science and technology are participated in a competition. Avea headquarters chose the winner in this competition, applied and carried the new innovation project in Avea. The author also states two other companies using OI. One is Dizayn Grup which has sanitary product groups, infrastructure product groups and agricultural irrigation product groups. Dizayn Grup plays important role in agriculture and infrastructure sector. Company aims to continue growing by innovations. OI example of this company is the “miracle” project which is an open project for all university students related with the study areas same as company. The second company is expressed as TEB in banking sector by Çubukçu (2011). TEB applies OI by various projects and different kinds of competitions.

Yet, there are more companies using OI in their projects. Deliormanlı and Özdemir (2013) give an example from white goods and consumer durables company Arçelik, where OI is used in Turkish coffee maker Telve project with R&D collaboration of other coffee producer company.

Moreover, considering automotive sector, vehicle manufacturing company Ford Otosan (with original brand from America, manufacturing branch in Turkey) accomplish an OI motor project with Chinese company JMC with license agreement. Continuing with automotive sector, there are companies in automotive subsidiary industry using OI approaches. One of these companies, named as Norm Civata (located in İzmir) plays active role in university and government collaborations in new product development stages. These collaboration types are Teydep (with Tübitak support, total 11 projects) and San-Tez (with Science, Industry and Technology Ministry support, total 2 projects). Teydep and San-Tez project types are accomplished through collaboration with seven different universities in Turkey. Norm Civata manufactures many different screw and bolt types for automotive sector both within Turkey and foreign countries outside the Turkey (Katma değeri yüksek ürünlerimizle dünya pazarlarında olacağız, 2015).

In Banking sector also there are OI applications. Akbank Marketing of Retail Banking Head Executive Muratoğlu (2008), explains how their bank uses OI in new product, service or channel improvements in his interview with the editor of Capital Magazine Hande Yavuz. For instance, credits, individual credit, mobile credit, web credit, sms (mobile message) and credit transactions are formed by the aid of OI approaches; working and collaborating with other companies.

On the other hand, a company operating in one of the branches of textile sector, carpet weaving, named as Atlas Halı uses OI. Balcı (2013) an author in Turkish newspaper Hürriyet, explains that Atlas Halı has an OI project named “nano-halı”. In this project, Atlas Halı consults and collaborates with many companies using nanotechnology. Mostly, OI project operations achieved by collaboration with Turkish technological company named Innovcoat located in Gebze.

Continuing with the textile sector a company, which is named Kordsa Global, one of the Sabancı Holding companies, uses OI approaches. Kordsa Global is prominent and famous manufacturer of polyester thread, nylon thread and tire cord fabric in Turkey. The company accomplishes many collaboration projects with the universities

as Sabancı University, Boğaziçi University, Kocaeli University, Yıldız Technical University, Izmir Institute of Technology and Tokyo Institute of Technology. As a result of one of these projects “Kordsa Global Composite Technologies Excellence Center” is built in Teknopark Istanbul in December 2014. This project is achieved with the collaboration of some academicians in Sabancı University (Kordsa’dan açık inovasyon işbirliği, 2015), (Kordsa Global, n.d.).

There are more examples for companies using open innovation approaches in Turkey. For instance, Aselsan, a company established for meeting the requirements of defence industry of Turkish military, uses OI approaches. The company is also subordinated to Turkish Military Forces Foundation. Aselsan have many collaborations with universities such as ODTÜ, Cumhuriyet University, Sabancı University and Izmir Institute of Technology with the projects named as “Eymir”, “Gediz”, “Kangal” and “Elmas”. The company also got funding from European Union with Eureka program, 7 th framework of Marie Curie funds and 7 th framework of security agency. Besides, Aselsan makes collaboration with external partners, organizes idea and project competitions to public, sells intellectual property rights or patents and outsources R&D periodically every year (time period does not mentioned in company’s page), (Açık inovasyon, n.d.).

On the other hand, analyzing computer technology sector in Turkey, Logo Yazılım, a software developer company, uses OI approaches. A prominent OI example for Logo Yazılım is collaboration with other strategic partners in foreign countries. The company collaborates with IBM, Intel and Microsoft Logo. Within a project named “Support for independent software developers”, Logo had an authorization to use IBM technological resources and test laboratories (Yavuz, 2008). Another company in computer technology sector, named Emc uses OI approaches. Emc’s operations center is located in America. It offers products related with data storage and backup systems. Also one of its branches located in Turkey. This Turkey branch of the company acquired many innovation developer companies into its organization. This growth with new R&D experts ensures many advantages to Emc Turkey’s branch. Moreover, the company has collaboration (intense information and knowledge exchange between the

company and the universities) projects with some universities in Turkey (Yavuz, 2008).

Observing another sector, as energy and transportation, General Electric's Turkey branch also uses OI approaches. General Electric (GE) in the world has many different kinds of products. Some of its products are aviation services, marine engines, refrigerators, military engines, ac/dc power supplies, transformers, switchboards, panel boards, all business lighting, power generations, water heaters etc. In Turkey the company's branch deals and produces airplane motors, wind energy tools and appliances and all types of lighting equipment. The company's Turkey branch accomplishes two collaborations with other companies in innovation projects. For this reason, it can be accepted that they use OI approach. GE's Turkey branch collaborates with Tusaş Motor Sanayi for manufacturing new generation high productivity airplane. The other collaboration is accomplished with Tölomsaş (Türkiye Lokomotif ve Motor Sanayi A. Ş.) to innovate "Powerhaul" locomotives that reduce greenhouse gas emission about 9%. GE's Turkey branch is not contented with these OI actions, company desires to achieve more. Collaborations with Dokuz Eylül University and Istanbul Technical University are important OI achievements of GE's Turkey branch (DEU ile General Electric'in inovasyon işbirliği, 2014), (General Elektrik ile İTÜ arasında üniversite-sanayi işbirliği, 2015), (Türkiye işbirliğine daha sıcak bakıyor, n.d.).

Looking for chemical sector, Henkel's branch in Turkey Turk Henkel, applies OI approaches in their organization. The total number of OI collaboration projects are approximately 250 with its external partners (alliances, universities, research institutes and other companies) from past to 2008. Turk Henkel is the leading manufacturer of adhesive technologies, laundry & home care and beauty care (Yavuz, 2008).

In food sector, one of the famous Turkish companies Ülker applies OI approach. Ali Ülker, the CEO of the company explains that they use a platform named sensory analysis laboratory ("duyusal analiz laboratuvarı") for consulting customers' opinions. This platform is established in 2012, from that year to the present the application is

still continuing. From 2012 to 2016 for 750 innovations sourced by 110.000 customer opinions are received.

There are more companies in Turkey using one or more OI approaches. The described ones above are the most famous ones. Considering the explanations above, Figure 2.1 indicates the main sectors using OI in Turkey. Although there are some other sectors using OI (as noticed in the survey analysis of this study), in Figure 2.1 main sectors using OI are indicated.



Figure 2.1 Main sectors that apply open innovation approaches in Turkey

2.4 Factors that Effect Open Innovation

Chesbrough et. al (2006) group factors that affect open innovation into two parts. These are incentives and cultural norms. Besides, they claim individual behaviour differences to these factors in attitudes and needs. Another argument says that there are trends and streams in open innovation. These are globalization, technology intensity, technology fusion, new business models and knowledge leveraging (Gassmann, 2006). Open innovation key success factors which are defined for “high-technology” industries are also listed in Table 2.3 (Chesbrough & Crowther, 2006).

Table 2.3 Inbound open innovation key success factors (Chesbrough & Crowther, 2006, p. 233)

	Key success factors		Key success factors
Strategy/goals	Provide top-down direction and encouragement for OI practices	Integration and management	Assign business ownership and responsibility for success
	Focus efforts and ensure alignment with business growth objectives		Do not create separate management systems – modify existing systems (unless a new business model is needed)
Sourcing	Build deep networks in relevant areas	Metrics and organization	Align metrics and incentives to encourage success whether in an open or closed environment
	Bring in innovations where R&D can still add value and have wins		Communicate OI link to strategy and business objectives, publicize wins
	Obtain market exclusivity or purchase technology outright when core		

In reviewing the literature, relevant journals, databases, publications, congresses and academic presentations are selected and then studies investigating the relationship between various factors and open innovation are identified. These studies are reviewed in detail and summarized in Table 2.4 and Table 2.5. In both tables the second column shows the variable name in the original study and the respective facilitator name used

in this thesis as explained in chapter four and indicated in Figure 4.1. In Table 2.4 the factors affecting OI performance are given with their references and construct measures in the original study. In Table 2.5 information about the studies that investigates the factors affecting OI performance are given with explanations of the variables in the original study, their effect on OI performance, data collection and analyse method and conceptual framework in the studies.



Table 2.4 Construct measures of the factors affecting OI performance

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Performance area	Selected References	Construct Measures
An abundance of resources	<u>Existence of sufficient financial resources / OI budget</u> under the subheading of OI long-term investment	Open Innovation performance	1. Chesbrough et al. (2009), 2. Gemünden & Ritter (2003), 3. Gnyawali & Srivastava (2013), 4. Fernandez et al. (2008)	1. – (no question, only from literature) 2. According to the hypothesis, “A company’s degree of network competence is positively influenced by the degree of access to resources.”, the yes-no question is added under this hypothesis “Do you have access of financial resources for developing and innovating products and processes?” 3. Hypothesis by claiming “Proposition 4b.: The higher the network resource potential of a firm, the higher the likelihood of innovation by the firm primarily through the overcoming of organizational rigidity.” 4. – (no question, only from literature and claiming)
	<u>Existence of informational resources / information technologies and communication technologies</u>	Open Innovation performance	1. Gemünden & Ritter (2003) 2. Agranoff & McGuire (1999) 3. Gnyawali and Srivastava (2013)	1. According to the hypothesis, “A company’s degree of network competence is positively influenced by the integration of a company’s communication structure.”, the yes-no question is added under this hypothesis, “ Do you have access of financial resources allocated for communication (e.g. telephone, fax, postage)?” 2. – (no question, only from literature and claiming) 3. – (no question, only from literature and claiming)
Management, governance and organization	<u>Improve performance and new arrangements / workers’ motivation in the process</u> under the subheading of idea management, team training, coaching , in the heading of OI oriented new product/process development	Open Innovation performance	1. Page (2003)	1. – (there is no survey question implied from author)
	<u>Knowledge management and sharing culture / company’s culture</u> heading	Open Innovation performance	1. Darroch (2005)	1. According to the hypothesis H1a. “Firms that effectively manage knowledge are likely to be more innovative.” The yes-no question is added under this hypothesis, “Is knowledge disseminated on-the-job?” Knowledge dissemination is explained as using techniques such as quality circles, case notes, mentoring and coaching to disseminate knowledge.

Table 2.4 Construct measures of the factors affecting OI performance (continue)

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Performance area	Selected References	Construct Measures
Management, governance and interoperation organization	<u>Managing flexible structures not hierarchical</u> / idea management team training, coaching under the heading of OI oriented product/process development	Open Innovation performance	1. Agranoff & McGuire (1999), 2. Ojasalo (2004)	1. – (no question, only from literature and claiming) 2. – No question because it is case analysis. Claiming from literature.
	Workers' motivation in the process / workers' motivation in the process under the subheading of idea management, team training, coaching , in the heading of OI oriented new product/process development	Open Innovation performance	1. Gnyawali & Srivastava (2013)	1. No question, no interview or survey. Conceptual model is formed by the aid of the literature and claiming. There is only a proposition, which is "The higher the competitive intensity within a firm's cluster, the higher the likelihood of innovation by the firm primarily through increased motivation to innovate."
	<u>Networkers spent less time running internal operations</u> / planning and integrating, testing and quality control stages, marketing and commercialization stages under the heading of OI oriented product/process development	Open Innovation performance	1. Meier & O'Toole (2003)	1. Subject is achieved in education sector, schools in Texas. 1 is excellent to 5 inadequate rank 8 questions 1.1.1 Quality of first year teachers 1.1.2 Quality of experienced teachers 1.1.3 Athletic facilities 1.1.4 Parental involvement 1.1.5 Professional development 1.1.6 Adequacy of state aid 1.1.7 Community support 1.1.8 School board support Authors combine these 8 question values with time frequency of 9 groups 1 is daily to 6 is never 1.2.1 School board members 1.2.2 Teachers' associations 1.2.3 Parent groups, e.g. PTA 1.2.4 Your principals 1.2.5 Local business leaders 1.2.6 Other superintendents 1.2.7 Federal education officials 1.2.8 State legislators 1.2.9 Texas Education Agency
	<u>Management of IPR (Intellectual Property Rights) Issues</u> / effective communication with IPR experts	Open Innovation performance	1. Bogers (2011)	1. – No question because it is case analysis. Claiming from literature.
Research and development, R&D, activities	<u>Innovation idea management</u> / idea management team training, coaching under the heading of OI oriented product/process development	Open Innovation performance	1. Björk & Magnusson (2009) 2. Doloreux & Gübeli (2005) 3. Chesbrough et al. (2009)	1. No survey type questions 2. No question because it is case analysis. Claiming from literature. 3. – (no question, only from literature and claiming)
	<u>Technological collaboration</u> / OI technological resources heading	Open Innovation performance	1. Bessant, Pavitt, & Tidd (2001) 2. Chesbrough et al. (2009)	1.- There is no constituted survey from authors. Only from literature and claiming. 2. – (no question, only from literature and claiming)
Information Technology, IT	<u>Complexity IT infrastructure</u> / information technologies	Open Innovation performance	1. Chau & Tam (1997)	1. According to the hypothesis 5 "Higher degrees of complexity of IT infrastructure will positively affect the likelihood of open systems adoption", the related survey question is ""
	<u>Information-communication technology, (ICT)</u> / information technologies and communication technologies	Open Innovation Performance	1. Garayev & Kapucu (2012), 2. Camillo, Franco, Pietro, & Virgilio (2011) 3. Enkel (2002),	1. Hypothesis 3 explains: "Utilization of information-communication technologies (ICT) is positively associated with network sustainability". There are 5 yes-no survey questions based on this hypothesis: 1.1 Our organization relies on the use of information technology in communication and coordination. 1.2 Our organization's operations are streamlined by technological tools of communication and coordination. 1.3 Our organization has sufficient technical and technological capacity to deal with disasters 1.4 The use of ICT facilitates/enhances the operations of our organization. 1.5 Our operations are supported by a disaster information management system (WebEOC, E-Team, etc.) 2., 3., – (no question, only from literature and claiming)

Table 2.4 Construct measures of the factors affecting OI performance (continue)

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Performance area	Selected References	Construct Measures
External control	<u>External agencies or institutes regulatory control / effective communication with other network partners</u>	Open Innovation Performance	1. Alexander et al. (2003)	1. Two survey questions are asked with 5-point Likert-type scale with values 1 (strongly disagree), 2 (disagree), 3 (no opinion), 4 (agree), 5 (strongly agree) of first question and 1-2 (not at all effective), 3-4 (somewhat effective), 5 (very effective) for second question 1.1 "In this community, significant health improvements could be made if a few individuals or agencies, rather than the partnership as whole, took the right steps." 1.2 "Demonstrating to state agencies the contributions that partnerships can make to improving health and human services."
	<u>Legal rules (intellectual property law) / accomplishing government regulations</u>	Open Innovation Performance	1. Lemley & McGowan (1998)	1. – (no question, only from literature and claiming)
Network type	<u>Formal or informal rules, procedures and organization / integrative organizational practices</u> heading	Open Innovation Performance	1. Aarts & Klerkx (2013)	1. No question because it is case analysis. Claiming from literature.
	<u>Innovation network connectivity between the nodes / OI network connections</u> heading	Open Innovation Performance	1. Björk & Magnusson (2009)	1. No survey type questions
Size of network	<u>Large-scale network / OI network connections</u> heading	Open Innovation Performance	1. Phelps & Schilling (2007)	1. No survey, no question from literature they found dependent and independent variables and form regression analysis.
Net-work inner stability	<u>Trust, collaboration or cooperation / company's culture</u> heading	Open Innovation Performance	1. Rijnsoever (2013) 2. Bevis & Dodourova (2014)	1. – (no question, only from literature and claiming) 2. According to research objective of knowledge flows the code of "trust" are mentioned as in 4 quotations from survey results (as an explanation not an answer of question) "You have to trust in others' knowledge, that is a learning process." "A lot of trust was lost during the last 20 years due to very heavy procurement rules along the value-chain. Now maybe we have a kind of recovery." "The cluster could be a solution because you have to find the trust at some level." "The clusters should invest into know-how. You cannot do it as an outsider. You do actually need to have at least a basic understanding of the technologies in order to be trusted so that the rest follow you."

Table 2.5 Information about studies that investigate the factors affecting OI performance

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Variable Explanation in paper (article, book, journal etc.)	Effect type	Performance area	Selected References	Data Collection Method	Conceptual Framework	Data Analyze Method
An abundance of resources	Existence of sufficient financial resources / OI budget under the subheading of OI long-term investment	1. OI partners' resources 2. Financial resources 3. Diversity of resources, both tangible and intangible resources are involved.	Positive	Open Innovation Performance	1. Chesbrough et al. (2009), 2. Gemünden & Ritter (2003), 3. Gnyawali & Srivastava (2013),	1. From literature 2. Survey (741 German companies are asked, 308 are turned) 3. Literature	1.- 2. Hypothesis 3. Propositions	1.- 2. Cronbach's α is used for multi-item measures, confirmatory factor analysis is achieved with LISREL. 3. Conceptual model development
	Existence of informational resources / information technologies and communication technologies	1. Communication, relationship initiation 2. Communication 3. Informal Knowledge	Positive	Open Innovation Performance	1. Gemünden & Ritter (2003) 2. Agranoff & McGuire (1999) 3. Gnyawali & Srivastava (2013)	1. Survey (741 German companies are asked, 308 are turned) 2. Literature 3. Literature	1. Hypothesis 2.- 3. Propositions	1. Cronbach's α is used for multi-item measures, confirmatory factor analysis is achieved with LISREL 2.- 3. Conceptual model development
Management, governance and organization	Improve performance and new arrangements / workers' motivation in the process under the subheading of idea management, team training, coaching, in the heading of OI oriented new product/process development	1. Entrepreneurial management strategies	Positive	Open Innovation Performance	1. Page (2003)	1. Survey (170 semistructured interviews with practitioners and analysts for 10 states of America)	1. Six entrepreneurial strategy propositions	1.-
	Knowledge management and sharing / company's culture heading	1. Knowledge management	Positive	Open Innovation Performance	1. Darroch (2005)	1. Survey (1,743 surveys are mailed out and 443 are returned)	1. Hypothesis	1. Structural equation modeling (correlation tables are included)

Table 2.5 Information about studies that investigate the factors affecting OI performance (continue)

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Variable Explanation in paper (article, book, journal, etc..)	Effect type	Performance area	Selected References	Data Collection Method	Conceptual Framework	Data Analyze Method
Management, governance and interoperation organization	<u>Managing flexible structures not hierarchical / idea management team training, coaching</u> under the heading of OI oriented product/process development	1. Network management 2. Network management	Positive	Open Innovation Performance	1. Agranoff & McGuire (1999) 2. Ojasalo (2004)	1. Literature 2. Interviews of 37 SME software companies' key people	1.- 2. Six propositions	1. Literature and claiming 2. Case study of two type grouped companies A and B. Open and selective coding of the data is implied for achieving results
	<u>Workers' motivation in the process / workers' motivation in the process</u> under the subheading of idea management, team training, coaching , in the heading of OI oriented new product/process development	1. Motivation (Innovation catalysts)	Positive	Open Innovation Performance	1. Gnyawali & Srivastava (2013)	1. Literature	1. Propositions	1. Conceptual model development
	<u>Networkers spent less time running internal operations / planning and integrating, testing and quality control stages, marketing and commercialization stages</u> under the heading of OI oriented product/process development	1. Network-management-style-factor	Positive	Open Innovation Performance	1. Meier & O'Toole (2003)	1. Questionnaire (507 usable responses)	1. Proposed factors	1. Cases of 2535 are formed, factor analysis, correlation and regression analysis
	<u>Management of IPR (Intellectual Property Rights) Issues / effective communication with IPR experts</u>	1. IPR (Intellectual Property Rights) Issues	Positive	Open Innovation Performance	1. Bogers (2011)	1. Semi-structured interviews	1. Propositions	1. Case study (8 cases for 8 companies)
Research and development, R&D, activities	<u>Innovation idea management / idea management team training, coaching</u> under the heading of OI oriented product/process development	1. Idea management 2. Spin-off development 3. Idea management	Positive	Open Innovation Performance	1. Björk & Magnusson (2009) 2. Doloreux & Gübeli (2005) 3. Chesbrough et al. (2009)	1. Interviews in Swedish company 2. Interviews (90 min questionnaires) with 3 high-technology companies 3. From literature	1. From literature 2. From literature 3. -	1. Social network analysis done with UCINET. χ^2 test is achieved for 4 quantiles using Matlab. 2. 3 cases study analysis as (Case A, B and C) 3. -
	<u>Technological collaboration / OI technological resources heading</u>	1. Collaboration 2. Cooperation	Positive	Open Innovation Performance	1. Bessant, Pavitt & Tidd (2001) 2. Chesbrough et al. (2009)	1. Survey 2. From literature	1. From literature and propositions 2. -	1. Case studies 2. -
Information Technology, IT	<u>Complexity IT infrastructure / information technologies</u>	1. Complexity of IT infrastructure	Positive	Open Innovation Performance	1. Chau & Tam (1997)	1. Interviews with 89 senior executives in Hong Kong	1. Hypothesis	1. Factor analysis, Logistics regression with using Cronbach's alpha, one-tailed t-test.
	<u>Information-communication technology, (ICT) / information technologies and communication technologies</u>	1, 2, 3 Information-communication technology, (ICT)	Positive	Open Innovation Performance	1. Garayev & Kapucu (2012) 2. Camillo et al. (2011) 3. Enkel (2002),	1. Survey (118 responses) 2., 3. Literature	1. Hypothesis 2. - 3. -	1. Multiple linear regression analysis, using UCINET software for social network analysis 2., 3. Literature and claiming

Table 2.5 Information about studies that investigate the factors affecting OI performance (continue)

Factor Name	Variable Name in the Original Study / Respective Facilitator Name in Figure 4.1	Variable Explanation in paper (article, book, journal, etc..)	Effect type	Performance area	Selected References	Data Collection Method	Conceptual Framework	Data Analyze Method
External control	<u>External agencies or institutes regulatory control</u> / effective communication with other network partners	1. Partnership effectiveness	Some effects, whether positive or negative	Open Innovation Performance	1. Alexander et al. (2003)	1. Survey (433 usable)	1. From literature and propositions	1. t-test, nonparametric Wilcoxon signed-rank test
	<u>Legal rules (intellectual property law)</u> / accomplishing government regulations	1. Intellectual Property, Government standard-setting, telephony, corporate law, contract terms	Mostly positive sometimes negative	Open Innovation Performance	1. Lemley & McGowan (1998)	1. Literature	1. -	1. Literature and claiming
Network type	<u>Formal or informal rules, procedures and organization / integratiorganizational practices</u> heading	Within organization champions	Some effects, whether positive or negative	Open Innovation Performance	1. Aarts & Klerkx (2013)	1. Semi-structured interviews	1. From literature	1. Case study analysis, data coded in Atlas 5.0 software.
	<u>Innovation network connectivity between the nodes</u> / OI network connections heading	1. Innovation network connectivity	Positive	Open Innovation Performance	1. Björk & Magnusson (2009)	1. Interviews in Swedish company	1. From literature	1. Social network analysis done with UCINET. χ^2 test is achieved for 4 quantiles using Matlab.
Size of network	<u>Large-scale network</u> / OI network connections heading	1. Large-scale network structure	Positive	Open Innovation Performance	1. Phelps & Schilling (2007)	1. Survey	1. From literature and propositions	1. Poisson regression approach
Net-work inner stability	<u>Trust, collaboration or cooperation</u> / company's culture heading	1. Trust 2. Trust	Positive	Open Innovation Performance	1. Rijnsoever (2013) 2. Bevis & Dodourova (2014)	1. Literature 2. Interviews (European car industry)	1. - 2. From literature and propositions	1. Literature and claiming 2. Qualitative inductive approach

CHAPTER THREE

PROBLEM DEFINITION AND THESIS STRUCTURE

3.1 Problem Definition

As mentioned in the section 1.3, under the heading of aim and importance of this thesis, there are stages in achieving open innovation process. Minshall, Mortara, Napp, & Slacik (2009) explain open innovation process in three stages. These are “**research**”, “**development**” and “**commercialisation**”. Figure 3.1 shows these stages and their relevance with OI.

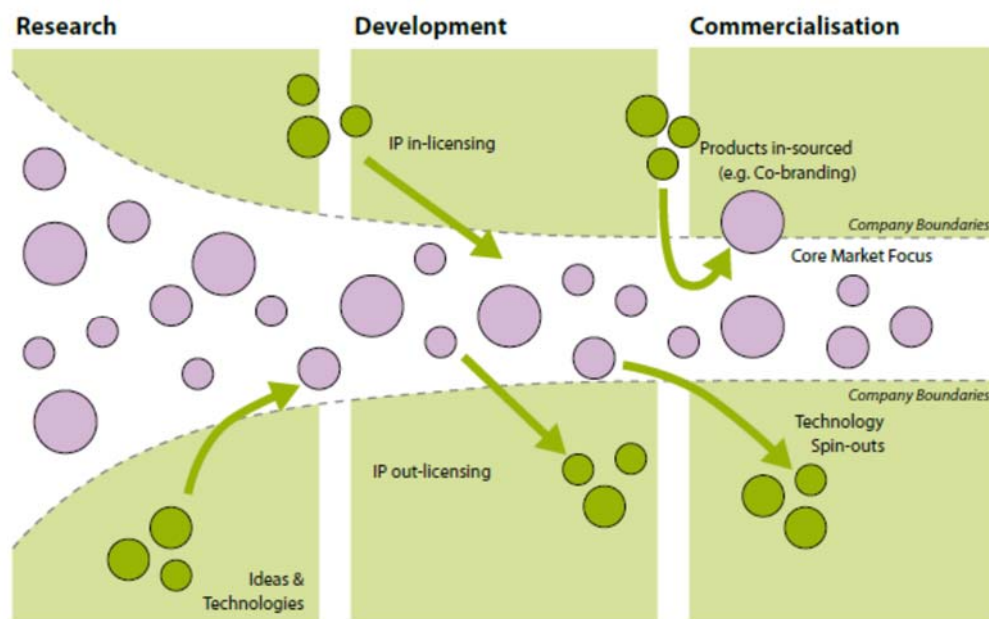


Figure 3.1 A diagram illustrating an open innovation process (Minshall, Mortara, Napp, & Slacik, 2009)

For deeper understanding of Figure 3.1, the purple and green colored large and small sized circles represent ideas that are coming from inside or outside the company. In research stage, all of these ideas are investigated. The selected ones (the best or most promising ones) are entered to second stage of development and the last stage of commercialisation. The non-selected ideas are dropped. In development stage the

research findings are narrowed to more valuable and viable projects by selling intellectual property (IP) licences (IP in-licensing) or buying IP licences (IP out-licensing). In last stage, commercialisation, the core product is formed of variety of inputs from inside and outside. At this stage company have two alternatives; whether the company commercialize and accomplish brand transactions for this new product/process or could still choose to buy in market-ready products from outside, for example in co-branding exercises. Additionally, it can be seen that the company's boundaries are permeable (the dashed lines) indicating information coming in or sending out has not restriction or limitation.

In this thesis, the internal and external facilitator factors of OI are identified mostly from the literature and few from the business conditions in Turkey. These facilitators affect all these three stages of open innovation by providing advantages and convenience to OI actions. At the end of this work, the most beneficial and important facilitators are defined for companies in Turkey.

3.2 Thesis Structure

As mentioned above, the aim of this thesis is to identify the factors that facilitate OI and find the most important ones of these factors for companies in Turkey. The study is designed in stages to reach this goal. First, the literature is searched for the factors that affect open innovation. These factors can be facilitators or impediments. They are identified from the literature through a comprehensive search of relevant journals, databases, publications, congresses, conferences and academic presentations. Relevant studies were reviewed according to factors to constitute their effect on OI performance, construct measures, data collection method, conceptual framework and data analyze method. In chapter two, all of the OI factors in these studies and their analysing methods are described and explained within detailed tables. In the second stage, from all acquired factors some of them are selected and others are eliminated. The selection phase is also achieved by analysing both literature and business conditions in Turkey. In the third stage, the selected OI factors are analysed whether they are internal or external OI factor to the companies. Therefore, two groups are

formed. In the fourth stage, internal and external OI factors are separated and grouped into facilitators or both facilitators and impediments. Four groups are established in this separation and grouping stage. These second, third and fourth stages of this study are explained in chapter four and elaborated upon consulting academic publications in the world, business and market conditions in Turkey. In the fifth stage (chapter five), a comprehensive survey tool is developed to collect data from companies in Turkey about OI and OI factors. Data is collected using this survey tool through face-to-face interviews. In sixth stage (chapter six), the data is analysed using exploratory factor analysis, nonparametric statistical methods and score-based evaluation of rank-ordered data. Research design of the thesis is described in Figure 3.2 below.



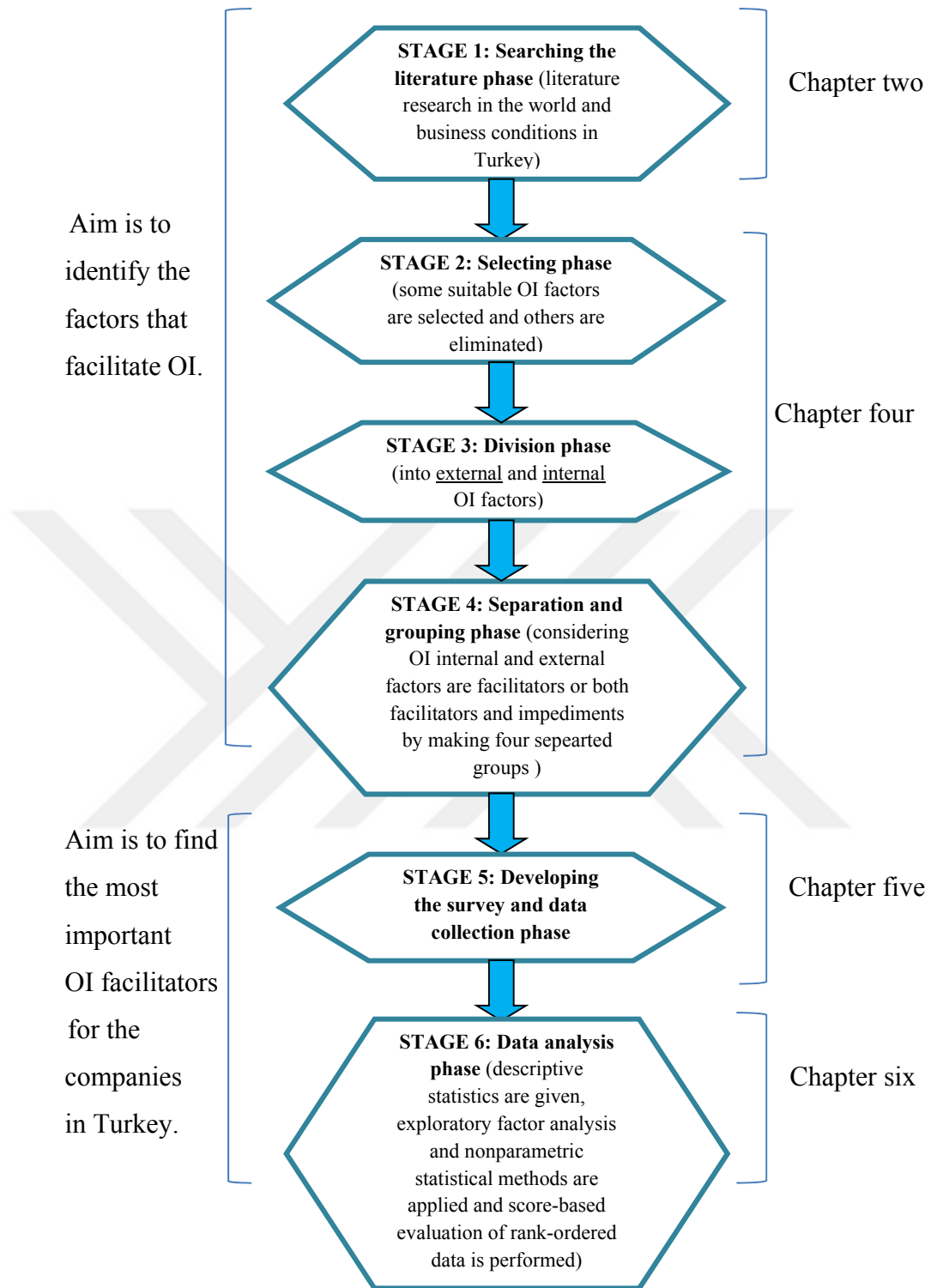


Figure 3.2 Research design of the thesis

CHAPTER FOUR

OPEN INNOVATION FACILITATORS

As Chesbrough (2003), argues that the innovation approach applied by organizations has shifted from a closed system to an open system, the boundaries blurred and slowly disappeared. It can be seen that a new concept as open innovation (OI), is certainly more complex than old-time closed innovation. As like in many mechanisms in the world, OI also has catalyzing and simplifying factors for all its phases.

There are many ideas and suggestions in literature that ease and simplify implementation of OI. According to Piller & Wielens (2013), there must be “key success factors” to ease OI operations.

Various factors are investigated in the literature for their effects on OI performance as indicated in chapter two. Some of these facilitators can both facilitate or prevent the operations of OI. They are going to be mentioned in the next section. In this thesis they are analyzed under two groups: external facilitators and internal facilitators of the companies.

External and internal facilitators are specified in Figure 4.1. The colours in this figure are different according to their level of granularity. The first level main headings are denoted as green colour (level 1). The second level headings are denoted with blue colour. Third level headings are denoted with orange colour. Forth level headings are denoted with red colour. There is only one fifth level heading that is denoted with dark blue colour.

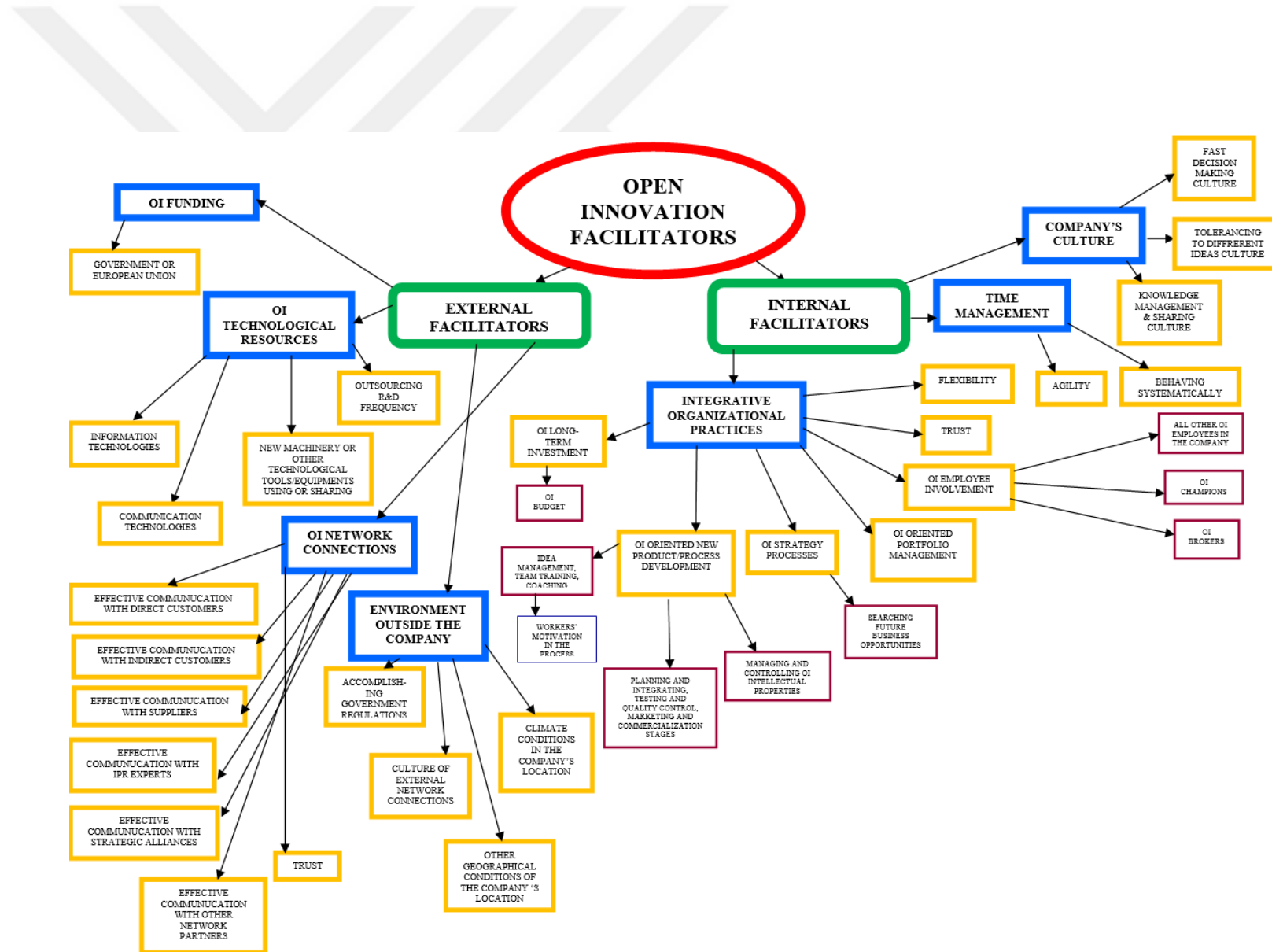


Figure 4.1 Open innovation facilitators

4.1 External Facilitators of Open Innovation

In literature OI facilitators are generally analyzed without grouping. However, in this study they are analysed in two groups. External facilitators of OI refer to the factors, which effect OI externally, outside from the company. In Figure 4.2, they are mentioned in four main headings under the title of External Facilitators. These are *environment outside the company*, *OI funding*, *OI technological resources* and *OI network connections*. All of these main headings have subheadings.

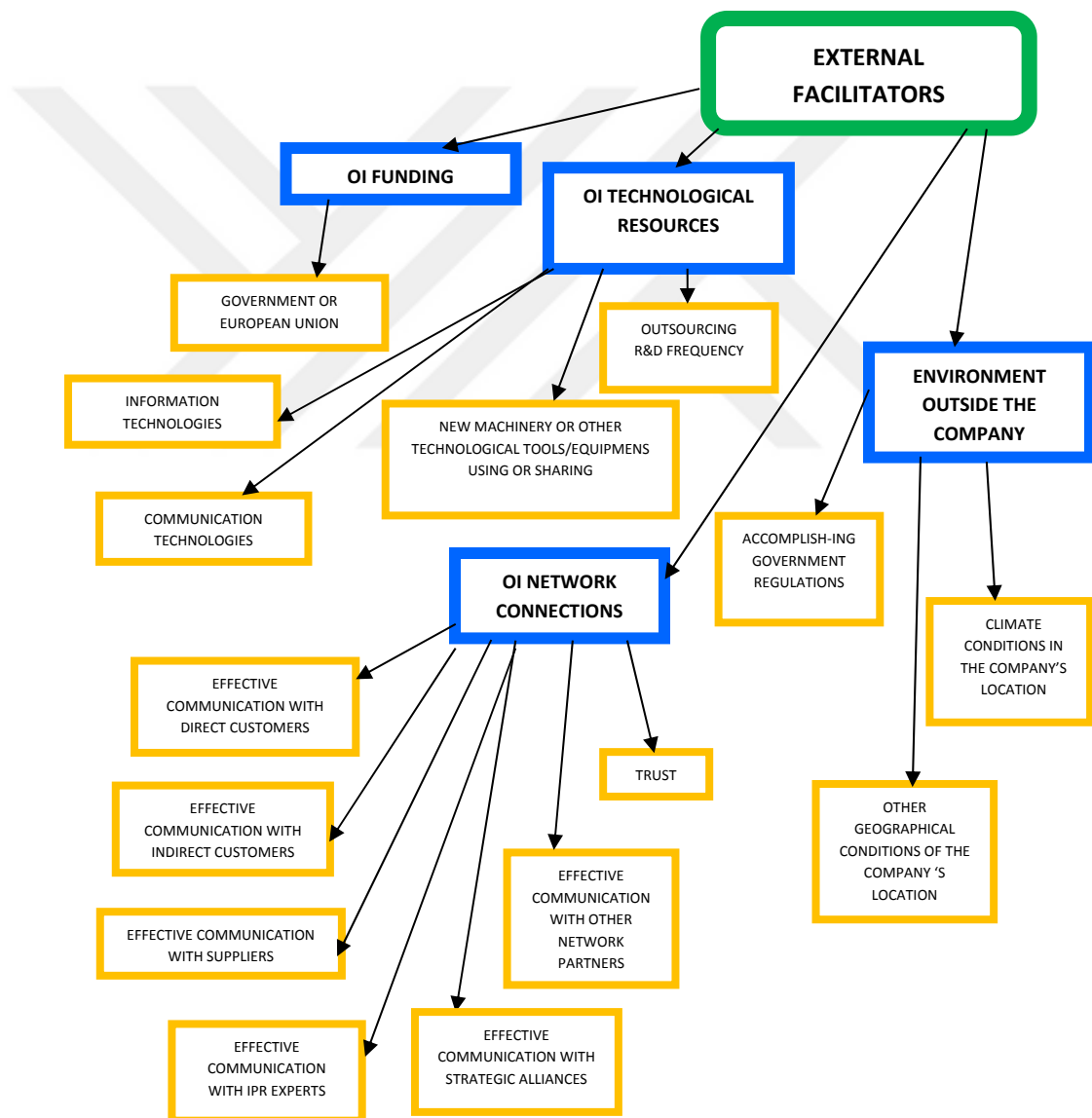


Figure 4.2 External facilitators of OI

All of these headings and subheadings are constituted by directly referring to the literature or by interpreting and adapting.

4.1.1 OI Funding

Before explaining *OI Funding* it is appropriate to start with the definition of *funding*. *Funding* means providing financial resources for a specific action. This specific action can be a project, a program or other kind of work. *OI Funding* means ensuring required financial resources for OI projects or activities. Piller & Wielens (2013) mention their study about the OI funding that a reserved budget for every OI project is required. Besides, it is one of the main facilitators of the OI mechanisms. In our country main funds are provided by the **government**. Also, few companies have a chance to attain **European Union** support.

4.1.2 OI Technological Resources

OI Technological Resources are tools or systems to produce OI product/process. Considering the literature for these main facilitators, *OI technological resources* are mentioned by Piller & Wielens (2013). They explain the importance of technological resources and their allocation. They asked the companies if they want to perform OI activities in house by buying new resources or **outsourcing R&D**. (in Figure 4.1. it is shown as subheading “outsourcing R&D frequency”) They imply that **outsourcing R&D** in OI actions provide benefits in some cases. **Outsourcing R&D frequency** is the accomplishment quantity of **R&D outsourcing**. This can be changed by every company’s sector or field of activity as well as company’s product or process diversity. Same authors also mention **crowdsourcing** with compared to **outsourcing**. In **crowdsourcing** obviously, there is an action of outsourcing but it includes more people called crowd. Piller & Wielens (2013) exactly state that “Crowd sourcing was the underlying mechanism that enables formal and informal relationships, defined as the act of taking a task and outsourcing it to a large, undefined network of potential contributors in form of an open call” (p. 1). In some OI strategies and actions, **crowdsourcing** also used as an OI strategy and methodology.

Huizingh (2011) argues that **information technologies** and **communication technologies** can be “new decision-making tools” which aid for managers in making decisions with defining or determining decision factors in less known areas. These are the integrated enterprise software programs. Besides, Dodgson et al. (2006) mention of **information technologies** and **communication technologies** under *OI technological resources*. These technologies help companies to improve the ability of their work across different geographic and organizational boundaries. They are inexpensive and provide rapid and secure inflow and outflow information transfer for OI.

The other facilitator under OI technological resources is **new machinery or other technological tools/equipment using or sharing** in external OI network connections. Aslesen & Onsager (2009) claim that OI applying companies should entail its partners’ external knowledge relations and dependencies with available knowledge resources. Additionally, they assert much of this external knowledge comes from people and **new machinery or other technological tools/equipment using or sharing**.

4.1.3 IO Network Connections

OI Network Connections are defined in the paper of Jarvenpaa & Wernick (2012). They say that *OI Network Connections* are all of the network members that directly or indirectly affect OI activities. These are suppliers, customers, rival companies, research units of universities, and other institutions. Aim of these members is to improve innovations in technology, products, and services that can be further commercialized.

Brunswick and Vanhaverbeke (2015) indicate that **effective communication with direct customers, indirect customers, suppliers, IPR experts** and **other network partners** facilitate OI by playing an important role in knowledge transfer and phases of OI. Besides, these facilitators provide new insights into new business opportunities related with the open innovation projects. Chesbrough et al. (2014) also point out the

importance of **effective communication with strategic alliances** for *OI network connections*.

The same subject is also discussed by Huizingh (2011) and Aslesen & Onsager (2009). Huizingh (2011) calls *OI network connections* as “outside players”, which are suppliers, customers, competitors, research institutions and any other organizations in different industries to facilitate OI activities. These players can either have opinions to develop company’s OI actions or disseminate the solutions from OI results. He also claims that these actions firstly need “collaboration”. Other OI network partners are “universities” according to Bogers and West (2014). They clearly imply that aggregation efforts between companies and universities have many benefits and new technologies can be gained externally. Universities can be accepted as **other network partners**. Therefore, **effective communication with other network partners** can be accepted as a facilitator for OI.

Effective communication with other network partners are also explained and valued as a facilitator for OI in El-Ella’s (2014) doctoral thesis. These can be temporary workers that the company is once or twice in a relationship with depending on the OI project. El-Ella (2014) claims that **other network partners** can be temporary agency workers, direct-hires, on-call workers, independent contractors, self-employed workers, consultants or freelancers.

Another external facilitator given in Figure 4.1 is **trust**. **Trust** is a significant facilitator between any external network member and company or between external network members. That’s why, it is evaluated and placed under the heading of *OI Network Connections*. Simard and West (2005) and El-Ella (2014) refer to this subject, **trust**, when a company desires to give value and strength to their OI mechanisms and members.

4.1.4 Environment Outside the Company

Environment outside the company is defined by Riley (2015) as the surrounding that effect and influence the company and its activities. The content of this environment can both include opportunities and risks. Piller & Wielens (2013) also indicate the *Environment Outside the Company* is important for OI. This environment implies **accomplishing government regulations, climate conditions in the company's location and other geographical conditions of the company's location.**

Accomplishing government regulations is mainly about law for OI. Huhtilainen, Lee, & Nysten-Haarala (2010) explain *law for OI* contains the legal rules and obligations for all OI operations and activities in every process. Huhtilainen et al. (2010) give examples for this subject as “*OI intellectual property law*”, “*OI contracts*” and “*OI general policy over information exchanges*”. They express that for OI “IP rights and law not only provide incentives for innovation, and protect them as property, but also coordinate the modalities of their exchanges” (p. 7).

Taking the conditions in Turkey, consulting to department of revenue management “Ar-Ge Kanunu” (R&D Law) is constituted for all types of innovation (including OI) in 2008 (5746 sayılı araştırma, geliştirme ve tasarım faaliyetlerinin desteklenmesi hakkında kanun genel tebliği (Seri No: 4-5-6) yayımlandı, n.d.). By the aid of this law there are incentives for companies using all types of innovations. These incentives are:

1. Companies, except from government agencies or institutions, have income tax discount according to their employees working in R&D, research or innovation department; for doctoral degree 95% , for graduate and undergraduate degree 90% and for others 80%. Overtime work period wages, wages in holidays or paid annual leave situations are excluded in this law.
2. Income tax or corporation tax incentives are accomplished according to the half of the expenditures for innovations, research or R&D activities of the companies (except from government agencies or institutions).

3. For innovation and R&D activities, venture capital incentives exist for companies. According to the business law numbered 5764 with no assurance until 100.000 TL, government can give incentives if the companies satisfy the conditions in (e) of the paragraph one in the second article of the Turkish law.
4. There is also stamp tax exemption for companies of the private sector if they submit required documents from who they collaborate with TEKMER management, TÜBİTAK or other government institutons or agencies.

Besides, this *Ar-Ge Kanunu* is mentioned as 5746 coded law and 6676 coded law of 28th title in Turkey (Araştırma, geliştirme ve tasarım faaliyetlerinin desteklenmesi hakkında kanun, n.d.). Price Water House Coopers, PWC as worldwide consulting, assurance service and tax planning company's Turkey branch says that 5746 also have more incentives (Price Water House Coopers, 2015). These are:

1. Companies which have required number of R&D employees equal to or more than specified in law 5746, are entitled to R&D discount in governmental tax base. This is achieved by government if company opens another R&D center inside its area.
2. Before business competition, companies' all R&D expenditures from business collaboration projects are going to be erased from governmental tax base.

4.2 Internal Facilitators of Open Innovation

Internal facilitators refer to the OI facilitators inside the company. It is denoted in Figure 4.3 below. These are integrative organizational practices, time management and company's culture (see Figure 4.3).

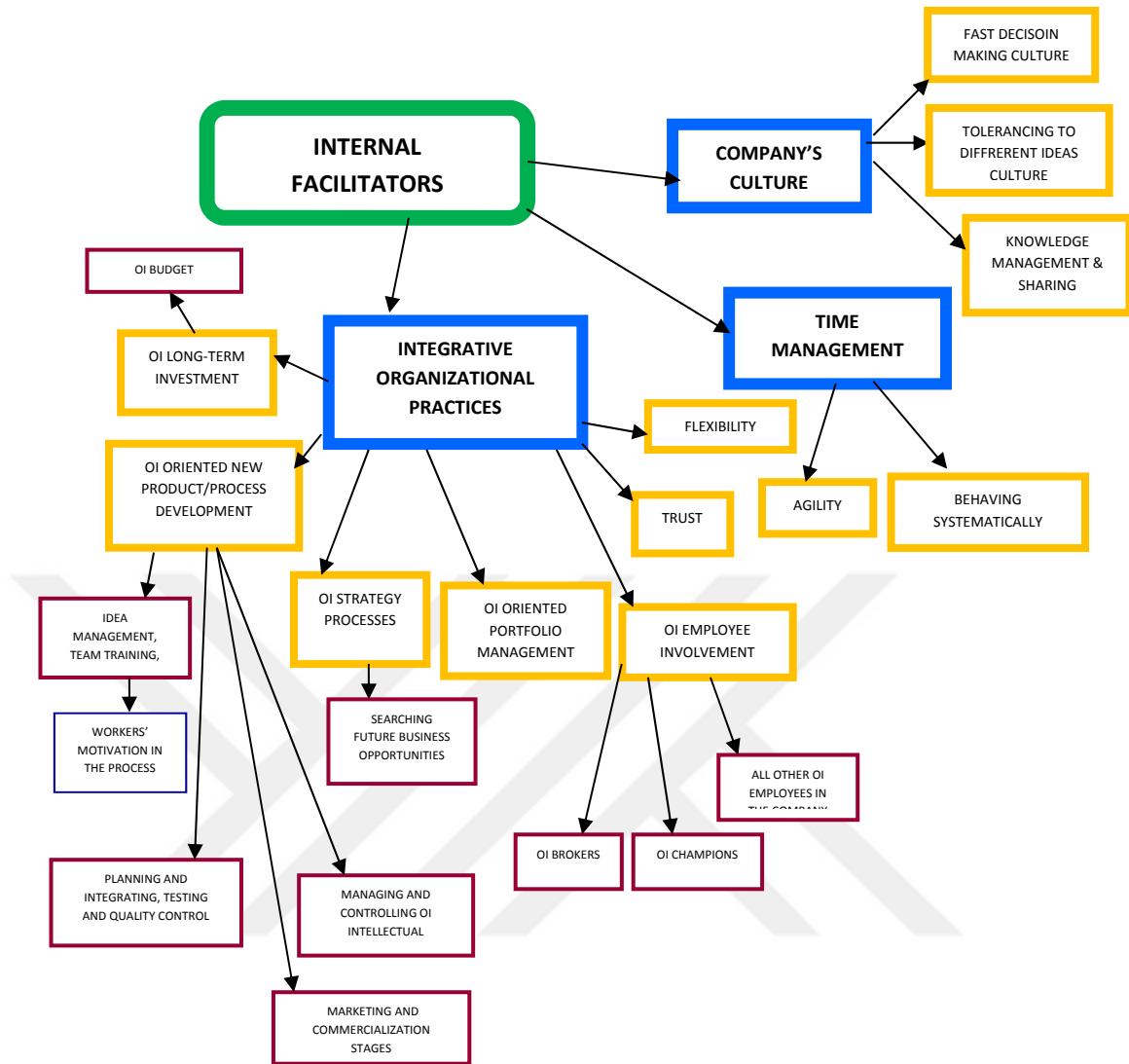


Figure 4.3 Internal facilitators of OI

4.2.1 Integrative Organizational Practices

Integrative Organizational Practices as described in the paper of Brunswicker & Vanhaverbeke (2015), are both strategic and operational components that help to reach organizational purposes and targets. These practices provide companies effective and efficient ways in administering their plans and operations. *Integrative Organizational Practices* are divided into seven groups as indicated in Figure 4.3 above. These are *OI long-term investment*, *OI oriented new product/process development*, *OI strategy processes*, *OI oriented portfolio management*, *OI employee involvement*, *trust* and *flexibility*.

4.2.1.1 *OI Long-Term Investment*

OI long-term investment is defined by Brunswicker & Vanhaverbeke (2015) as all the expenditures related to OI. With the aim of is to building long-term knowledge rather than yielding short-term results. *OI long-term investment* is a significant organizational facilitator for both building and controlling internal knowledge and sourcing external knowledge.

OI Budget is a subheading of *OI long-term investment* referring to the total financial saved or reserved money (from income) for OI investments and expenditures. Brunswicker and Vanhaverbeke (2015) claim financial innovation assets are crucial for every company because they permit the company to experiment and engage in riskier OI projects. For building the phases of OI, *OI long-term investment* and adequate **OI budget** is very significant.

Here, in this thesis it is accepted that **OI budget** is sufficient and appropriate for OI project. Therefore, it is a facilitator. Otherwise, if the **OI budget** is less than the required amount for OI project, it causes many problems and the OI project can be interrupted. Hence, **OI budget** is not considered to be written under the heading of “Factors That Facilitate and Prevent OI Mechanisms”.

4.2.1.2 *OI Oriented New Product/Process Development*

New product/process development means either improving existing product, process or service, or developing a new product, process or service mechanisms for targeting a particular market segment or segments. In literature, *new product development* and *new service development* process is described with a number of stages (Akrani, 2012).

Main NPD (new product development) stages are:

1. **Idea Generation** (named as ***idea management, team training, coaching*** in Figure 4.1): This first stage contains important brainstorming, interviewing,

SWOT analysis, R&D, study of marketing and consumer trends (starts with considering, deep thinking of what to innovate).

2. **Idea Screening** (named as *planning and integrating* in Figure 4.1): This second stage is planning, evaluating and filtering phase. A huge bundle of ideas is separated into feasible, sustainable and scalable ones.
3. **Concept Development & Testing** (named as *testing and quality control in Figure 4.1*): In third stage, all product features are tested according to some quality criteria.
4. **Business analysis** (named as *marketing and commercialization stages* in Figure 4.1): In fourth stage, the company tend to decide on product selling price, selling volume, profitability and break-even point.
5. **Product development** (named as *planning and integrating* in Figure 4.1): Through this stage the company achieves resource estimation, scheduling and leveling, engineering operations planning, supplier collaboration, logistics planning, program reviewing and monitoring etc.
6. **Test Marketing** (named as *marketing and commercialization stages* in Figure 4.1): The development and evolution of product prototype is seen in this stage. Company also considers the market side of this new prototype dealing with both customer's and the developer's (R&D employees) requirements.
7. **Commercialization** (named as *marketing and commercialization stages* in Figure 4.1): This includes the formal launch of the product, product's promotion and advertising.
8. **Review of market performance** (named as *marketing and commercialization stages* and *managing and controlling OI intellectual properties* in Figure 4.1): This is the last stage, indicating sustained actions completing NPD. This stage include customer satisfaction pursuing and customer satisfaction controlling, managing new product's intellectual properties, analysing and continuously searching the competitors and market environment, continuously controlling the sales and profit volume and ensuring sustained relationship between the company employees who play significant roles in NPD processes.

First facilitator under integrative organizational practices as *OI oriented new product/process development* is mentioned in the paper of Bogers and West (2014). The facilitator, which is named as **idea management, team training, coaching**, is adverted as “obtaining innovations from external sources”, directly covering “inbound OI”. This is significant and starting point for OI oriented new product, process or service development projects. Under this facilitator **workers’ motivation in the process** is considered to be important. In Gallagher and West (2006)’s paper **workers’ motivation in the process** is referred as one of the three main challenges in executing of OI activities. Barczak and Durmuşoğlu (2011) consider and explain in their paper the stages of OI oriented *new product/process development*. They group phases into three headings; these are discovery, development and commercialization, which are different from the standard NPD stages. “**Planning and integrating**” is performed during development. **Planning** is an analysing and execution part of OI NPD. After collecting ideas in the first action of idea management, team training and coaching, the next stage is to sort and analyse these ideas according to the company’s aim. These are all **planning** stage. After planning phase, the **integration** stage begins according to Barczak and Durmuşoğlu (2011) Different knowledge areas are added according to the aim of OI in integration phase. **Planning and integrating** activities are done to provide a good flow of OI operations.

“**Testing and quality control**” phase is also included in development group according to the authors. **Testing and quality control** named as “examination”. This is the last phase before commercialization aim to test and control the result of the new OI. The OI product/process/service must ensure the expected standards with its quality. “**Marketing and commercialization**” is in last group commercialization in authors’ determination. During commercialization, production acceleration, training of the distribution and sales forces, analysing market, taking required actions in market, purchasing of media time/space and development of media messages are also carried out. All of these phases are facilitators and crucial actions for OI according to Brunswicker & Vanhaverbeke (2015). In this thesis work (in Figures 4.1, 4.3 and 4.4) it is considered to analyse these facilitators together in two parts named **planning and**

integration, testing and quality control stages and **marketing and commercialization stages**.

One more facilitator, related to *OI oriented new product/process development* is **“managing and controlling OI intellectual properties”**. Pham-Gia (2011) explains that “The managing of OI requires different management techniques from implementation of a suitable incentive system to the set-up of Intellectual Properties (IP) and management supporting tools” (p. 102). He claims **managing and controlling OI intellectual properties** is a facilitator for OI. Furthermore, Friesike (2011) says that “IP system is supposed to foster innovations” (p. 8) and affirms that IP, as intellectual property, encourages and improves all types of innovations, including OI. Agerfalk Agerfalk, Edenius, Hrastinski, Lundström & Wiberg (2013) point out this subject in different view. Managing and controlling IP is in the way by buying IP to profit from other rivals or selling IP to increase market share and competition power. This is a principal for OI operations according to the authors.

4.2.1.3 OI Strategy Processes

OI Strategy Processes are the actions for searching future business opportunities, exploration of new technologies, sustained analysis of market condition in every time. (Brunswicker & Vanhaverbeke, 2015) According to Jaruzelski & Holman (2011) there are three basic R&D strategies for all types of innovations (including OI). These are:

- ❖ A need seeker strategy: This strategy deals with both current and potential customers according to their requirements, desires, and considerations to make the company the first to market with those new OI offerings.
- ❖ A technology driver strategy: This strategy is about companies’ technological capabilities. These can be company’s R&D success power, solving customers unarticulated needs by offering OI solutions by using new technology. Companies using this strategy are interested in constituting a detailed technology road map.

- ❖ A market reader strategy: This strategy embrace continuous search on market trends before investing and commercializing new OI. Company should be a fast follower through incremental change and variation in market.

On the other hand, Birol (2014) argues that there are four types of innovation strategies (including OI). These are:

- Attacking innovation strategy: In this innovation strategy company aims to be a leader and pioneer in the market compared to the other competitors. Company determines a high portion of investment for R&D and OI expenditures. It is more risky, additionally, has more return or profit compared to other three innovation strategies.
- Defensive innovation strategy: As it can be perceived by its name, rather to be a pioneer in the market, here company decides to search and pursue the OI novelties. This is less risky situation compared to attacking innovation strategy. However, this strategy brings less return or profit.
- Imitator innovation strategy: In this strategy the company does not desire to accomplish OI on its own. Rather, the company determines to search, follow and apply the novelties or innovations in the OI market from a distance by making contracts of OI performing companies. This is a kind of imitation with declaration between each company (user and supplier). This strategy has less expense and less risk. However, this strategy brings less return or profit.
- Dependent innovation strategy: This strategy constitutes a dependence on main or leader OI company. Company realize and accomplish the requests from the leader OI company. Besides, this company cannot make any OI decision on its own.

Under the third heading as “*OI Strategy Processes*” (under “integrative organizational practices”) “***searching future business opportunities***” is a facilitator for OI according to Brunswicker & Vanhaverbeke (2015). For developing OI strategy, identifying future business opportunities and embodying them into internal mission and capabilities is so essential.

4.2.1.4 OI Oriented Portfolio Management

Before explaining *OI oriented portfolio management* it is better to define *portfolio*. A balanced *portfolio* contains the priorities, budget, resources and objectives which are required for OI. Considering *Portfolio Management*, it is the art and science of achieving decisions about investment mix and policy, resources, objectives, matching investments to objectives, asset allocation for individuals and institutions, and balancing risk against performance (Portfolio management, n.d.). McFarthing and Ohr (2013) state that *OI oriented portfolio management* is the actions to translate strategic objectives and priorities into project-based OI innovation activities. “*OI oriented portfolio management*” under the “integrative organizational practices”, is a facilitator and useful action for OI. (Piller & Wielens, 2013) Effective portfolio management is vital and significant for all types of innovation. In this thesis it is considered under internal OI facilitators. Cooper, Edgett, & Kleinschmidt (1999) focus on innovation portfolio management as a tool and group the impact and role of OI portfolio management tool into four. These are:

- ❖ **Making strategic choices**

This choice is generally related with market, products, processes, services and technologies, so that the company invests on it.

- ❖ **Resource allocation**

This choice is about how company invests on engineering, R&D and market share.

- ❖ **Project selection**

This choice depends on which project company choose from various alternatives.

- ❖ **Balance**

This choice provides balance between OI project that the company achieve, resources and capabilities that the company have and the necessities of OI actions.

McFarthing and Ohr (2013) divide portfolio management into two groups. One is called strategic portfolio management and the other is called operational portfolio management. Strategic portfolio management means through their considerations achieving the right OI projects. The other, operational portfolio management means how to successfully accomplish the selected OI projects. Here, by two portfolio management achievements strategy and execution part of OI projects are integrated.

4.2.1.5 OI Employee Involvement

OI employee involvement means consulting, adding, combining ideas and opinions of all employees of the company. El-Ella (2014), assert that *OI Employee Involvement* nurtures the internal side of OI. She adds *OI Employee Involvement* can be achieved in many ways. These can be done by:

- taking up employees' suggestions,
- fostering employees to take initiatives beyond organizational boundaries,
- introducing suggestion schemes such as idea suggestion boxes,
- achieving idea competitions.

Moreover, El-Ella (2014) explains *OI Employee Involvement* ensures corporate OI processes. It is one of the main contributors for business success. In this thesis, *OI Employee Involvement* is divided into three subheading facilitators for OI. These are ***OI brokers***, ***OI champions*** and ***all other OI employees in the company***.

OI brokers are the people whose aim is to accelerate OI activities. According to Tidd (2014), ***OI brokers*** are intermediaries for the OI process. ***OI brokers*** mediate between OI seekers and providers. The author also claims that ***OI brokers*** have some common characteristics. They can perceive basic and applied science. They have a high marketing expertise; understanding of OI innovations which are useful, ability to link problems and solutions of different industrial sectors. Additionally, they can analyse OI network partners and enable matching multiple OI network partners according to their complementariness. Sousa (2011) explains that "OI brokers, also called as knowledge brokers, can act as intelligent change agents that stimulate

difference and increase the number of external exchanges but in a focused way, stimulating innovation while creating momentum for action” (p. 19). He also states **OI brokers** facilitate OI by enabling public-scientific, industry-specific, and firm-specific knowledge exchange between knowledge providers and knowledge receivers.

OI champions are people, who support, strengthen, encourage and drive OI activities (Morris, 2013). Aarts & Klerkx (2013) state that, **OI champions** are “Individuals who informally emerge in an organization and make a decisive contribution to the innovation by actively and enthusiastically promoting its progress through the critical stages” (p. 193). This definition is viable for all innovation types certainly for OI too. Morris (2013) says **OI champions** may work in different OI areas in the company. These are senior management positions, line management roles or front line operations roles. They ensure a bridge role between OI leaders and bottom level OI staff. Moreover, other author Whelan (1989) claims **champions** (for all innovation types) achieve successful exploitation process within innovations. He argues that **champions** (for all innovation types) can take role in top management or day by day running of the recent innovation project. Therefore, as a result, **OI champions** can be accepted as OI facilitators.

According to the literature mentioned above, one can easily consider **OI brokers** and **OI champions**’ missions being same in OI. Nevertheless, in reality, it is not true. According to the authors Gildemacher and Klerkx (2012), **OI champions** have the role in daily OI project management task, while, **OI brokers** have the role as process monitoring, conflict mitigation of the OI project. **OI brokers** have more significant accountability. The vision, objectives and project progress of OI actions, planning and controlling of OI partners are the responsibilities of **OI brokers**.

El-Ella (2014) asserts that **all other OI employees in the company** are significant and facilitators for OI such as R&D workers, production area staff, finance department employees or all other workers within the company.

4.2.1.6 Trust

The word **trust**, is seen in many science field; such as social, politics, economy, engineering, technology etc. **Trust** is the belief for the reliability (Trust, n.d.). This reliability can be confidence or faith in a person or thing, or in characteristics of a person or thing. Meaning of **trust** may differ in various science fields. In OI it is used in relationships between OI network members. Hosmer (1995) implies **trust** as “The reliance by one person, group, or firm upon a voluntarily accepted duty on the part of another person, group, or firm to recognize and protect the rights and interests of all others engaged in a joint endeavor or economic exchange” (p. 393).

As it is mentioned above in both external and internal facilitators of OI, **trust** plays significant role. In the relationship inside the company itself and between its direct customers, indirect customers, suppliers, IPR experts, strategic alliances and other network partners as accepted external facilitators, trust is significant. Also, it is accepted as internal facilitator of integrative organizational practices in the relationship of company's inside employees.

Brunswick & Vanhaverbeke (2015) mention **trust** in the interaction with network partners as both external facilitator and internal facilitator. They claim **trust** constitute joint value creation in the relationship of the OI network partners. Besides, El-Ella (2014) argues that **trust** is a facilitator for OI activities and accepted to be in *integrative organizational practices*. **Trust** should be built up to fit the growing open innovation environment.

4.2.1.7 Flexibility

In general **flexibility** has several meanings (Flexibility, n.d.). These are

- The quality of bending easily without breaking
- The ability to be easily modified
- Willingness to change or compromise

According to the OI point of view in the literature, Terzieva (2012) searches and analyzes flexibility in the OI process based on Real Option Theory. She explains that **flexibility** allow the company the possibility to adapt and alter through the new knowledge and technology within new or existing OI investments/operations. She claims to counteract and struggle for market and technology uncertainty in OI actions, companies are required to establish **flexibility** in OI operations. She also adds, **flexibility** should be used to achieve the connection and justify real option valuation of OI engagements. Terzieva (2012) divides **flexibility** in OI processes into 5 types. These are mentioned below.

1. **Operational flexibility:** This type of **flexibility** is seen in OI projects. By the aid of **operational flexibility** project managers can quit, invest, switch (shift from one to another project), contract or delay project when required.
2. **Strategic flexibility:** This type is seen in OI investments. These investments can be series of interdependent or dependent investments.
3. **Reactive flexibility:** After change or development in the OI business environment, this type of **flexibility** ensures company to adapt and respond new conditions.
4. **Proactive flexibility:** The type of this **flexibility** allows the option holder to increase the value or diversity of an option once acquired.
5. **Compound flexibility option:** The last **flexibility** type allows the company to combine at least two requested OI operational options. What and how many options to combine depend on the authorized company's managers. About this type Terzieva (2012) mentions "In reality, most OI investment decisions are represented by **compound options** due to the several correlated sources of uncertainty involved in associated projects" (p. 28).

Moreover, Lee, Park, G., Park, J., & Yoon (2010) states that **flexibility** is an advantage in accelerating all types of innovation. (including OI also) **Flexibility** is considered in *integrative organizational practices*.

4.2.2 Time Management

Time management is significant not only for open innovation also other areas of business life. Considering its definition, “*Time management* refers to the way that you organize and plan how long you spend on specific activities.” (What is time management?, 2016, p. 1) Another definition is made by Claessens, Eerde, Roe, & Rutte (2005) that *time management* refers to administering actions according to their duration; combining starting and ending points.

Ahonen, Antikainen, & Mäkipää (2010) in their study exploring collaboration in OI communities, focus on the following two research problems: how can users be motivated to collaborate in OI communities and what kind of tools and methods can promote collaboration in OI communities? They conduct multiple case studies in different countries, one in France, one in Netherlands and the other one from Finland. As a result of their studies they claim that, *time management* is a significant facilitator for OI and a beneficial motivation factor to collaborate in OI community. Mentioning in more detail, *time management* is a tool and method for collaboration in the case of: sense of cooperation and sense of community and similarity and sense of efficacy.

4.2.2.1 Agility

Agility is considered under *time management* in this thesis (Figure 4.1). As Conboy, Morgan, & Power (2010) found in their study “**agile** and lean principles and practices create the right environment for open innovation to thrive” (p. 1). Therefore, it can be considered as a facilitator under *time management*.

In this thesis, it is accepted that *time management* is executed completely and perfectly. Problems in time management are not considered because managing with **agile** principles do not have prevention effects. Therefore, this facilitator does not mention in the heading of “Factors That Facilitate and Prevent OI Mechanisms”.

4.2.2.2 *Behaving Systematically*

Behaving systematically is considered under *time management* in Figure 4.1. ***Behaving systematically*** means to accomplish actions or activities according to a fixed plan or system. It also means to be methodical. Chesbrough, Jong, Kalvet & Vanhaverbeke (2008) mention ***behaving systematically*** as a facilitator for OI under a different heading. Moreover, Lichtenthaler (2011) indicates that ***behaving systematically*** for OI is very significant to complete basic actions of OI; especially in performing knowledge exploration, retention, exploitation or sharing inflow and outflow of an organization's boundaries. It is also essential for OI in accomplishing OI actions on time.

4.2.3 *Company's Culture*

Considering primarily of a word *culture*, it is better to first explain its meaning.

“*Culture* refers to the cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving” (Culture, n.d., p. 1).

These behaviors and beliefs are also effective in OI actions. In this thesis, *company's culture* is analysed in three groups: ***knowledge management & sharing culture***, ***tolerancing to different ideas culture*** and ***fast decision making culture***.

4.2.3.1 *Knowledge Management & Sharing Culture*

“***Knowledge management & sharing culture***” plays an important role to facilitate OI activities. Chesbrough, Enkel, & Gassmann, 2010 expressed that “Creating a culture that values outside competence and know-how is crucial for open innovation practice” (p. 214).

4.2.3.2 Tolerancing to Different Ideas Culture

Tolerance is “a fair, objective, and permissive attitude toward those whose opinions, beliefs, practices, racial or ethnic origins, etc., differ from one's own” (Tolerance, n.d., p. 1). *Tolerancing to different ideas* is an objective and respective attitude for various opinions according to different situations. In OI this behaviour is important for all OI actions since OI's based on collaboration. In this thesis, all of the attitudes, actions and reactions in *tolerancing to different ideas* are referred as ***tolerancing to different ideas culture*** as a facilitator for OI.

4.2.3.3 Fast Decision Making Culture

First of all, considering the term *decision making*, it can be considered a thought process of selecting a logical choice(s) from the different available options. (Decision making, n.d.) *Fast decision making* is the accomplishment of *decision making* action or actions quickly as possible. Observing the arguments of Tasler (2013) there are some ways to achieve ***fast decision making***. These are “knowing the ultimate strategic objective”, “thinking rationally about how your options align the ultimate objective” and “doing something with these knowledge and those thoughts”.

Fast decision making culture encompasses all of the consciousness and attitude while achieving *fast decision making*. In Figure 4.1 ***fast decision making culture*** is defined as a facilitator for OI. Considering the literature, ***fast decision making culture*** is mentioned by Sloane's (2011) as being important and essential in relationships between its OI partners. This is an internal facilitator, borned inside the company, however it affects all OI partners (both internal and external OI workers/partners of the company).

4.3 Factors That Facilitate and Prevent OI Mechanisms

Some of the identified factors have both positive and negative effects on OI. These can be either external factors or internal factors. In this thesis, the research takes into

account the positive effects of the factors as facilitators (not regarding negative effects of the factors). However, in this section factors that both facilitate and prevent OI mechanisms are acknowledged (Figure 4.4). Considering Figure 4.4 all of the factors that both impede and facilitate OI are indicated dashed frame and filled with grey color. Other factors are indicated with straight lines and not filled with any color.

4.3.1 OI Technological Resources Impediment for OI

Considering external facilitators as *OI technological resources* the subheading facilitator as **information technologies**, the new or improved system can also have obstacles besides the benefits. The obstacles can be in setup phase, adapting phase of information systems for OI. Every OI project obviously can be different from one to another. Clearly, the company can need large changes in the information system. Conversely, this factor is also a facilitator as mentioned above. Also there are risks in other subheading facilitators as **new machinery or other technological tools/equipment using or sharing** in external OI network connections and **outsourcing R&D frequency**. In **new machinery or other technological tools/equipment using or sharing** troubles can also occur in setup phase, adapting phase or machines/tools/equipment can get out of order with incorrect use.

Outsourcing R&D frequency can also be risky if the responsible for outsourcing R&D has less knowledge and experience to choose the right external R&D for OI collaboration or cooperation.

4.3.2 OI Network Connections Impediment For OI

One of the external facilitators of OI, *OI network connections* can both facilitate or prevent OI actions. Its facilitator side has already mentioned above. However, as obstructive side a distorted or disordered relationship between *OI network connections* as **direct customers, indirect customers, suppliers, IPR experts, strategic alliances** and **other network partners** can unfortunately disrupt all OI actions.

The disordered relationship can create problems in knowledge sharing between *OI network connections* and the company. Besides, impudent or unclear relationships also affect OI actions negatively. Şimşek and Yıldırım (2015) states this subject with lack of technological knowledge and lack of competent employee arising from external OI partners as *OI network connections*. Biddle (2011) claims that with the external *OI network connections*, as an example **IPR experts**, a negotiation difficulty may occur. As indicated above there are mainly two types of OI, outbound and inbound. Difficulty appears in both buying IP and innovation and selling IP and innovation. The company's reputation, prestige and size have effect on OI negotiations with external **IPR experts**. A company is in a trouble when its size is small, has less reputation compared to its competitors in buying or selling IP.

4.3.3 Environment Outside the Company Impediment for OI

Accomplishing government regulations, other geographical conditions of company's location and climate conditions in the company's location can also have either facilitator or preventer effect. For every country, for every region, for every city or district or village **accomplishing government regulations, geographical conditions and climate conditions in the company's location** are different. In Turkey cities as Afyonkarahisar, Iğdır, Osmaniye, Gaziantep, Bitlis and Siirt as districts Keşan, İnegöl, Esenyurt (in Istanbul) have high polluted air. Whereas, Eskişehir as a city, has the most fresh and clean air in Turkey according to the data of Environment and Urban Ministry (Türkiye'nin havası en kirli ve en temiz şehri belli oldu, 2015). Thus, company's location can affect workers performance. Workers performance is related with OI mechanisms and operations.

4.3.4 Integrative Organizational Practices Impediment for OI

There are some subheadings of *integrative organizational practices* that can be both facilitator, as well as impediment for all OI actions. These are *OI oriented new product/process development* (all of their subheadings included), *OI Strategy Processes* and *OI Employee Involvement* (all of their subheadings included).

4.3.4.1 *OI Oriented New Product/Process Development Impediment for OI*

The factor of *OI oriented new product/process development* has both facilitator or preventer effect. Its impediment effect is explained by Şimşek and Yıldırım (2015) in their survey with Turkey's information communication technology developer companies. According to their findings, problems in knowledge sharing, lack of technological knowledge and lack of competent employees are obstacles and preventing cases for ***idea management, team training, coaching, planning and integrating, testing and quality control stages, marketing and commercialization stages and managing and controlling OI intellectual properties*** in OI.

Moreover, Şimşek and Yıldırım (2015) highlight administrative obstacles related to ***idea management, team training***. Less or insufficient management support, administrative burdens or conflicting rules negatively affect OI. These wrong management behaviours also affect ***workers' motivation in the process***.

On the other hand, ***marketing and commercialization stages***, can be barrier for OI. The barrier effect of marketing can be seen with insufficient market intelligence, difficulties in market affinity and marketing problems with new products/processes/services (Şimşek and Yıldırım, 2015).

4.3.4.2 *OI Strategy Processes Impediment for OI*

Considering internal facilitators as *OI Strategy Processes* for ***searching future business opportunities***, there are also impediments and problems. Davis (2015) states that defining OI strategy is hard work. It is one of the roadblocks of OI. Unclear and unobserved subjects in the OI strategy cause many problems. Moreover, Asakawa and Pontiskoski (2009) also argue about the impediment effect of *OI Strategy Processes*. They handle *OI Strategy Processes* in cognitive level (as they divide OI barriers into 3 parts; cognitive, behavioral and institutional); using wrong strategy causes many barriers in OI. Obviously, *OI Strategy Processes* have also facilitator sides mentioned above.

4.3.4.3 *OI Employee Involvement Impediment for OI*

Under the *Integrative organizational practices*, *OI employee involvement* both have facilitator and preventer side. Şimşek and Yıldırım (2015) underline the preventer side of *OI employee involvement*. According to their findings company's internal employees who has lack of knowledge and lack of labor flexibility causes many troubles in OI activities. In their survey with Turkish ICT companies in technology development zones 40% of the participating companies confirmed this impediment effect for *OI employee involvement*. Obviously, as mentioned earlier *OI employee involvement* embraces ***OI brokers, OI champions and all other OI employees in the company.***

4.3.5 *Company's Culture Impediment for OI*

If *company's culture* supports and improves OI actions, it can be accepted as a facilitator. Otherwise, *company's culture* can also impede OI actions. As Şimşek and Yıldırım (2015) emphasize *company's culture* can be a barrier to OI if there are problems in balancing innovation and daily tasks, communication problems, aligning partners and organization of OI. Salmi, Savitskaya & Torkkeli (2010) also specify that as a part of organizational culture, cultural differences, management power distance, uncertainty avoidance level, masculinity or femininity and long or short term orientation can create difficulties in accomplishing OI actions. This is also valid for ***knowledge management & sharing culture, tolerancing to different ideas culture and fast decision making culture.***

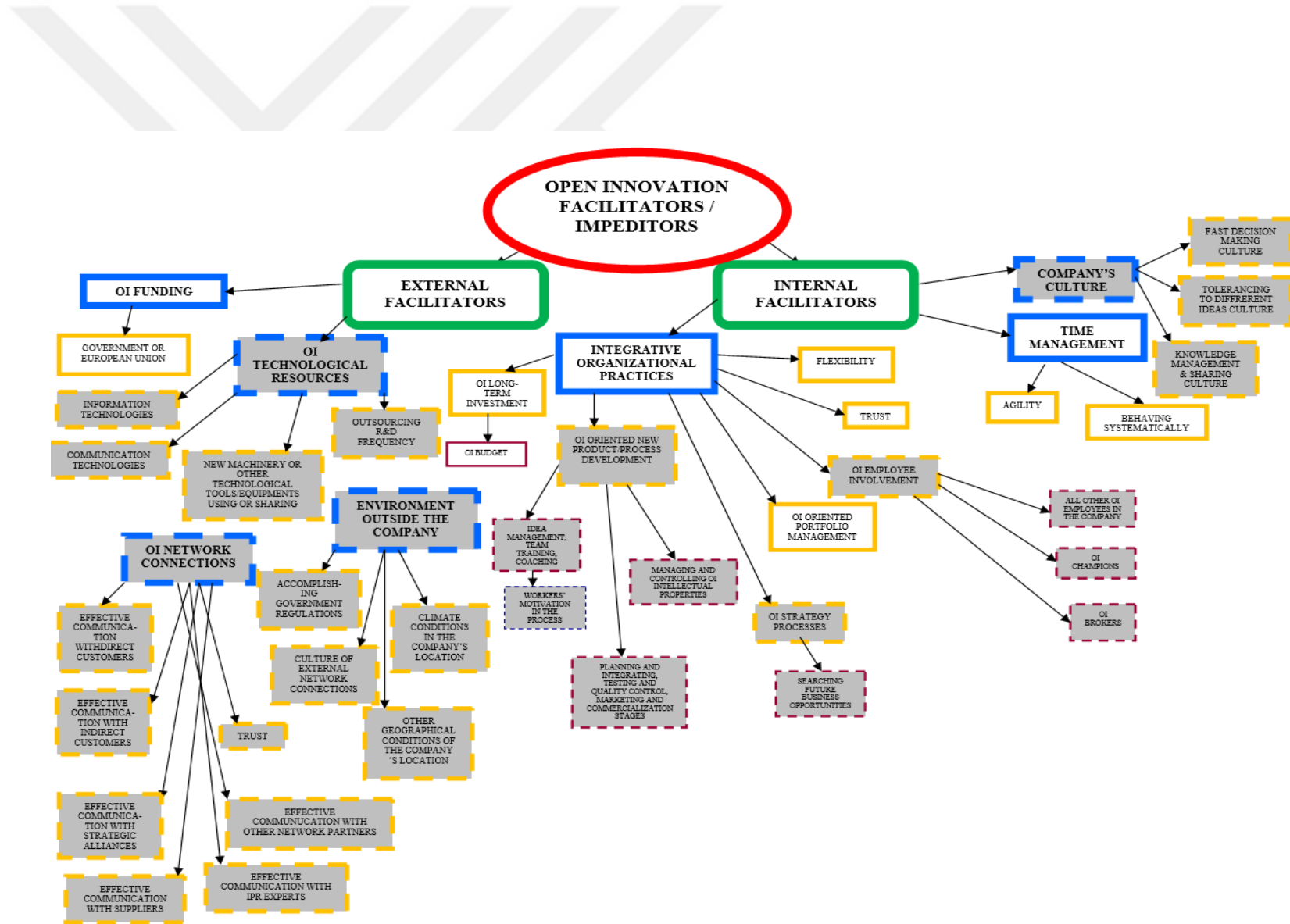


Figure 4.4 Open innovation factors that both impede and facilitate

CHAPTER FIVE

SURVEY DEVELOPMENT AND DATA COLLECTION

5.1 Survey Design

After identifying internal and external facilitators of OI from an extensive and detailed review of the literature, a comprehensive survey instrument is developed to collect data about OI and its facilitators from companies in Turkey. The related survey is given in Appendix-1. It is conducted with the companies, which are located in Turkey and applying open innovation approaches. The companies are not only selected from Izmir, but also from other cities such as İstanbul, Kocaeli, Manisa, Sakarya, Adana and Tekirdağ based on their availability, willingness and appropriateness. The survey is consisted of the following four parts:

First part: **General questions about the company**

Second part: **Level of Implementation of Open Innovation Approach in Companies**

Third part: **Perceptions on Open Innovation Facilitators**

Forth part: **Perceptions on the Most Important OI Facilitators**

Both quantitative and qualitative types of questions are used in the survey. The particular question types are “open-ended questions”, “single choice questions”, “multiple choice questions”, “gap-filling questions”, “ranking questions”, “pick and rank questions” and “yes-no questions”. A paper and an electronic version of the survey, using Qualtrics program, are prepared. However, none of the contacted companies preferred to complete the electronic version of the survey. The survey is applied though face-to-face interviews with the respondents.

5.1.1 First Part of the Survey

In the first part of the survey there are 18 general questions for the company. The aim of this first part is to identify and describe the respondent and company in general. The questions include the establishment year of the company, total workers number, definition of the company whether it is independent or other company's subsidiary,

the market type domestic or foreign in which the company maintain its existence, defining sales amount according to the specified internals and product diversity according to the specified internals etc... There is no restriction for the respondent to answer all questions. The respondent here has a right to select the questions for to answer. However, some questions on the beginning have to be answered by the respondent. The respondent has to answer these obligatory questions: company's commercial correspondence name, respondent's name and surname, respondent's working area in the company, work position and e-mail address. Other questions are not compulsory, but the respondent is encouraged to fully answer the questions.

5.1.2 Second Part of the Survey

Second part of the survey consists of 25 questions. The first 22 questions are single choice questions with 5-point likert scale and the last 3 questions are single choice questions with categoric answers. From the likert scale, the first 13 questions measure the time frequency and the last 9 questions measure the agreement/disagreement status. The anchors used in the first 13 questions for 5-point likert scale are “never”, “rarely” “sometimes” “frequently” and “always”. The anchors used in the last 9 questions for 5-point likert scale are “strongly disagree”, “partially disagree”, “undecided”, “partially agree” and “strongly agree”.

The aim of the second part of the survey is to observe and analyse company's attitude towards OI approaches. Companies can adopt different OI approaches depending on their market, competition and survival conditions. The second part includes questions related to OI approaches. Questions are considered in two groups: product/process development related and all company's operations related. Considering the first 22 questions, company is asked for its degree of forming new collaboration with new external partners and maintaining existing collaboration with existing external partners in new product/process development operations; selling intellectual property rights, licenses or purchases, or buying license in new product/process development; purchasing or selling technical or scientific support services; pursuing new trend or technologies; using or consulting OI intermediaries;

giving importance to customers and having intense collaboration with external and internal partners; using OI approaches effectively and efficiently; knowing OI mechanisms and processes and knowing OI advantages.

Last 3 questions are asked to learn how many years does the company use OI approach, the percentage of open innovation compared to close innovation and the percentage of yearly budget allocated for open innovation compared to close innovation.

While forming second part of the survey, some questions are taken from Şimşek (2015) and Portilla (2016) and they are cited in Appendix-1.

5.1.3 Third Part of the Survey

The third part of the survey is about open innovation facilitators. These facilitators explained in detail in chapter four are divided into two groups: external facilitators and internal facilitators. There are 4 main headings under the external facilitators and under these headings there are 15 second level headings as external OI facilitator factors. On the other side, there are 3 main headings under the internal facilitators and 12 second level headings as internal OI facilitator factors. Besides, there are 9 third level headings and 1 fourth level heading as internal OI facilitator factors. These 9 third level internal OI facilitator factors are:

1. OI budget
2. Idea management, team training, coaching
3. Planning and integrating, testing and quality control stages
4. Marketing and commercialization stages
5. Managing and controlling OI intellectual properties
6. Searching future business opportunities
7. OI brokers
8. OI champions
9. All other OI employees in the company

Fourth level internal OI facilitator factor is “workers’ motivation in the process”. Totally, 27 internal and external facilitators are included in the survey.

Every main heading (some of them start with yes-no question), (only one of them start with multiple choice question in “OI network connection” main heading part) has its own questions. There are 7 parts of questions according to 7 main headings totally.

Totally 47 questions; 4 yes-no type questions, 1 multiple choice question and remaning 42 single choice questions with 5-point likert scale. 42 single choice questions aim to evaluate the respondents’ consideration according to the question subject. If it is desired to explain the content of 5-point likert scale, these 5 scales are “strongly disagree”, “partially disagree”, “undecided”, “partially agree” and “strongly agree”.

The aim of this part is to specify, analyse, define the importance of the the subheading, sub-subheading and 4. level heading (sub-sub-subheading) OI facilitator factors are asked for the respondent’s opinon about their facilitator effect in 5-point likert scale according to agreement/disagreement status. Only one sub-subheading (3. level) facilitator, which is named “idea management, team training, coaching” **does not asked in the survey** because it has 4. level sub-sub-subheading named as “workers’ motivation in the process”. These 27 subheading factors’ (2. level) names are:

1. Government or European Union (as incentive)
2. Communication Technologies (for OI)
3. Information Technologies (for OI)
4. New machinery or other technological tools/equipment using or sharing
5. Outsourcing R&D frequency
6. Effective communication with direct customers
7. Effective communication with indirect customers
8. Effective communication with suppliers
9. Effective communication with IPR experts
10. Effective communication with strategic alliances

11. Effective communication with other network partners
12. Trust (within OI network connections)
13. Accomplishing government regulations
14. Climate conditions in the company's location
15. Other geographical conditions of the company's location
16. OI long-term investment
17. OI oriented new product/process development
18. OI strategy processes
19. OI oriented portfolio management
20. OI employee involvement
21. Trust (within company's workers)
22. Flexibility
23. Agility
24. Behaving systematically
25. Knowledge management & sharing culture
26. Tolerancing to different ideas culture
27. Fast decision making culture

Then, 7 main headings of OI factors are ranked by the respondent. These 7 main headings (1. level) names are:

1. OI funding
2. OI technological resources
3. OI network connections
4. Environment outside the company
5. Integrative organizational practices
6. Time management
7. Company's culture

All questions are constituted by the author and the thesis advisor. In third part of the survey, questions are not from the literature that had asked before. Only the definition parts of the subheading OI facilitator factors are obtained from the literature.

5.1.4 Fourth Part of the Survey

In this last section, it is desired to rank two sections. First section is established to rank total 7 main headings and the other second section is established to rank 27 subheadings which are explained in the subtitle “third part of the survey”, above. There are also gaps filling parts for the respondents after ranking these headings and subheadings, to explain the reasons. However, no survey respondent tends to fill these gaps.

In first section all of the 7 main headings are ranked according the respondents considerations’. On the other hand, in the second section only 10 of the 27 subheadings are selected and then ranked by the respondents. All questions are constituted by the author and the thesis advisor. In forth part of the survey, questions are not from the literature that had asked before.

5.2 Sample and Data Collection

Initially, companies were contacted via telephone or e-mail to understand if they used, have been using or at present, are using OI approaches in their organization. All of the companies were private; none of them was governmental. If they accepted that they had/are having experience of OI, then time and date for a face-to-face interview is requested with a representative of the company. Generally, most of the companies indicated that they used/are using OI in their innovation projects. Although an online version of the survey is prepared in Qualtrics program, none of the respondents preferred to fill the online survey. The aim was to collect data with the survey in a range of sectors, company types or sizes and R&D expenditure to sales turnover ratio of the companies to cover a range of the companies in Turkey. Obviously, there are still remaining companies that are using/used OI; however, time constraint of this thesis and organizational procedures of the companies obstructed to perform more interviews. After the interviews, the filled surveys were collected and data is transferred to and organized in a working table using Microsoft Excel. In the analysis stage (explained in chapter six) both Microsoft Excel and SPSS programs are used.

CHAPTER SIX

DATA ANALYSIS AND FINDINGS

As explained in chapter five, the survey is developed in four parts in accordance with the aims of the study. Table 6.1 summarizes the aim of each part of the survey and the respective data analysis method used. 31 companies participated in this study by completing survey. The answers of the respondents and findings of the analysis for each part of the survey are given in the following sections.

Table 6.1 Survey parts and respective data analysis methods

Part number of the survey	Aim	Analysis method
1	The aim is to understand general characteristics of the survey participant companies as: type, location, sectorial distribution, sales turnover and age etc.	Descriptive statistics
2	The aim is to understand the perceptions and applications of the survey participant companies towards OI approaches which are IPR or technology selling or purchasing, following new trends and technologies, selling or purchasing technical or scientific support services, etc.	Descriptive statistics
3	The aim is to explore which main heading facilitator factor of OI should be in which group as external or internal and understand the perceptions of the surveyed companies on OI facilitators and analyze whether these perceptions differ depending on the time period that the companies have been using OI, annual R&D expenditure to sales turnover ratio, number of employees and company age.	Exploratory factor analysis Non-parametric statistical analysis: • Mann Whitney U • Kruskal Wallis H
4	The aim is to analyze the most facilitating OI factors as: first level main headings and second level headings.	Score-based analysis of rank-ordered data

6.1 Descriptive Information on the Companies

Answers and results according to first part of the survey questions are discussed in this section. The aim is to analyze general characteristics of the survey participant companies as: type, location, sectorial distribution, sales turnover and age etc.

6.1.1 Type of the Companies

In the survey commercial correspondence name of the company is asked to the respondent. From the obtained data type of the companies are derived and shown in the Figure 6.1.

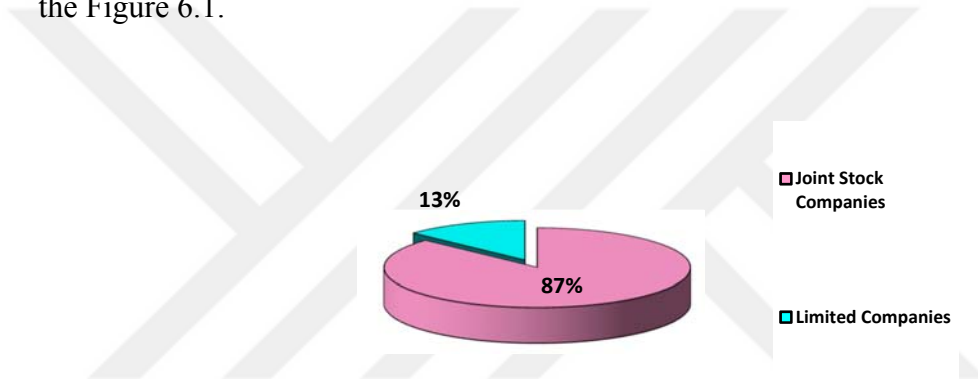


Figure 6.1 Percentages of the type of the companies

As seen in Figure 6.1 most of the participated companies (27 companies from 31) are **joint stock companies**. 13% (4 companies from 31) of the companies are **limited companies**.

For explaining the terms of the company types; a joint-stock company is a business entity in which different stocks can be bought and owned by shareholders (Joint-stock company n.d.). In a limited company, the liability of members or subscribers is limited or restricted to what they have invested or guaranteed to the company. (Limited company, n.d.)

6.1.2 Location of the Companies

Companies' addresses are received from the respondents. Based on this information locations of the companies by cities are shown in Figure 6.2

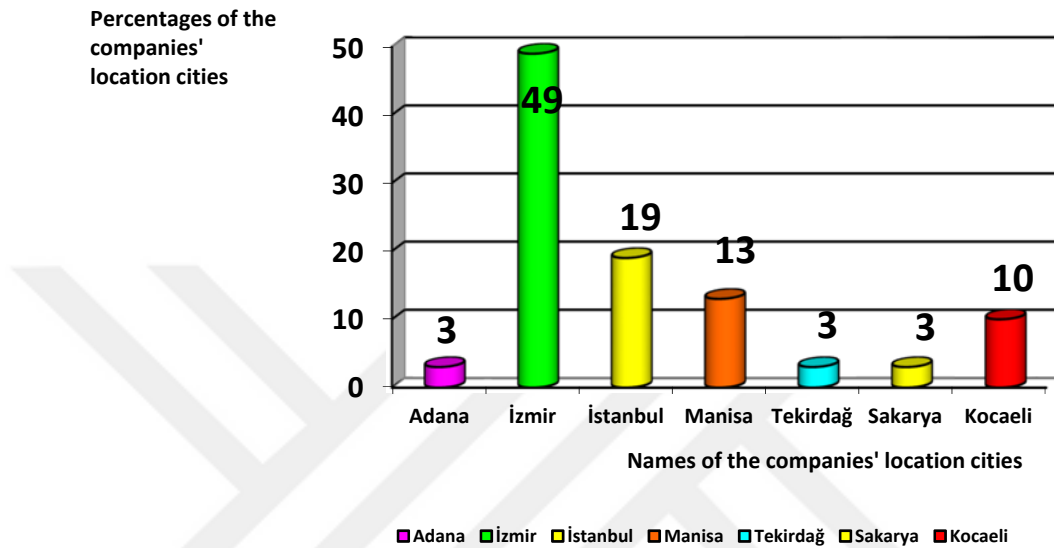


Figure 6.2 Percentages of the company location by cities

Figure 6.2 expresses that the survey is conducted with mostly companies locating in İzmir (15 companies from 31). The second biggest percentage of location city for participating companies is İstanbul (6 companies from 31). Other companies are based in Adana, Tekirdağ and Sakarya.

Additionally, respondents are asked to specify whether the company locates in organized industrial zone, free trade zone, technology park or not. According to survey results of 31 companies, no company locates in free trade zones or technology parks. Companies either locate in organized industrial zones or not. The percentages of the companies as located in different zones are denoted in Figure 6.3.

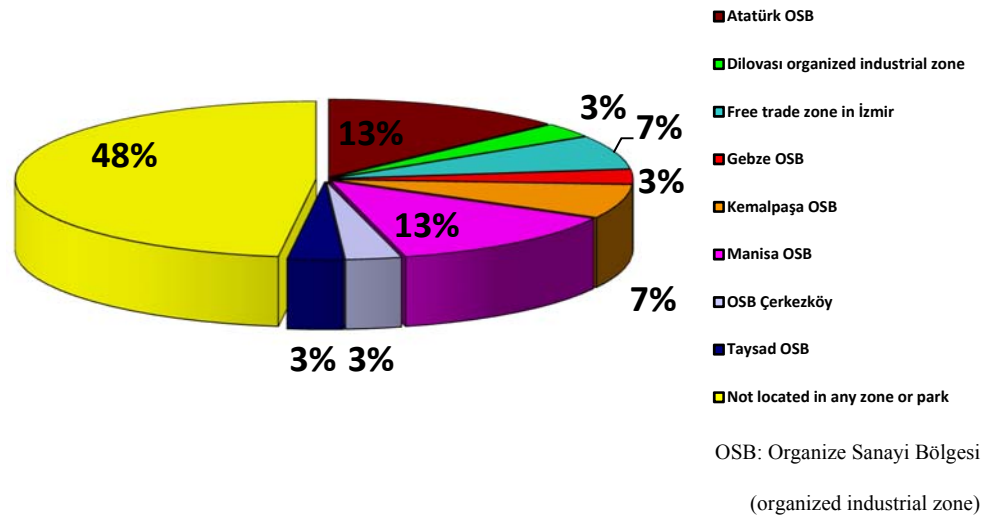


Figure 6.3 Percentages of the company location

As seen in Figure 6.3 about half of the companies are not located in any industrial zone or park. Companies located in Atatürk OSB and Taysad OSB has the second highest percentage of 13%. 7% of the companies are located in free trade zone in İzmir and 7% are in Kemalpaşa OSB. Other companies are located in Taysad OSB, OSB Çerkezköy and Dilovası organized industrial zone.

6.1.3 Working Areas of the Respondents

In conducting the survey, it was attempted to reach people, especially those related to innovation in their company, to answer the survey questions. The respondents' areas of work are indicated in Figure 6.4.

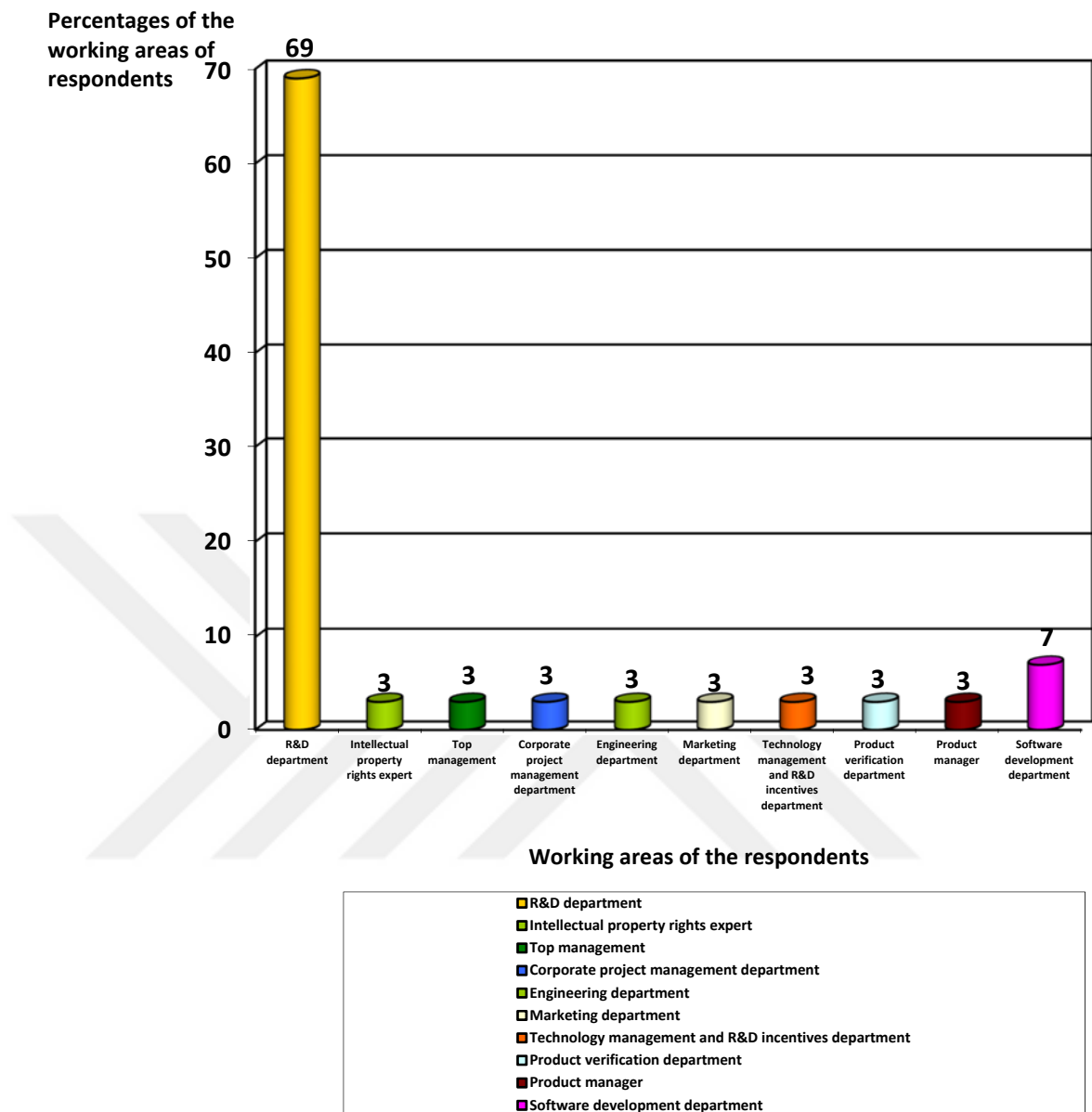


Figure 6.4 Percentages of the working areas of the respondents

As a result, this survey is mostly accomplished by R&D department workers, 69% (21 companies from 31). Considering the working areas, it can be said that the survey is conducted with respondents who are familiar with innovation process of their companies.

6.1.4 Working Positions of the Respondents

Working position is grouped into four in the relevant question for the survey. These are CEO/top manager, department manager, department expert/engineer and department personnel. Within the interviews with 31 companies, no survey is accomplished with department personnel. Percentages of respondents' working positions are shown in Figure 6.5 with a pie chart.

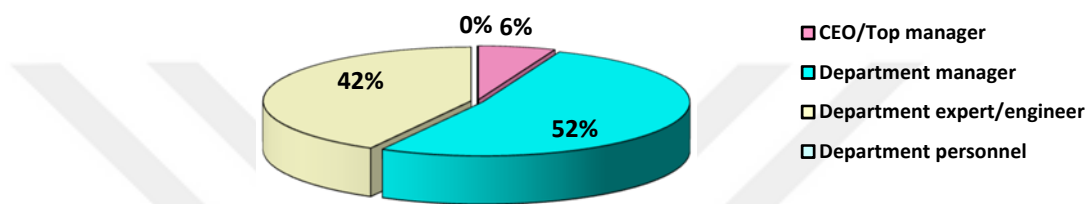


Figure 6.5 Percentages of the respondents' working positions

As seen in Figure 6.5 6% of the respondents are senior managers. More than half of the respondents are department managers and the remaining of the respondents are department experts/engineers. None of the respondents are department personnel.

6.1.5 Distribution of the Company Ages

Respondents are asked to indicate the foundation year of their company. Sometimes, there are many subsidiaries (with the same name), which have different foundation years or the central company (with the same name) foundation year is different. In such cases, the focus point is the foundation year of the company where the respondent works. From their information company ages are derived. Ages of the participating companies range between 4 to 67 years. The percentages of companies' base on their age intervals are denoted in Figure 6.6.

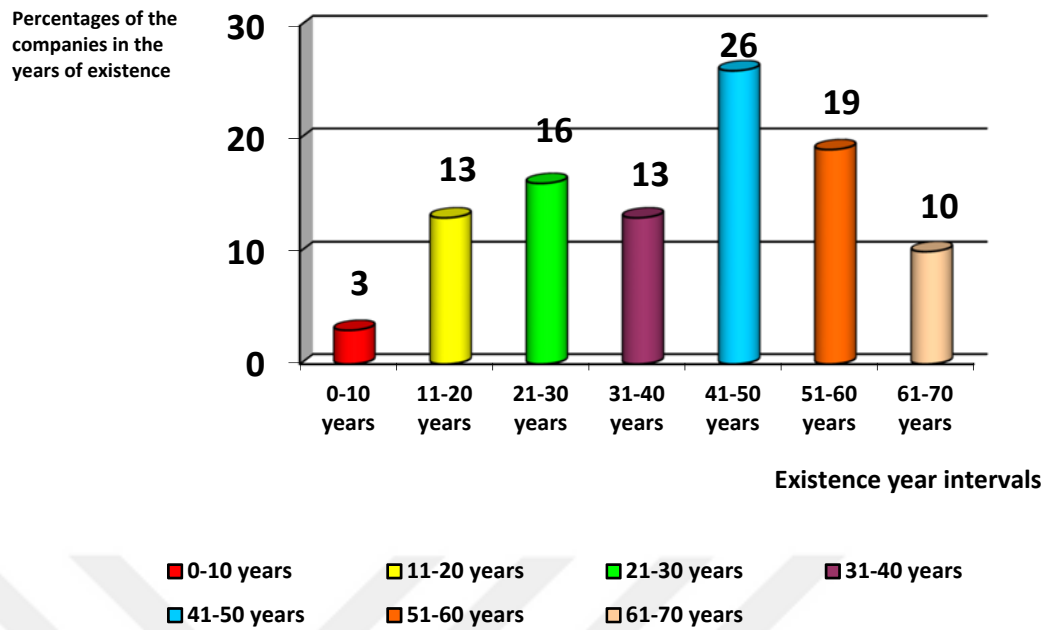


Figure 6.6 Percentages of the companies based on their age

Most of the companies are in the interval of 41 to 50 years. (The interval endpoints are also included). 6 companies are in the interval of 51 to 60 years. Only 1 company has been operated since the interval of 0-10 years. The oldest company of the survey was founded in 1950, from 67 years it has been continuing to its manufacturing.

6.1.6 Sectorial Distribution of the Companies

The respondents from the companies specify their sectors in this section of the survey. The related percentages of the operation sectors of the companies are indicated in Figure 6.7.

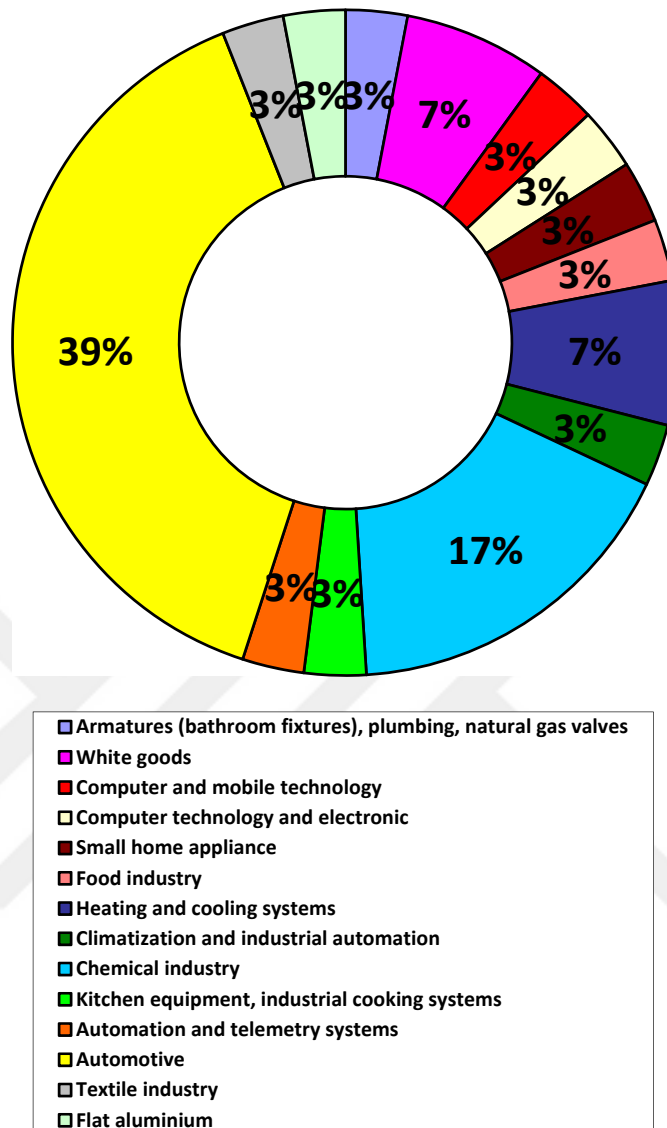


Figure 6.7 Percentages of the sectorial distribution of the companies

Concluding from Figure 6.7 the highest percentage of companies is in automotive sector with 39% (12 from 31 companies). The second highest percentage of companies is in chemical industry with 17% (5 from 31 companies). The third highest percentage of companies is in both white goods and heating and cooling systems (combi boilers, heat pumps' indoor unit and subcomponents) (commercial type refrigerated cabinet) with 7% each (each of them are 2 companies from 31). Firms from various other sectors are also participated in the survey seen in Figure 6.7.

6.1.7 Distribution of the Companies by Number of Employees

The total number of employees of the company is asked to the respondent. The obtained data is grouped in six intervals for better interpretation. The percentages of the companies in each interval are given in Figure 6.8. Interval endpoints are included in each interval.

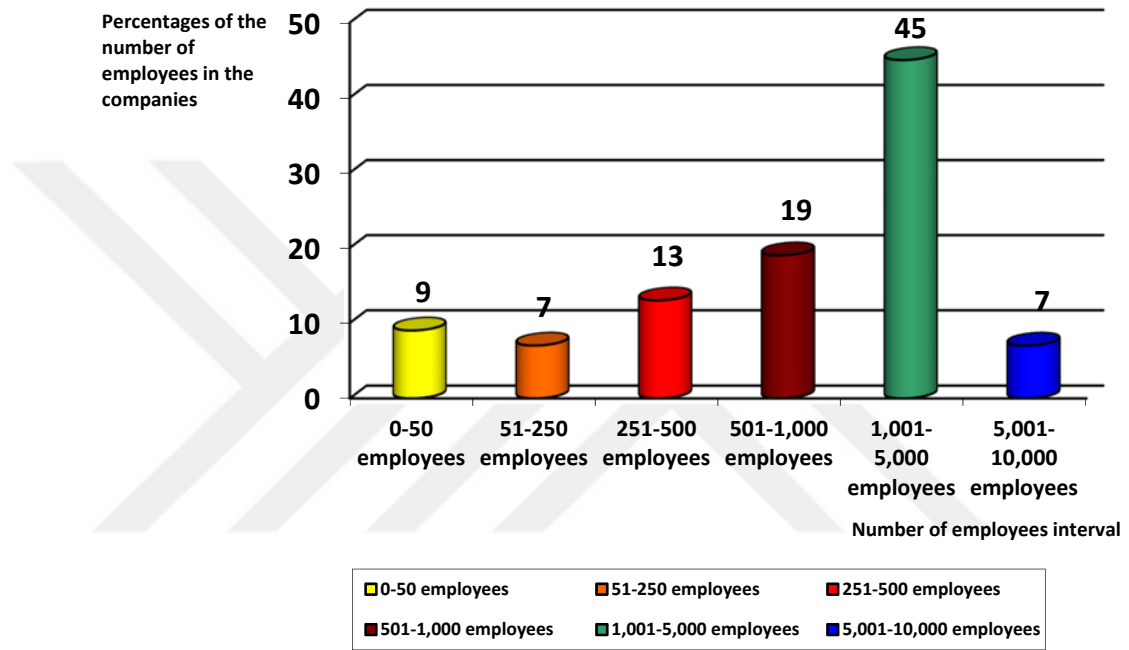


Figure 6.8 Percentages of the number of employees in the companies

As a result, Figure 6.8 indicates that the survey is conducted mostly, 45%, (26 from 31 companies) with large scale companies: 1,001-5,000 employees. In 19% (6 from 31 companies) of the participating companies' number of employees are in the interval of 501-1,000. In %7 of the companies' number of employees are in the intervals of 51-250 employees and 5,001-10,000 employees each.

In telephone conversation, before face-to-face interview, it is tended to receive an appointment with small scale companies. However, most of them explain that they do not use OI (including past time). In this survey, it is seen as 9%, 3 small scale companies, achieve to exert OI approaches.

6.1.8 Foundation Type of the Companies

According to their foundation type companies are divided into independent or dependent companies. Somehow, there is one more type as joint ventures. In the data collected with this survey, the number of joint venture type companies is only 2. They are included in the independent companies group. Figure 6.9 displays percentages of the companies by their foundation type.

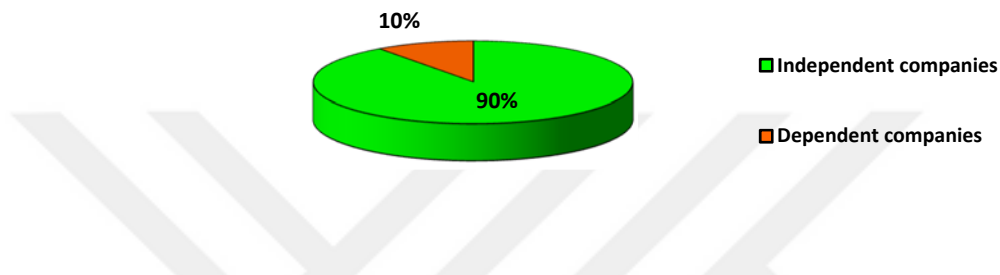


Figure 6.9 Percentages of the foundation type of the companies

As seen in this figure, 28 companies (90%) are independent companies (2 joint venture companies are included) and 3 companies (10%) are dependent companies.

6.1.9 Distribution of the Companies by Sales Turnover

Annual sales turnover values of the companies, which are obtained with the survey, are arranged in six intervals. In these intervals currency type is TL, Turkish Lira. In each interval only lower bound value is included. Percentages of the companies by their sales turnover are shown in Figure 6.10.

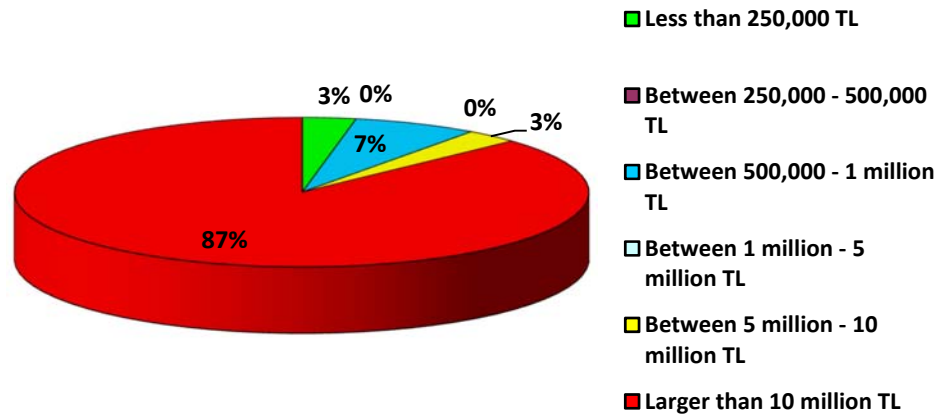


Figure 6.10 Percentages of the companies by annual sales turnover intervals

Concluding with Figure 6.10, 87% of the participating companies have annual sales turnover larger than 10 million TL. There are 27 companies at that interval. In two of the participating companies (7%) annual sales turnover is between 500,000 – 1 million TL. In one company, it is between 5 million – 10 million TL and in one company it is less than 250,000 TL. No companies have sales turnover at the intervals between 250,000 – 500,000 TL and between 1 million - 5 million TL.

6.1.10 Annual R&D Expenditure to Annual Sales Turnover Ratio

Annual R&D expenditure to annual sales turnover ratio differs for each company at each sector. For interpreting the results seven intervals are created. The endpoints of the intervals are included. The percentages for each interval are indicated in Figure 6.11.

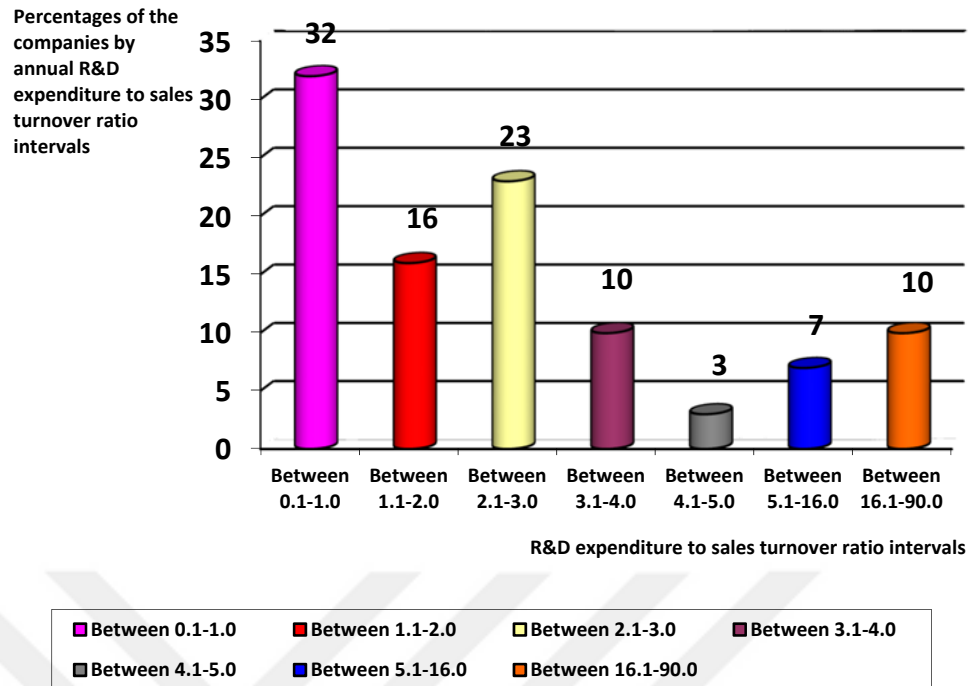


Figure 6.11 Percentages of the companies by annual R&D expenditure to annual sales turnover ratio intervals

As a result, from Figure 6.11, it can be seen that about one third (10 from 31 companies) of the companies have an annual R&D expenditure to sales turnover ratio between 0.1 and 1.0. About quarter of the companies (7 from 31 companies) have a ratio between 2.1 and 3.0. 16% of the companies have a ratio between 1.1 and 2.0. 10% of the companies have ratio between 3.1 and 4.0 and 16.1 and 90.0 each. 7% of the companies (2 from 31 companies) have ratio between 5.1 and 16. Only one company (3%) has a ratio between 4.1 and 5.0.

Continuing this survey section analysis, a comparison with seven interval groups above can be made between annual R&D expenditure to sales turnover ratio and sectors of the companies in Figure 6.12.

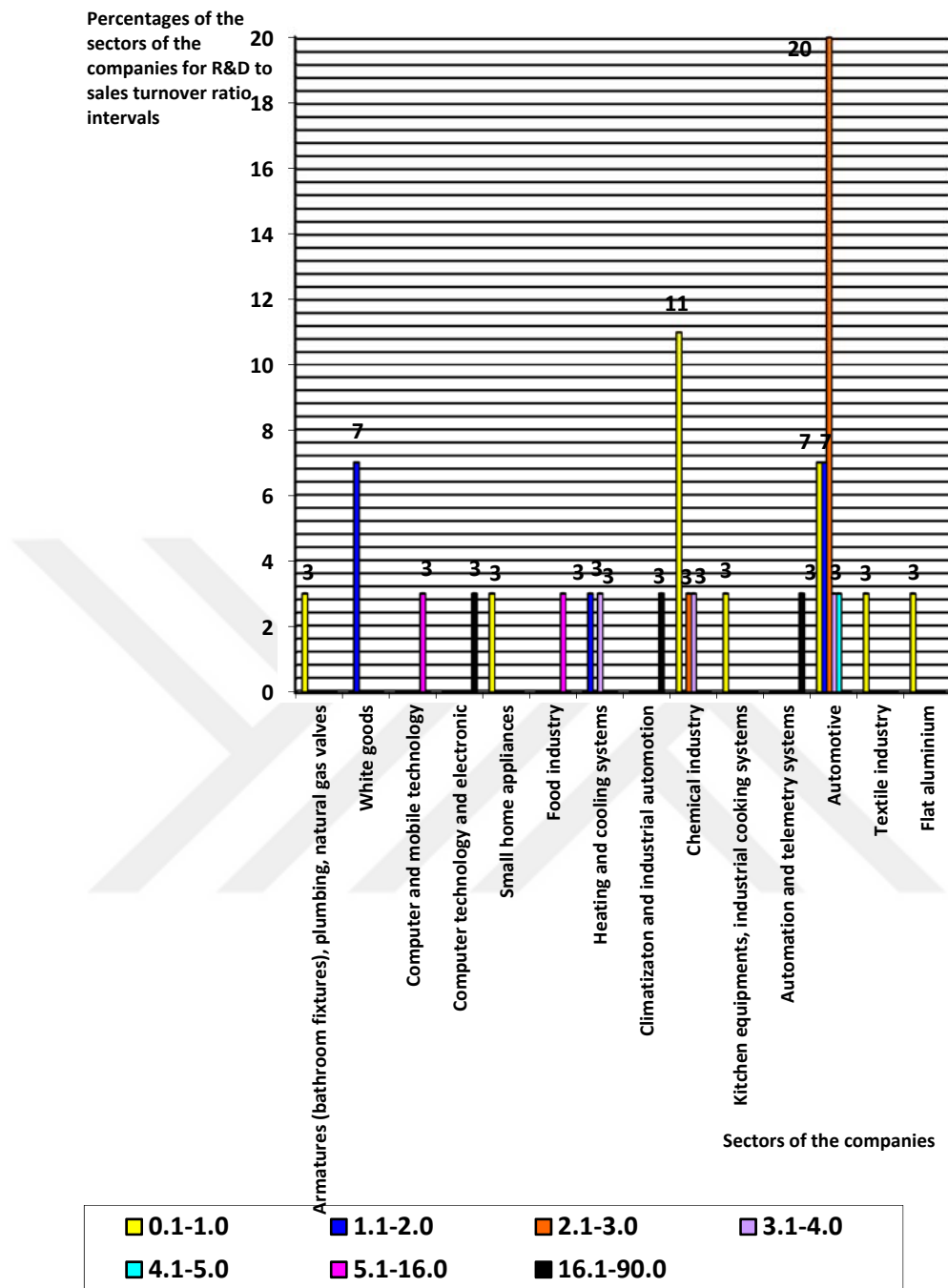


Figure 6.12 Percentages of the company sectors according to R&D expenditure to sales turnover ratio intervals

Considering Figure 6.12 most of the sectors (8 sectors) are in the first R&D expenditure to sales turnover ratio interval (0.1 – 1.0). These sectors are armatures (bathroom fixtures), plumbing, natural gas valves, chemical industry, small home appliances, kitchen equipment, industrial cooking systems, automotive, textile

industry and flat aluminium (sheet, roll, foil). Consequently, based on this section result, generally companies' R&D to sales turnover ratio is seen in the interval of 0.1-1.0.

Second rank contains the intervals of 1.1-2.0, 3.1-4.0 and 16.1-90.0. Each of these intervals has 3 different sectors. In the interval of 1.1-2.0 white goods, heating and cooling systems and automotive sectors are seen. In the interval of 3.1-4.0 heating and cooling systems, chemical industry and automotive sectors are observed. Lastly, in the interval of 16.1-90.0 automation and telemetry systems, climatization and industrial automation and computer technology and electronic sectors are observed.

Only one sector, automotive, is seen in the interval of 4.1-5.0. All of the percentages in Figure 6.12 are determined with considering the whole survey companies. For instance, 3% means 1 company from 31 companies.

The computer and mobile technology sector and computer technology and electronic sectors' R&D expenditure to sales turnover ratio intervals are high (sixth and seventh intervals). Automation and telemetry and climatization and industry automation sectors also have the highest R&D expenditure to sales turnover ratio. As a result, it can be said that these sectors achieve to allocate high budget or investments for R&D expenditures.

6.1.11 Market Type of the Companies

In the survey companies are asked to specify the market they operate in. Three market types are identified: domestic market, foreign market, both domestic and foreign market. The respondent must select only one of these three choices; it is arranged as single choice question. Figure 6.13 expresses the distribution of companies by the market type in which they operate.

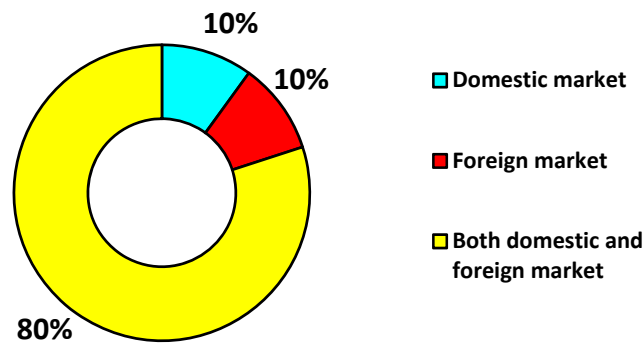


Figure 6.13 Distribution of the companies by the market type

Interpreting Figure 6.13 the highest percentage, 80%, with 25 companies, is seen in both domestic and foreign market. The second highest percentages are equal to 10% each which are domestic market (3 companies) and foreign market (3 companies).

6.1.12 Product Variety of the Participating Companies

This section of the survey is designed to analyse product varieties of the companies. Product varieties are analyzed in 5 different interval groups. Moreover, for sale operations, final product is changed for every company in every sector. If the company sells raw materials or semi-products to its customers, they are also included together in final products. Only lower bond values are included in the intervals. Percentages of the companies by their product varieties are shown in Figure 6.14.

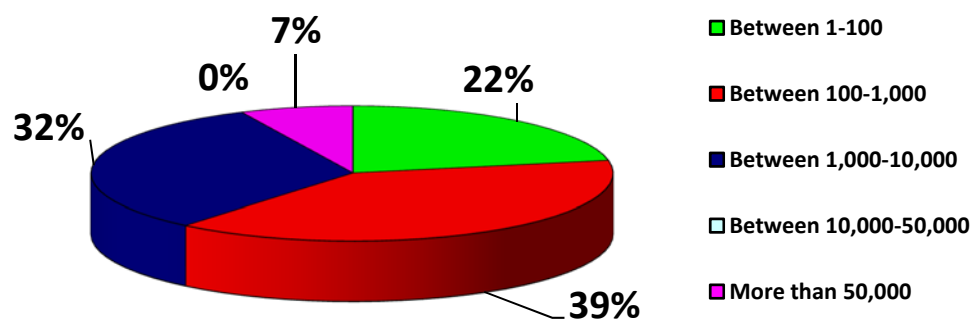


Figure 6.14 Percentages of the companies by product variety intervals

More than quarter of the companies (39%, 12 companies) observed in product variety between 100 and 1,000. 32% (10 companies) of the companies have product variety between 1,000 and 10,000. Less than quarter of the companies (22%, 7 companies) have product variety between 1 and 100. The least number of companies as 7% (2 companies) have the product variety more than 50,000. In this sample no company has the product variety between 10,000 and 50,000.

6.2 Level of Implementation of Open Innovation Approach in Companies

Answers and results obtained from second part of the survey questions are discussed in this section. Questions are aimed to analyze the company applications based on OI approaches. Each of the following subsections corresponds to a question in the second part of the survey.

6.2.1 Forming New Collaborations with New External Partners during New Product/Process Development

Collaborating with new external partners during the new product/process development is one of the OI approaches. In this question, it is desired to evaluate if the companies are forming new collaborations with new partners during new product/process development. The percentages of the respondents' answers are denoted in Figure 6.15.

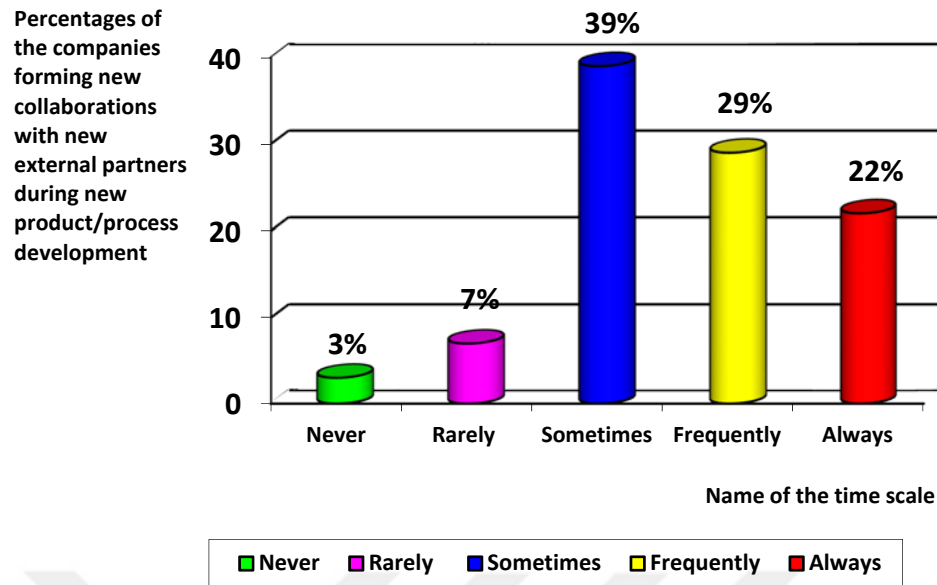


Figure 6.15 Percentages of the companies forming new collaborations with new external partners during new product/process development

As seen in Figure 6.15, 97% of the companies somehow, often or occasionally form new collaborations with new partners during the new product/process development. Only 1 firm (3%) never accomplishes this OI action. Companies' collaboration with new partners new in product/process development is a significant phenomenon for OI because with every new partnership the company's knowledge and experience increases.

6.2.2 Working with Only the Existing External Partners during New Product/Process Development

This question is the contrary of the first question explained above. It is desired to evaluate if the companies are working with only the same partners during new product/process development. The percentages of the respondents' answers are expressed in Figure 6.16.

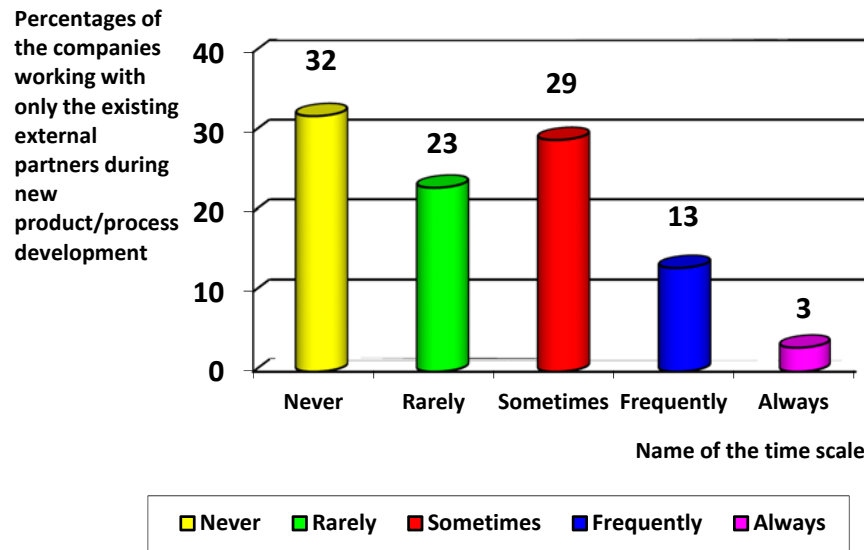


Figure 6.16 Percentages of the companies working with only the existing external partners during new product/process development

As observed in Figure 6.16, more than 50% of the companies specify that they never or rarely perform new product/process development activities working with only existing external partners.

It is important that this question is the contrary of the first, so, the preferable answer choices should be “never”, “rarely” and “sometimes” for the companies using OI approach of working with new external partners. Working with same partners does not improve knowledge and may decrease novelty accomplishments. This is a disadvantage for the company. In this point of view, totally 84%, 26 companies answer with “never”, “rarely” or “sometimes”. Therefore, it can be inferred that most of the companies in this survey use and apply this OI approach.

6.2.3 Getting a License or Buying the Intellectual Property Rights (IPR) or Technology during New Product/Process Development

In this question, it is desired to evaluate if the company gets either license or purchases IPR or technology in product/process development. The related percentages of the companies are indicated in Figure 6.17.

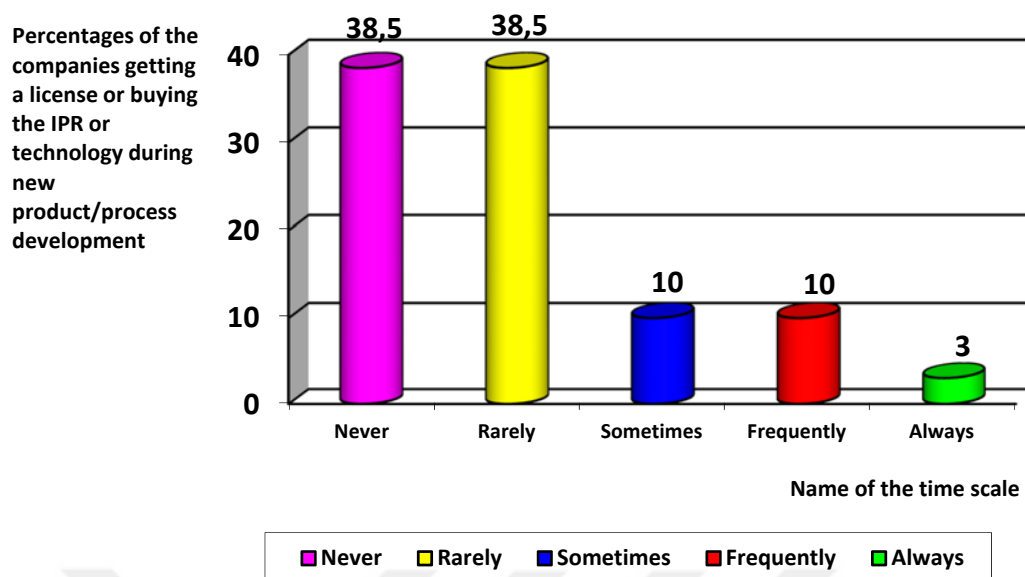


Figure 6.17 Percentages of the companies getting a license or buying the IPR or technology during new product/process development

The highest percentages are seen in “never” and “rarely” answer choices with 38,5% each (12 companies for each answer). The least percentage is found for the answer “always” with 3%. One of the OI approaches is to get license or buy the IPR or technology during product/process development. Here, the preferable answer choices should be “frequently” or “always”. However, total of these answers are 13% for the companies using this OI approach which corresponds less than quarter of all of the participant companies.

6.2.4 Licensing or Selling the Intellectual Property Rights (IPR) or Technology during New Product/Process Development

In this question, it is desired to evaluate if the company licenses or sells the IPR or technology during their innovation processes. The related percentages are expressed in Figure 6.18.

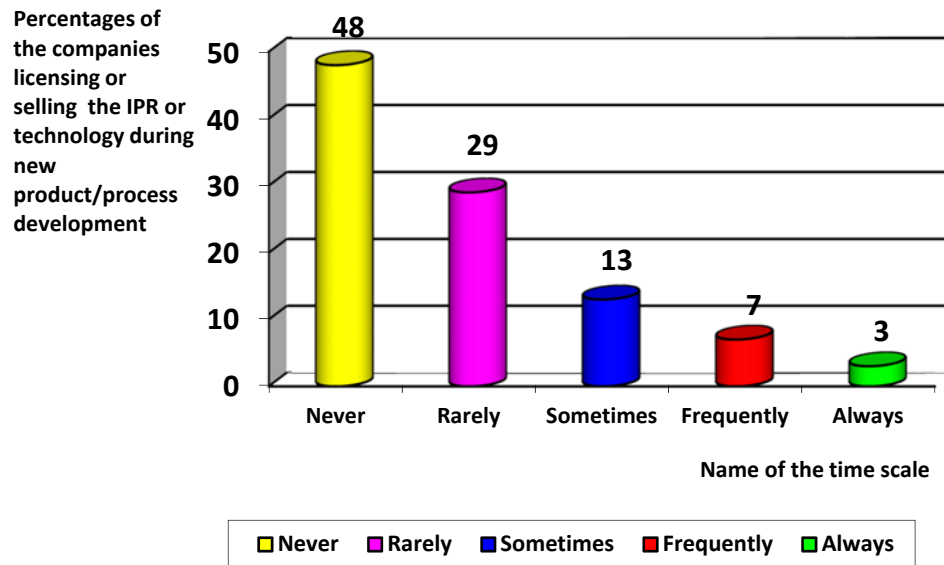


Figure 6.18 Percentages of the companies licensing or selling the IPR or technology during new product/process development

Licensing or selling the IPR or technology during innovation processes is another OI approach. As defined in Figure 6.18 about half of the companies indicate that they either always, frequently, sometimes or rarely license or sell the IPR or technology during the new product/process development. The other half of the companies do not seem to adopt this OI approach.

6.2.5 *Getting a License or Buying the Intellectual Property Rights (IPR) or Technology during the General Operation of the Company*

As part of their OI approach, companies can get a license or buy the IPR or technology not only during innovation processes but also during their general operation. In this question, it is desired to determine the proportion of such companies. The related percentages are specified in Figure 6.19.

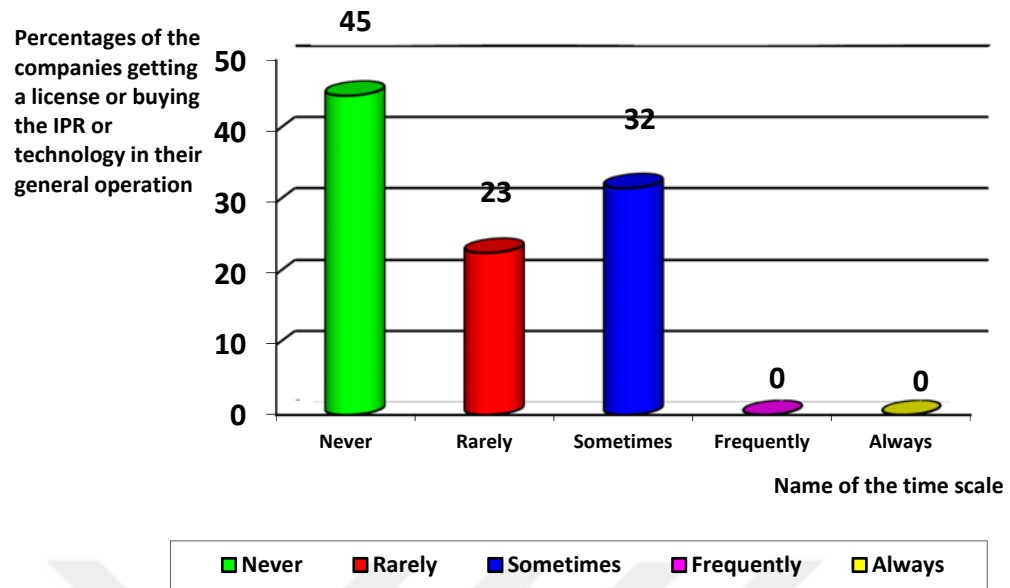


Figure 6.19 Percentages of the companies getting a license or buying the IPR or technology in their general operation

As seen in Figure 6.19, 45% of the companies point out that they never get a license or buy the IPR or technology during their general operations. It is observed that surveyed companies rarely use this approach.

6.2.6 Licensing or Selling the Intellectual Property Rights (IPR) or Technology during the General Operation of the Company

Companies can either license or sell the IPR or technology during the general operation of their OI applications. In this question, it is aimed to determine the proportion of such companies. The related percentages are denoted in Figure 6.20.

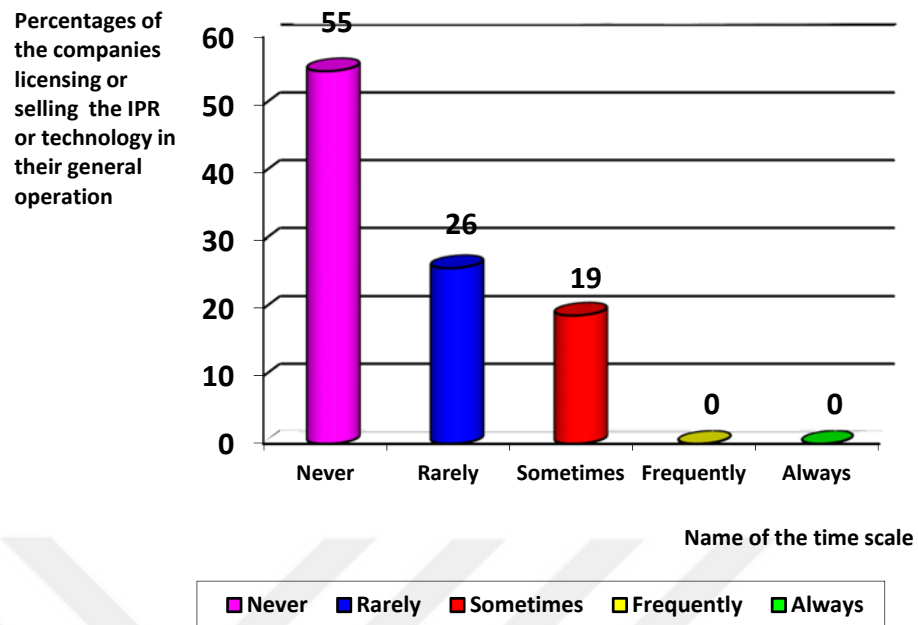


Figure 6.20 Percentages of the companies licensing or selling the IPR or technology in their general operation

As seen in Figure 6.20, more than half of the companies never licensing or selling the IPR or technology in their general operation. Remaining companies are occasionally or often prefer this OI approach. Unfortunately, surveyed companies rarely use this approach. Besides, it can be concluded that companies adopt OI approaches more during new product/process developments rather than in general operations.

6.2.7 Purchasing Technical or Scientific Support Services from External Partners or Other Companies

In this question it is desired to learn if the company purchase technical or scientific support service from external sources as partners and other companies. The R&D service is also included in this analysis. The related percentages are specified in Figure 6.21.

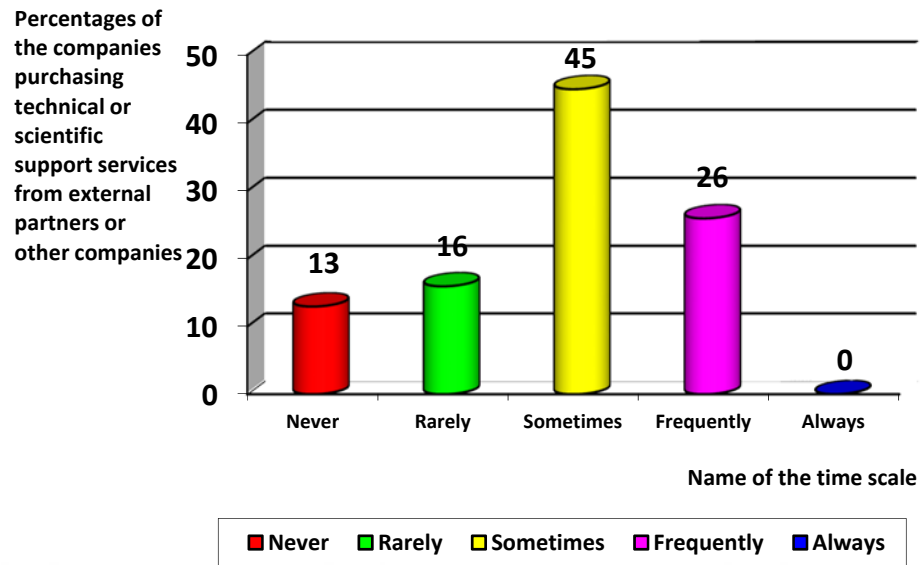


Figure 6.21 Percentages of the companies purchasing technical or scientific support services from external partners or other companies

The middle answer choice “sometimes” has the highest percentage as 45% (14 companies). The second highest percentage is in the answer choice “frequently” with 26% (8 companies). The third highest percentage is 16% (5 companies) for the answer choice “rarely”. It is perceived that 87% of the surveyed companies purchase technical or scientific support services from external partner or other companies occasionally or often. To be more specific, approximately quarter of the companies apply this OI approach intensively.

6.2.8 Selling Technical or Scientific Support Services to External Partners or Other Companies

In this question it is aimed to find the proportion of companies that are selling technical or scientific support service to external partners or other companies. Same as the 7th question, the R&D service is also included in this analysis. The related percentages are denoted in Figure 6.22.

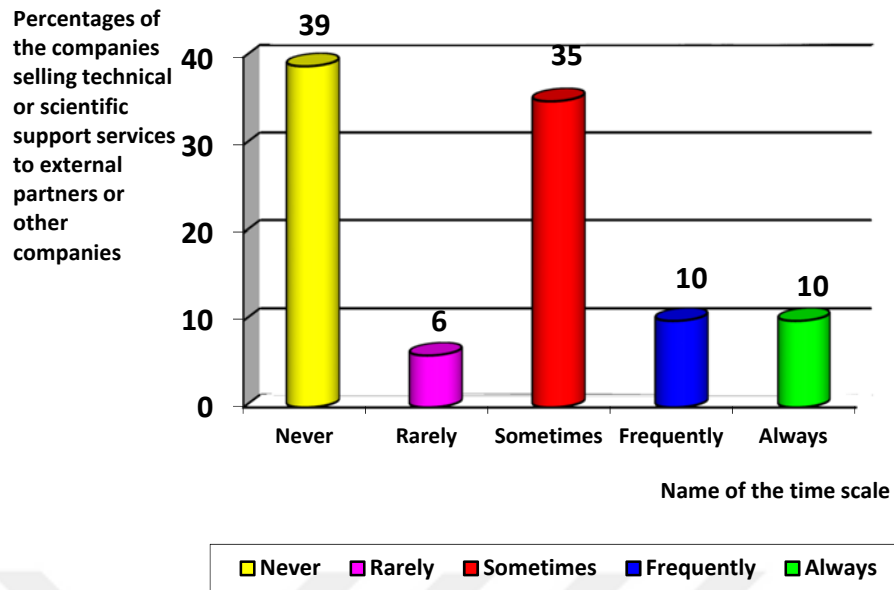


Figure 6.22 Percentages of the companies selling technical or scientific support services to external partners or other companies

The highest percentage is seen in the answer choice “never” with 39%, 12 companies. The second highest percentage is seen in the answer choice “sometimes” with 35%, 11 companies. It is noticed that 61% of the surveyed companies sell technical or scientific support service to external partners or other companies occasionally or often. Particularly, 20% of the companies use this OI approach intensively.

6.2.9 Following New Trends and Technologies Closely during New Product/Process Development

Generally surveyed companies imply that they pursue new trends and technologies in new product/process development stages. The related percentages to this question are denoted in Figure 6.23.

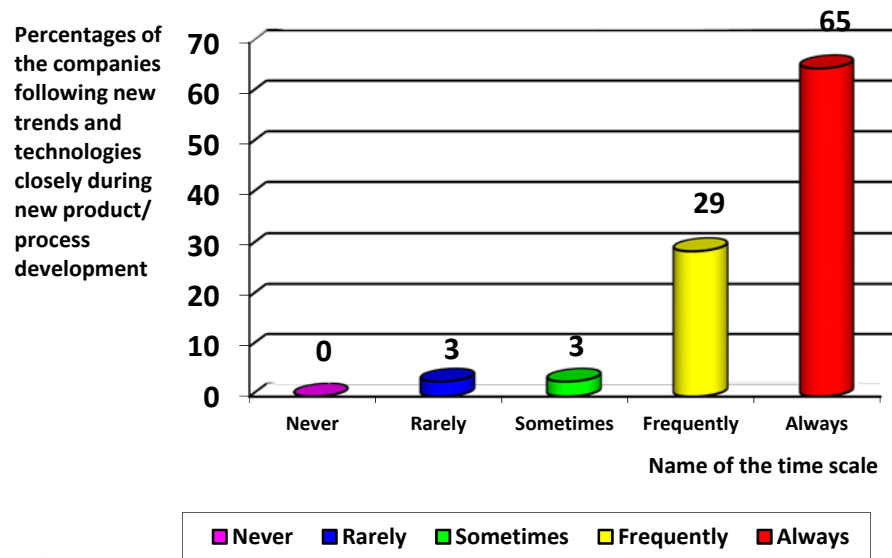


Figure 6.23 Percentages of the companies following new trends and technologies closely during new product/process development

As a result, the highest percentage is seen in the answer choice “always” with 65%, 20 companies. The second highest percentage is seen in the answer choice “frequently” with 29%, 9 companies. For a conclusion, totally (addition of “frequently” and “always” answer choice percentages) 94% of the companies apply this approach of the OI intensively.

6.2.10 Following New Trends and Technologies during General Operation of the Company

In this question, it is desired to find the proportion of the companies following new trends and technologies during their general operation. This question seems to be similar with the 9th question in second part but in question 9 the analysis is accomplished for during new product/process development. The related percentages are displayed in Figure 6.24.

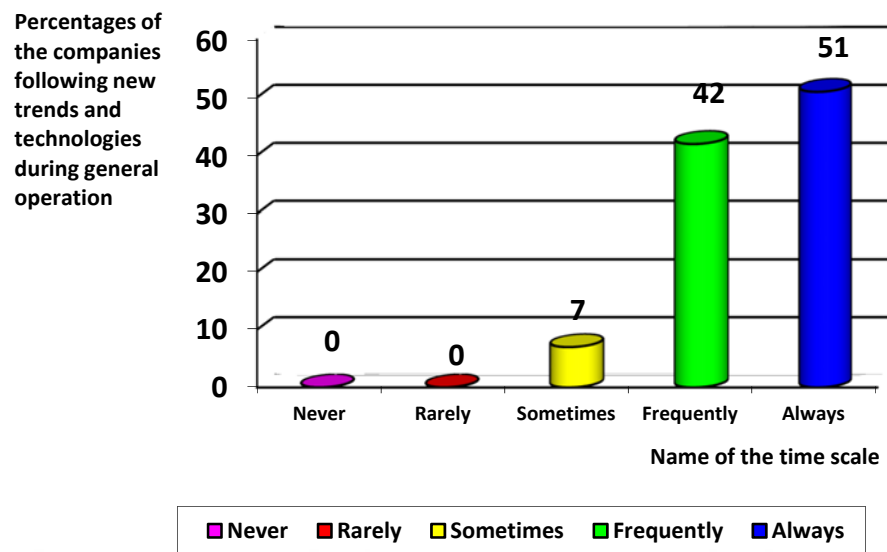


Figure 6.24 Percentages of the companies following new trends and technologies during general operation

All of the companies follow new trends and technologies during their general operation somehow occasionally or often. Especially, more than half of the surveyed companies always use this OI approach.

6.2.11 Working with OI Intermediaries (brokers, champions, etc.) during New Product/Process Development

Working with the OI intermediaries as brokers, champions etc. have an important role in OI approach. It is tried to evaluate if the companies are working with these OI intermediaries or not. The related percentages are indicated in Figure 6.25.

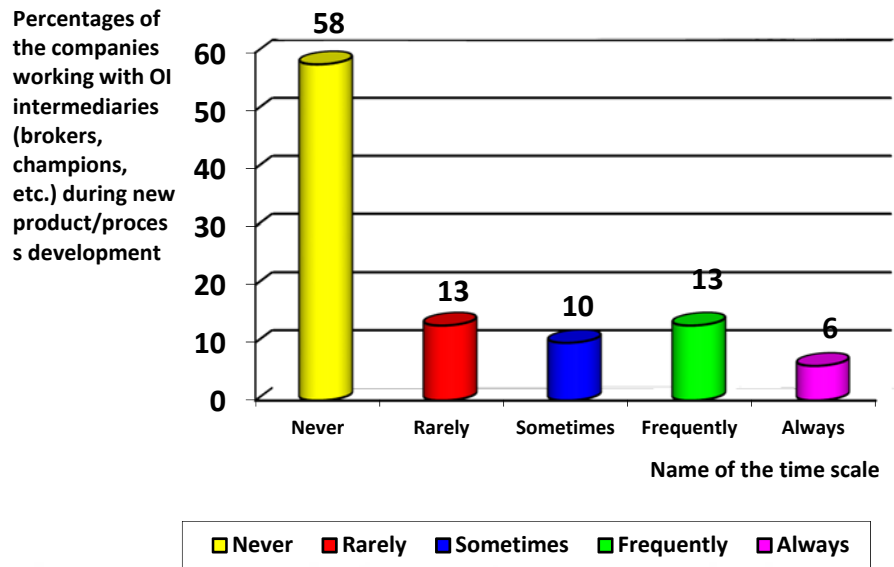


Figure 6.25 Percentages of the companies working with OI intermediaries (brokers, champions, etc.) during new product/process development

As a result, the highest percentage is seen in the answer choice “never” with 58% (18 companies). The second highest percentage is seen in two answer choices “rarely” and “frequently” each with 13% (4 companies). The least percentage is observed in the answer choice “always” with 6%, 2 companies. 29% of the companies occasionally or often use this OI approach.

6.2.12 Considering and Benefiting from the Opinions and Ideas of the Customers during New Product/Process Development

Considering and benefiting from the opinions and ideas of the customers during new product/process development is one of the OI approaches of the companies. In this question it is aimed to evaluate this OI approach. Percentages are specified in Figure 6.26.

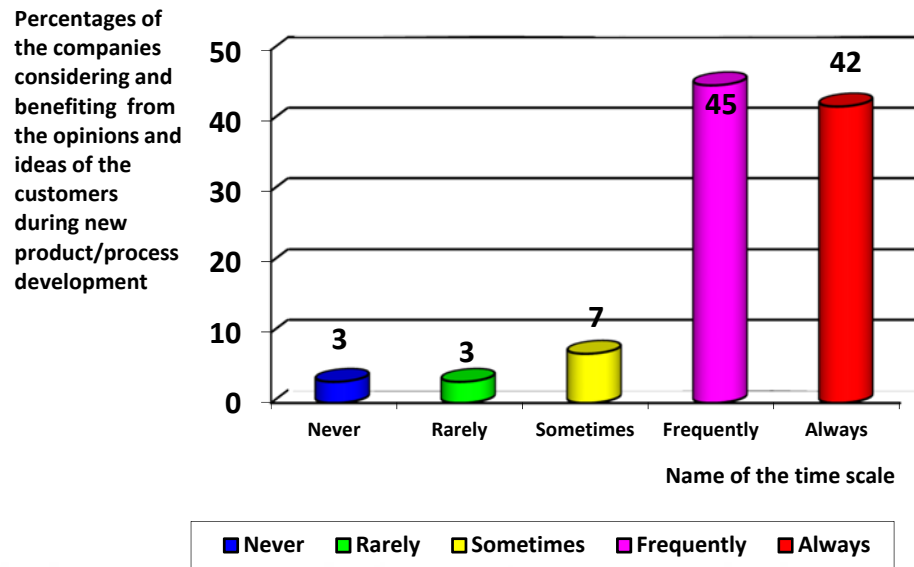


Figure 6.26 Percentages of the companies considering and benefiting from the opinions and ideas of the customers during new product/process development

The highest percentage is observed in the answer choice “frequently” with 45% (14 companies). The second highest answer choice is observed in the answer choice “always” with 42% (13 companies). 97% of the companies somehow, often or occasionally use this OI approach.

6.2.13 Considering and Benefiting from the Opinions and Ideas of the Customers during the General Operation of the Company

In this question, it is desired to evaluate companies considering and benefiting from the opinions and ideas of their customers during the general operation. This question is nearly similar to 12th question of the second part but the difference is the application field. The related percentages are expressed in Figure 6.27.

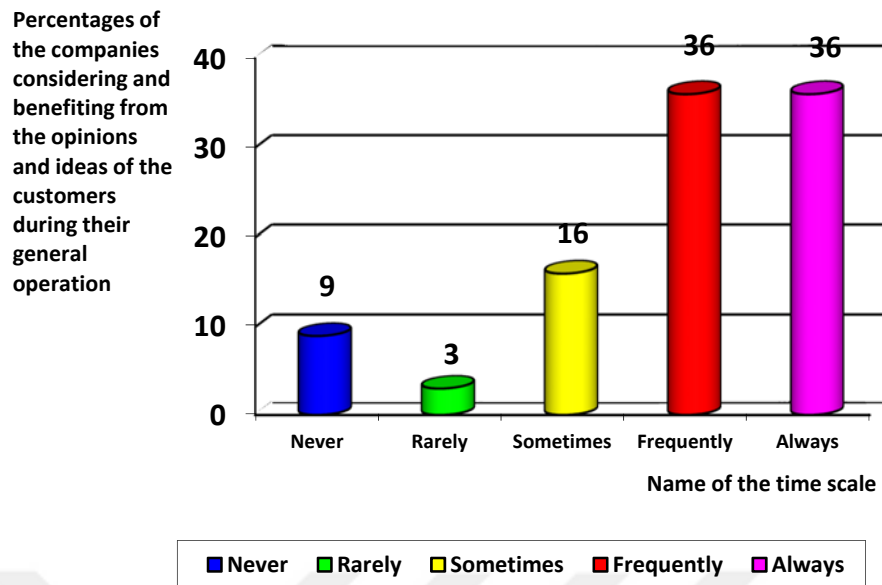


Figure 6.27 Percentages of the companies considering and benefiting from the opinions and ideas of the customers during their general operation

As seen in Figure 6.27, the highest percentage is seen in the answer choice 36% same in two different answer choices “frequently” and “always” (11 companies each). The second highest percentage noticed 16% (5 companies) in the answer choice “sometimes”. 91% of the companies somehow, often or occasionally use this OI approach.

6.2.14 Giving Importance to the Opinions and New Ideas of the Internal Partners during New Product/Process Development

In this question, it is desired to learn whether companies give importance to the opinions and new ideas of the internal partners during new product/process development. Giving importance to the opinions of the companies’ internal partners is important action to obtain different ideas and solve problems during OI. The related percentages are shown in Figure 6.28.

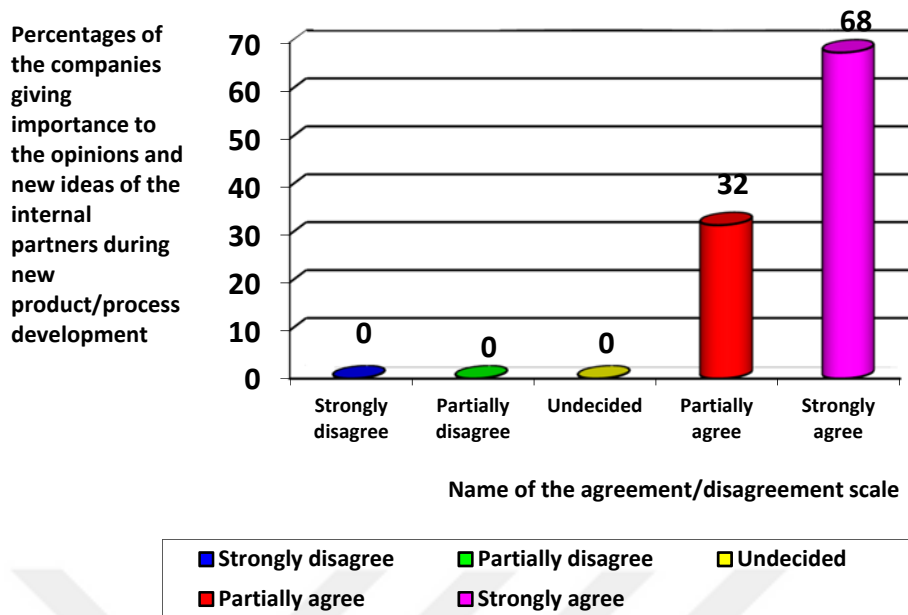


Figure 6.28 Percentages of the companies giving importance to the opinions and new ideas of the internal partners during new product/process development

As a result, more than half of the companies select the answer choice “strongly agree” which shows that they are giving importance to the opinions and new ideas of the internal partners during new product/process development. More than quarter of the companies partially agree that they are using or applying this OI approach. Consequently, all companies generally agree that they use this OI approach intensively.

6.2.15 Giving Importance to the Opinions and New Ideas of the External Partners during New Product/Process Development

In this question, it is desired to find the proportion of companies that are giving importance to the opinions and new ideas of the external partners during new product/process development. Related percentages are shown in Figure 6.29.

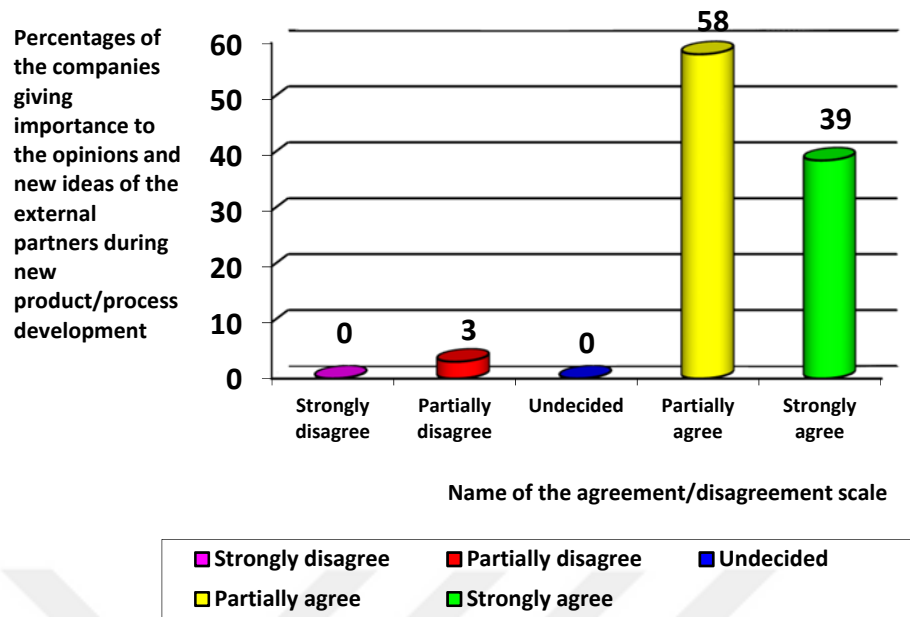


Figure 6.29 Percentages of the companies giving importance to the opinions and new ideas of the external partners during new product/process development

The highest percentage is observed in the answer choice “partially agree” with 58%, 18 companies. The second highest percentage is noticed in the answer choice “strongly agree” with 39%. 97% of the companies generally agree that they use this OI approach.

6.2.16 Having Intensive Collaboration with Internal and External Partners All the Time

In this question it is aimed to find out the proportion of the companies that are having intensive collaboration with internal and external partners all the time. The concerned percentages are shown in Figure 6.30.

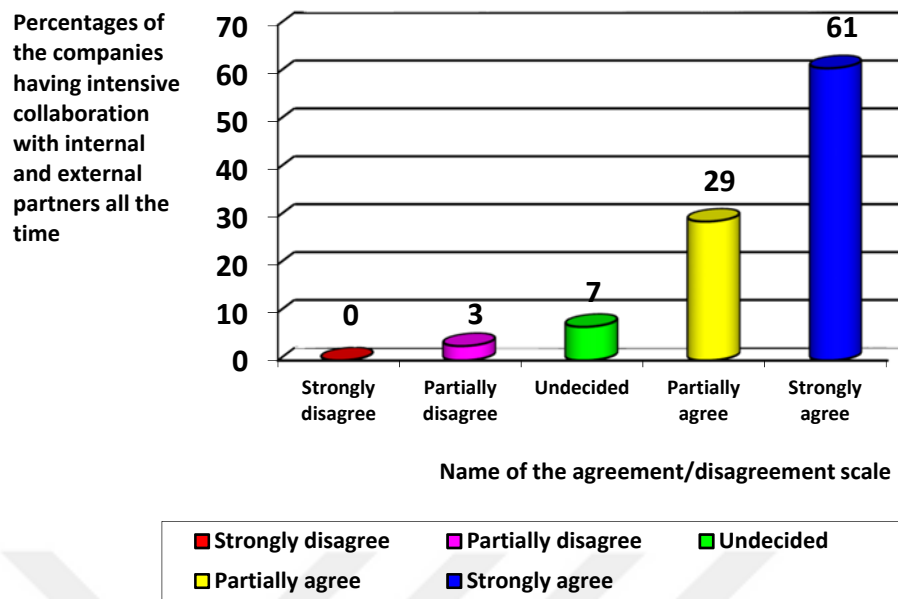


Figure 6.30 Percentages of the companies having intensive collaboration with internal and external partners all the time

As seen in Figure 6.30, the highest percentage is observed in the answer choice “strongly agree” with 61%, 19 companies. The second highest percentage is seen in the answer choice “partially agree” with 29%, 9 companies. Almost all of the companies somehow agree that they use this OI approach.

6.2.17 Having All Employees Use OI Approaches Efficiently and Effectively

In this question the aim is to find the proportion of the companies that are having all employees use OI approaches efficiently and effectively. The related percentages are indicated in Figure 6.31.

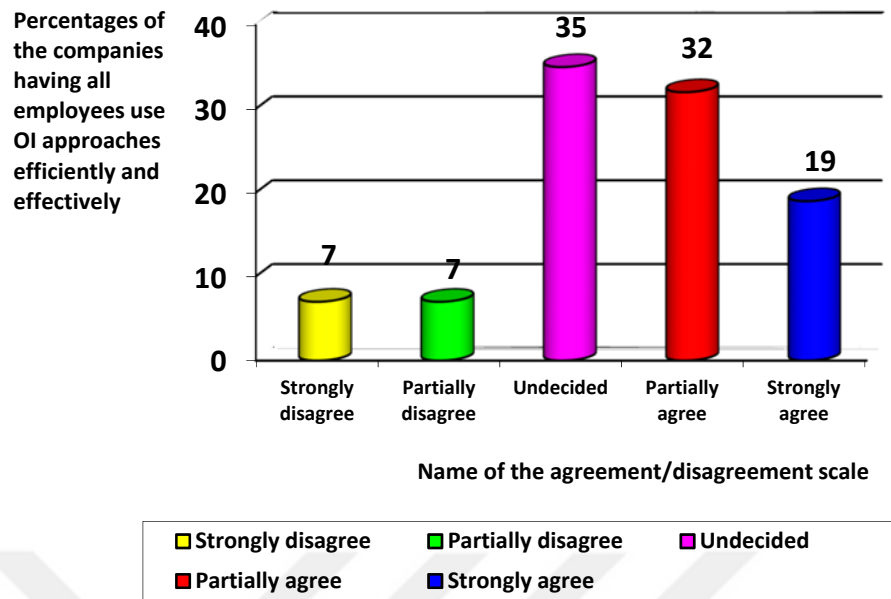


Figure 6.31 Percentages of the companies having all employees use OI approaches efficiently and effectively

As a result, the highest percentage is noticed in the answer choice “undecided” with 35%, 11 companies. The second highest percentage is recognized in the answer choice “partially agree” with 32%, 10 companies. The third highest percentage is seen in the answer choice “strongly agree” with 19%, 6 companies. Seemingly, it can be hard for the companies having all employees use this OI approach. However, 51% of the companies generally agree that they use this OI approach.

6.2.18 Having Only the Related/Responsible Workers Use OI Approaches Efficiently and Effectively

In this question the aim is to find the proportion of the companies that are having only the related/responsible workers use OI approaches efficiently and effectively. The related percentages are denoted in Figure 6.32.

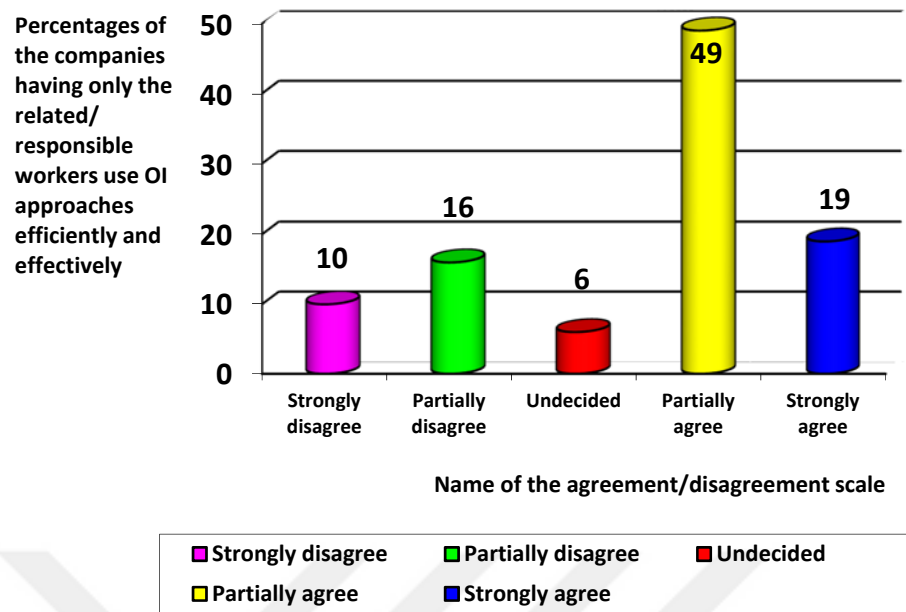


Figure 6.32 Percentages of the companies having only the related/responsible workers use OI approaches efficiently and effectively

As a result, 68% of the companies indicate that they are either “partially agree” or “strongly agree” for having only the related/responsible workers use OI approaches efficiently and effectively. 26% of the companies mostly do not agree to use this OI approach.

6.2.19 Having All Employees Know Mechanisms and Processes of OI Well

In this question it is desired to find the proportion of the companies that are having all employees know mechanisms and processes of OI well. The related percentages are displayed in Figure 6.33.

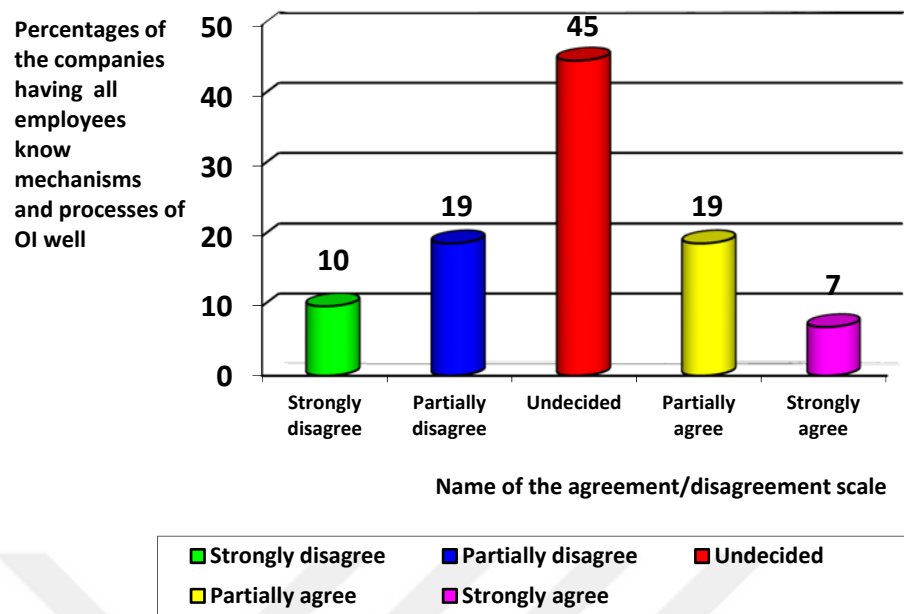


Figure 6.33 Percentages of the companies having all employees know mechanisms and processes of OI well

As seen in Figure 6.33, the highest percentage is observed in the answer choice “undecided” with 45%, 14 companies. The second highest percentages are seen in two answer choices “partially disagree” and “partially agree”. The third highest percentage is seen in the answer choice “strongly disagree” with 10%, 3 companies. 26% of the companies generally agree that they use this OI approach.

6.2.20 Having Only the Related/Responsible Workers Know Mechanisms and Processes of OI Well

In this question, it is desired to evaluate proportion of the companies that are having only the related/responsible workers know mechanisms and processes of OI well. The concerned percentages are denoted in Figure 6.34.

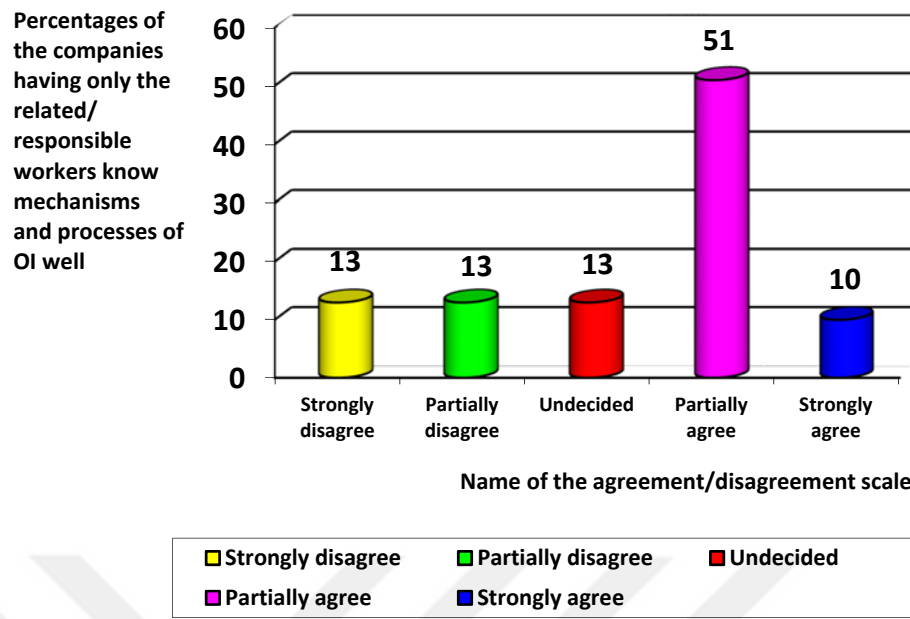


Figure 6.34 Percentages of the companies having only the related/responsible workers know mechanisms and processes of OI well

According to Figure 6.34 the highest percentage is seen in the answer choice “partially agree” with 51%, 16 companies. The second highest percentage is seen in three answer choices “strongly disagree”, “partially disagree” and “undecided” with 13%. 61% of the companies generally agree that they use this OI approach.

6.2.21 Having All Employees Know the Advantages of OI Approaches Well

In this question it is desired to determine companies that are having all employees know the advantages of OI approaches well. The related percentages are expressed in Figure 6.35.

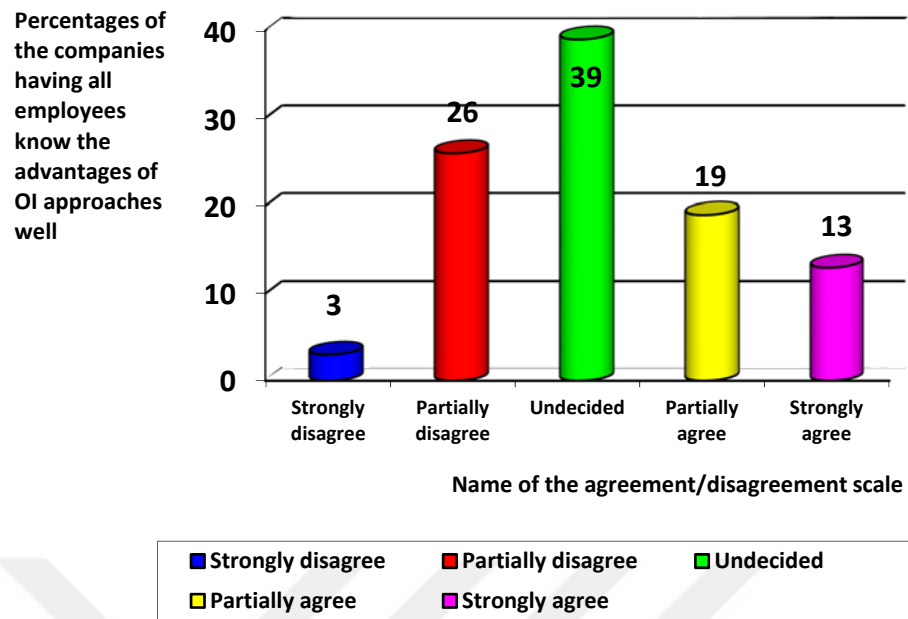


Figure 6.35 Percentages of the companies having all employees know the advantages of OI approaches well

As a result, the highest percentage is observed in the answer choice “undecided” with 39%, 12 companies. The second highest percentage is observed in the answer choice “partially agree” with 26%, 8 companies. 32% of the companies generally agree that all of their employees know the advantages of OI approaches well.

6.2.22 Having Only the Related/Responsible Workers Know the Advantages of OI Approaches Well

In this question it is desired to find the proportion of the companies that are having only the related/responsible workers know the advantages of OI approaches well. The related percentages are displayed in Figure 6.36.

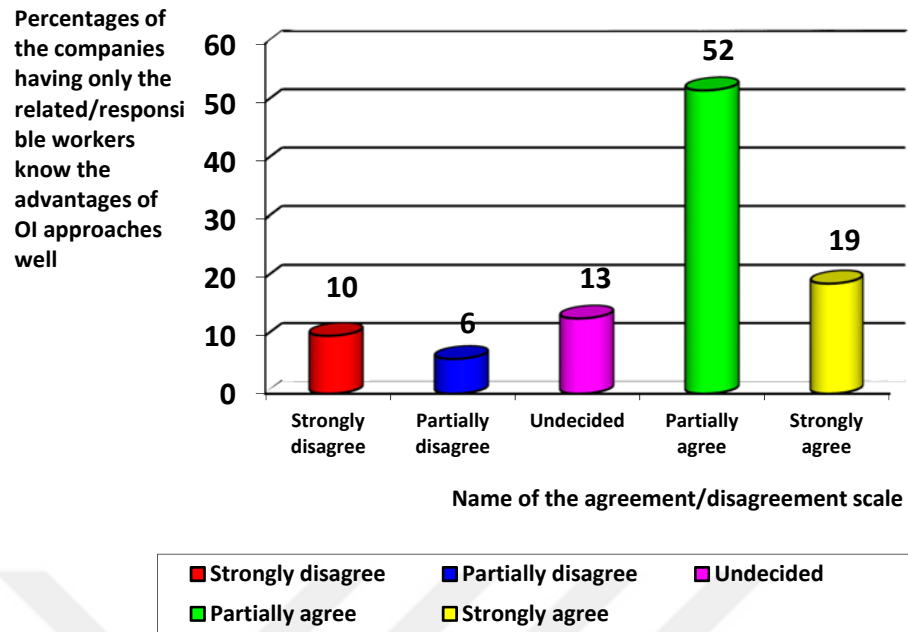


Figure 6.36 Percentages of the companies having only the related/responsible workers know the advantages of OI approaches well

Considering Figure 6.36, more than half of the companies partially agree that they are using this OI approach. 71% of the companies generally agree that only the related/responsible workers know the advantages of OI approaches well.

6.2.23 Time Period That the Companies Have Been Using OI

Using OI approaches for a long time is beneficial and advantageous for the companies because they acquire experience in their innovation activities. In this question it is desired to find out the time period that the companies have been using OI as years. The related percentages are seen in Figure 6.37 below.

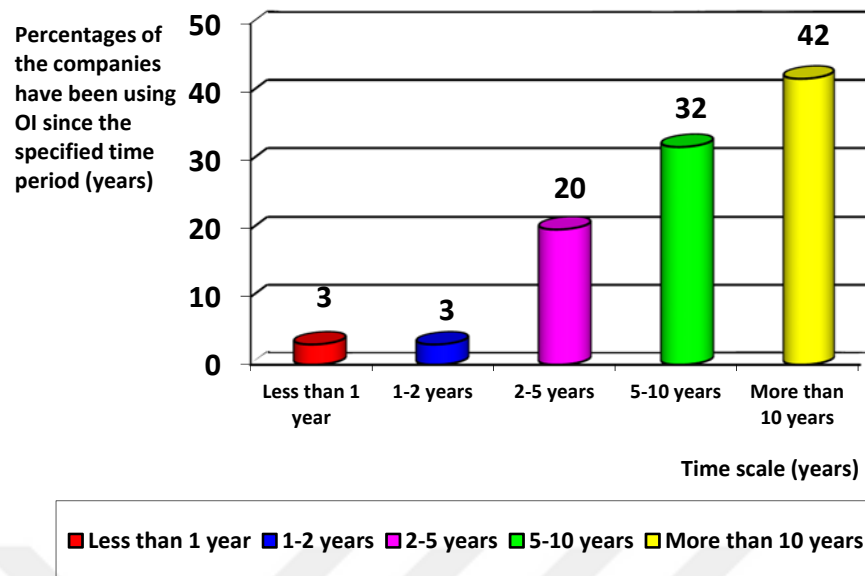


Figure 6.37 Percentages of the companies have been using OI since the specified time period (years)

As a result, it is seen that the highest percentage is in the answer choice “more than 10 years” with 42%, 13 companies. The second highest percentage is observed in the answer choice “5-10 years” with 32%, 10 companies. The third highest percentage is observed in the answer choice “2-5 years” with 20%, 6 companies. Consequently, about three-quarters of the surveyed companies indicate that they have been using OI approach more than five years.

6.2.24 Intensity of Using OI Approach

In this question, it is desired to find out OI usage proportion of the companies comparing with closed innovation (CI) (reverse of OI). Only lower bound values are included in the intervals. The related percentages are indicated in Figure 6.38.

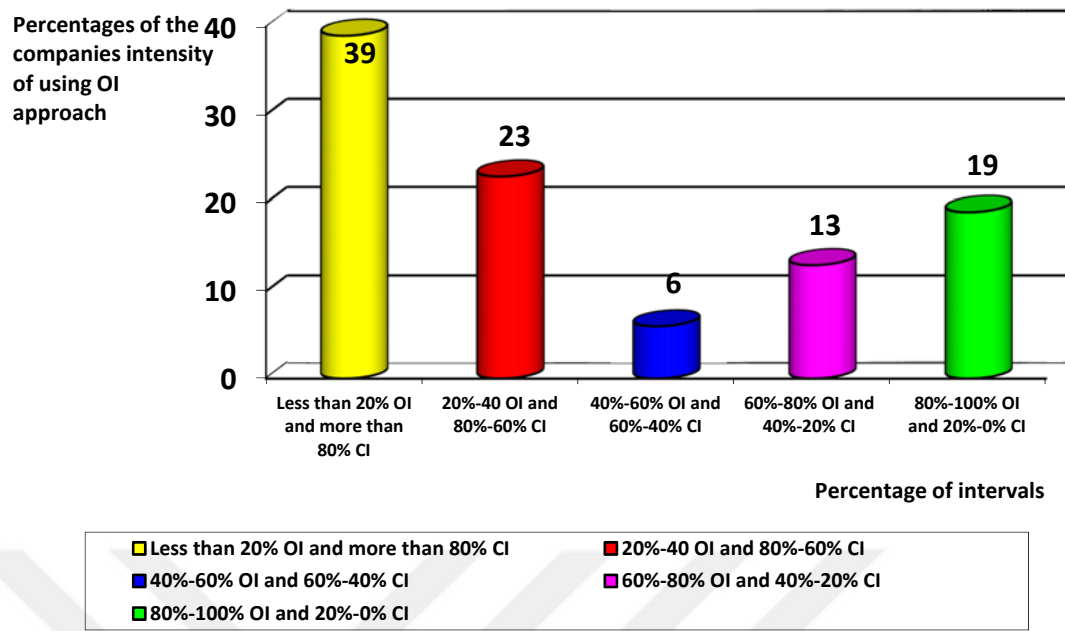


Figure 6.38 Percentages of the companies' intensity of using OI approach

The highest percentage is displayed in the answer choice “less than 20% OI and more than 80% CI” with 39%, 12 companies. The second highest percentage perceived in the answer choice “20%-40% OI and 80%-60% CI” with 23%, 7 companies. The third highest percentage is noticed in the answer choice “80%-100% OI and 20%-0% CI” with 19%, 6 companies. 38% of the companies use OI approaches with near or more than half of the innovation activities comparing with CI.

6.2.25 Budget Share for OI within Annual Innovation Budget

The objective of this question is to analyze budget share for OI within annual innovation budget of the companies. Budget share proportion for OI is important during executing OI activities. Six answer choices are adopted for this question. Only lower bound values are included in the intervals. The related percentages are indicated in Figure 6.39.

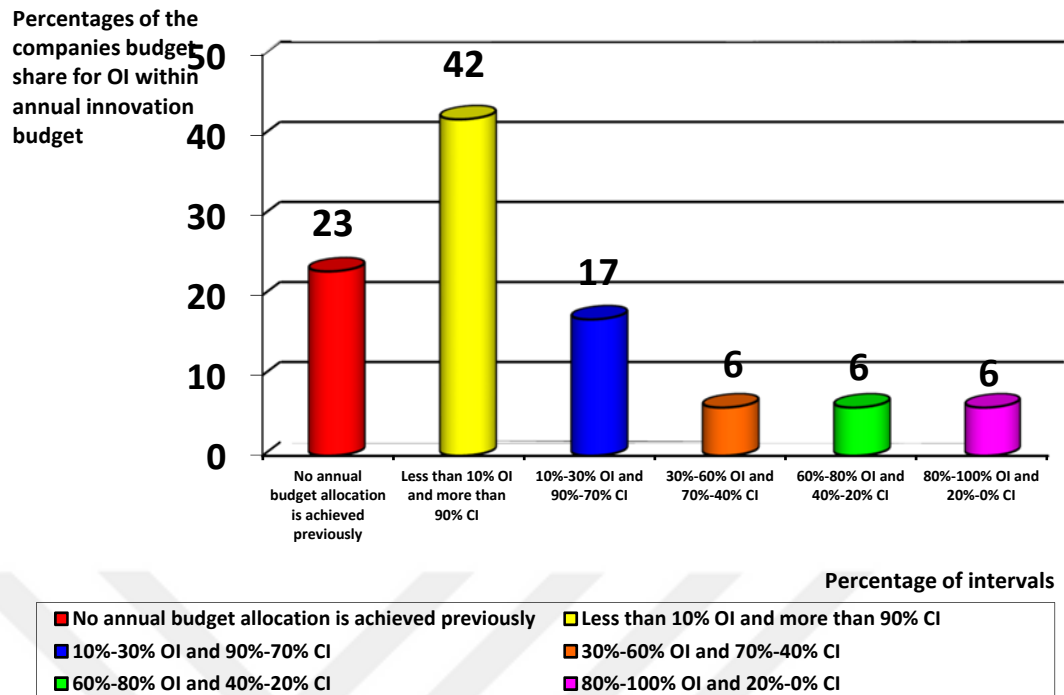


Figure 6.39 Percentages of the companies' budget share for OI within annual innovation budget

As a result, near to half of the companies allocate their annual innovation budget less than 10% for OI and more than 90% for CI. Near to quarter of the companies does not allocate any budget for OI previously. Less than quarter of the companies allocate their annual innovation budget between 10% and 30% for OI and between 90% and 70% for CI. Companies generally prefer to allocate fewer or no budget for OI expenditures.

6.3 Perceptions on Open Innovation Facilitators

The aim of the third part of the survey is to understand the perceptions of surveyed companies on OI facilitators and analyze whether these perceptions differ depending on the time period that the companies have been using OI, annual R&D expenditure to sales turnover ratio, number of employees and company age.

In this third part of the survey there are 47 questions. From 47, 4 questions are yes-no type, 1 question is multiple choice type and the remaining 42 questions are single choice questions with 5-point likert scale.

The data collected in this part of the survey are mainly ordinal. In this section, nonparametric tests are used to do the analysis. Nonparametric tests are used in the analysis of the data which are not required to fit a normal distribution. On the other hand, parametric tests contain specific probability distributions and key parameters of that distribution. Besides, the data is not continuous; it is ordinal (5 point likert-scale) or ranking type (When to use a nonparametric test, n.d.).

For testing the normality of the data on main heading (level 2) and subheading factor (level 3) values collected in the third part of the survey, **Shapiro Wilks W Test** is used. In this test, there are two hypotheses. These are:

H₀: The observed distribution fits the normal distribution (null hypothesis)

H_a: The observed distribution does not fit the normal distribution (alternative hypothesis)

According to the test of normality table given in Appendix-2, for all subheading and main heading factors the test is significant (p values are less than 0.05). H₀ is rejected and H_a is accepted. Therefore, our data do not fit to normal distribution.

In the following subsections, first the **descriptive statistics** are given, then **exploratory factor analysis** of the main headings of the facilitator factors is performed. Finally, in order to analyze whether perceptions of surveyed companies on OI facilitators differ depending on the time period that the companies have been using OI, annual R&D expenditure to sales turnover ratio, number of employees and company age, the non-parametric tests of **Mann-Whitney U Test and Kruskal-Wallis H Test** (for 7 main heading questions and 27 second level heading questions) are used.

6.3.1 Descriptive Statistics for Main and Subheading Facilitator Factors of the Third Part of the Survey

This analysis is determined to achieve for main heading and subheading facilitator factors by finding their median, mode, mean, std. error of mean, std. deviation

variance and sum values. These values are indicated Table 6.2 and 6.3. Highest median value as 5 represents that companies believe that these factors have more facilitator effect than others; however, there is no ranking here. The highest median value is seen for main headings as “OI funding”, “OI network connections”, “time management” and “company’s culture” and for subheadings as “government of EU (incentives)”, “communication technologies”, “information technologies”, “new machinery or other technological tools/equipment using or sharing”, “effective communication with direct customers”, “effective communication direct suppliers”, “effective communication with strategic alliances”, “effective communication with other network partners”, “trust (within OI network connections)”, “OI oriented new product/process development”, “flexibility”, “agility”, “behaving systematically”, “knowledge management & sharing culture”, “tolerating to different ideas culture” and “fast decision making culture”.

Table 6.2 Descriptive statistics for the main heading OI factors

Statistics		MF1	MF2	MF3	MF4	MF5	MF6	MF7
N	Valid	31	31	31	31	31	31	31
	Missing	0	0	0	0	0	0	0
Mean		4.06	4.13	4.52	3.90	3.84	4.55	4.65
Std. Error of Mean		.254	.190	.130	.176	.232	.121	.099
Median		5.00	4.00	5.00	4.00	4.00	5.00	5.00
Mode		5	5	5	4	4	5	5
Std. Deviation		1.413	1.056	.724	.978	1.293	.675	.551
Variance		1.996	1.116	.525	.957	1.673	.456	.303
Sum		126	128	140	121	119	141	144

Table 6.3 Descriptive statistics for the subheading OI factors

	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16	SF17	SF18	SF19	SF20	SF21	SF22	SF23	SF24	SF25	SF26	SF27
N Valid	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	4.06	4.71	4.74	4.39	3.55	4.52	3.42	4.45	3.77	4.32	4.26	4.45	3.61	2.52	4.03	3.81	4.32	4.03	4.00	3.68	3.94	4.13	4.39	4.48	4.65	4.65	4.42
Std. Error of Mean	.254	.095	.092	.200	.196	.138	.244	.121	.226	.182	.191	.145	.240	.240	.215	.234	.182	.199	.202	.280	.254	.235	.144	.130	.099	.143	.137
Median	5.00	5.00	5.00	5.00	4.00	5.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	2.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
Mode	5	5	5	5	4	5	3	5	5	5	5	5	5	1 ^a	5	4	5	5	4 ^a	5	5	5	5	5	5	5	5
Std. Deviation	1.413	.529	.514	1.116	1.091	.769	1.361	.675	1.257	1.013	1.064	.810	1.334	1.338	1.197	1.302	1.013	1.110	1.125	1.558	1.413	1.310	.803	.724	.551	.798	.765
Variance	1.996	.280	.265	1.245	1.189	.591	1.852	.456	1.581	1.026	1.131	.656	1.778	1.791	1.432	1.695	1.026	1.232	1.267	2.426	1.996	1.716	.645	.525	.303	.637	.585
Range	4	2	2	4	4	3	4	2	4	4	4	3	4	4	4	4	4	4	4	4	4	4	3	3	2	4	2
Sum	126	146	147	136	110	140	106	138	117	134	132	138	112	78	125	118	134	125	124	114	122	128	136	139	144	144	137

6.3.2 Exploratory Factor Analysis of the Main Headings of the Facilitator Factors

In this study exploratory factor analysis is performed with the aim of exploring whether seven main heading facilitator factors of OI are grouped into two as external and internal.

Pearce & Yong (2013) indicate the fundamental definition of exploratory factor analysis that this method summarizes data to perceive relationships and patterns easily. Exploratory factor analysis groups variables into a limited set of clusters based on shared variance. Factor analysis is divided into two main types: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). CFA aims to confirm hypotheses by using path analysis diagrams to denote factors and variables, whereas, EFA aims to expose complex patterns by exploring the dataset and testing predictions (Child, 2006). More clearly, EFA detects structures in the relationships between variables for classifying (Mindrila, 2013).

According to Mindrila (2013) there are main steps for exploratory factor analysis execution. All of these steps can be achieved in one of the statistical programs like Minitab, SAS, BMDP or SPSS. In this thesis, SPSS program is selected for EFA. EFA steps followed in this study are briefly explained below.

Step 1: Selecting variables to determine sample size.

In this first step of EFA the researcher should previously know the type of variables used in EFA and how many variables should enter to analysis (Hair, Black, Babin, Anderson, 2010). After selecting variables, there are choices named as descriptives in SPSS. In this analysis, univariate descriptives, initial solution for statistics are selected in the same program.

Step 2: Computing correlations among variables

The calculation of the input data to meet objectives by grouping variables after selecting variables in step 1 is required for step 2 (Hair, Black, Babin, Anderson, 2010). In SPSS, the researcher can either select correlation matrix or covariance matrix in this step. In this analysis, it is selected correlation matrix. Besides, in descriptives

section of the SPSS coefficients, significance levels, determinant and KMO and Bartlett's test of sphericity choices for correlation matrix are selected.

Step 3: Extraction as identifying dimensions in the data

After the variables specified and correlation matrix is formed, then the method of extracting the factors (common factor analysis or component analysis) and the number of factors selected represent the data. In the SPSS, seven different factor extracting methods exist from principal components to image factoring. In this analysis of the thesis principal components method is selected (Hair, Black, Babin & Anderson, 2010).

Step 4: Rotation

Rotation is turning of the axes of the factors until the necessary position is reached. For interpreting factors, there are two rotation types which are orthogonal factor rotation and oblique factor rotation. In the orthogonal factor rotation factors locate orthogonal and horizontal, axes are maintained 90 degrees. In the oblique rotation factors are not restricted to be in orthogonal, they are in different angles. The major orthogonal rotation methods are Quartimax, Varimax and Equimax. On the other hand, the major oblique rotation factors are Oblimin, Promax, Orthoblique, Dquart, Doblimin and Orthoblique. In SPSS statistics program one of the rotation methods as Varimax, Quartimax, Equimax, Direct Oblimin and Promax can be selected (Hair, Black, Babin & Anderson, 2010). In this analysis Oblimin method is selected for factor rotation.

Step 5: Interpretation

Interpretation is the final step for exploratory factor analysis. In this step the researcher evaluates the rotated factor loadings to find out the variables role and contribution to the factor structure. Besides, the researcher may delete of some variable(s) from the analysis or change the rotation or extraction method (Hair, Black, Babin & Anderson, 2010).

Since the aim of this study is to explore whether seven main heading facilitator factors of OI are grouped into two as external and internal, in extraction step it is selected **fixed number of factors as 2** that correspond to internal and external factors. The results of EFA are indicated in Appendix-3 by tables.

First of all, data size significance is evaluated according to KMO and Bartlett's test in Appendix-3. The level of significance (sig.) is 0.001 which is less than 0.05. Therefore, the data size is appropriate for EFA. The other important conclusion can be seen from the pattern matrix in Appendix-3. The highest values (it includes negative values because of absolute values) means that the variable should be clustered to that factor. According to the pattern matrix:

- ❖ Main factor 1 as **OI funding** with value 0.507 should be in **factor 2** that is (understood as) **external factor**
- ❖ Main factor 2 as **OI technological resources** with absolute value 0.763 should be in **factor 2**.
- ❖ Main factor 3 as **OI network connections** with value 0.778 should be in **factor 1**.
- ❖ Main factor 4 as **environment outside the company** with absolute value 0.866 should be in **factor 2**.
- ❖ Main factor 5 as **integrative organizational practices** with value 0.425 should be in **factor 1**.
- ❖ Main factor 6 as **time management** with value 0.735 should be in **factor 1**.
- ❖ Main factor 7 as **company's culture** with value 0.831 should be in **factor 1**.

The results showed a similar grouping with the main heading facilitators in Figure 4.1 as external and internal factors except the main heading facilitator factor as **OI network connections**. Factor 1 corresponds to internal factors, whereas factor 2 corresponds to external factors. This result shows that companies consider **OI network connections** as an internal facilitating factor which is managed within the procedures and rules of the company. They focus not the external partners but the company itself. If the company establish good and precise relationships with external OI network partners, the facilitating role of this factor increases. Companies unfortunately, do not tend to consider the relationships of the external partners towards the company.

6.3.3 Mann-Whitney U test for Time Period That the Companies Have Been Using OI and Subheadings of the Facilitator Factors

In this section, it is desired to understand whether perceptions of the surveyed companies on OI subheading facilitator factors differ depending on the time period that the companies have been using OI. 23rd question of the second part of the survey is taken into account while grouping the time periods. The time intervals as “less than 1 year”, “1-2 years” and “2-5 years” are taken to **time 1** as a group name. The remaining time intervals “5-10 years” and “more than 10 years” are taken to group **time 2**. Only lower bound values are included in the intervals. The following hypotheses are tested using Mann-Whitney U Test.

*H₀: The difference between perceptions of **time 1** and **time 2** groups on the 27 subheadings OI facilitator factors is not statistically significant (null hypothesis).*

*H_a: The difference between perceptions of **time 1** and **time 2** groups on the 27 subheadings OI facilitator factors is statistically significant (alternative hypothesis).*

The results for the first test are shown in Appendix-4. The results indicate that the responses of **time 1** and **time 2** groups are significantly different according to the subheading factor as **“government or European Union”** (incentives) because this factor’s p value is 0.007. In this case, H_a, alternative hypothesis is accepted for this subheading factor (H₀ is rejected). Moreover, the results also indicate that responses of **time 1** and **time 2** groups are significantly different according to the subheading factor as **“effective communication with direct customers”** because this factor’s p value is 0.023. H_a is also accepted for this subheading factor. Considering these two factors mean ranks are: for **“government or European Union”** (incentives) 9.31 for **time 1** and 18.33 for **time 2**, for **“effective communication with direct customers”** 10.69 for **time 1** and 17.85 for **time 2**. The differences between the perceptions of these two groups for these two subheading factors are high.

Besides, it can be interpreted that companies which have been using OI less than 5 (5 is included) years indicate that **“government or European Union” (incentives)** subheading factor has less facilitating role for OI comparing with companies which

have been using OI more than 5 years. Same consideration is valid for subheading factor **“effective communication with direct customers”**. For remaining 25 subheading factors H_0 , null hypothesis is accepted (H_a is rejected).

6.3.4 Mann-Whitney U Test for Annual R&D Expenditure to Sales Turnover Ratio and Subheadings of the Facilitator Factors

The objective is to perceive whether the perceptions of the surveyed companies on OI subheading facilitator factors differ depending on annual R&D expenditure to sales turnover ratio. Annual R&D expenditure to sales turnover ratio subject is analyzed in the section 6.1.10 above. It is divided into 2 groups: Between 0 and 2.9 (endpoints are included) R&D expenditure to sales turnover ratio values are taken to **rdtosales 1** as a group name and between 3.0 and 90.0 (endpoints are included) are taken to **rdtosales 2**. The following hypotheses are tested using Mann-Whitney U Test.

*H_0 : The difference between perceptions of **rdsales 1** and **rdsales 2** groups on the 27 subheadings OI facilitator factors is not statistically significant (null hypothesis).*

*H_a : The difference between perceptions of **rdsales 1** and **rdsales 2** groups on the 27 subheadings OI facilitator factors is statistically significant (alternative hypothesis).*

The results for the second test are indicated in Appendix-5. It is specified that the responses of **rdtosales 1** and **rdtosales2** groups are significantly different according to the subheading factor as **“government or European Union”** (incentives) because this subheading p value is 0.035, $p < 0.05$. In this case, for this subheading factor, H_0 is rejected and H_a is accepted. Therefore, for the companies having R&D expenditure to sales turnover ratio less than 3.0 **“government or European Union”** (incentives) subheading factor has a less facilitating role for OI comparing with companies having R&D expenditure to sales turnover ratio more than 3.0 (3.0 included). For remaining 26 subheading factors H_0 , null hypothesis is accepted (H_a is rejected).

6.3.5 Mann-Whitney U Test for Companies' Number of Employees and Subheadings of the Facilitator Factors

In this test, the objective is to figure out whether the perceptions of the surveyed companies on OI subheading facilitator factors differ depending on companies' number of employees. Distribution of the companies' number of employees, which is asked in the first part of the survey, are explained in section 6.1.7 above.

For the analysis companies' number of employees is divided into 2 groups: less than 250 employees (250 is included), which are small and medium sized companies, are taken to **empsub 1** group and 251 and more employees, which are large sized companies, are taken to **empsub 2** group. The following hypotheses are tested using Mann-Whitney U Test.

*H₀: The difference between perceptions of **empsub 1** and **empsub 2** groups on the 27 subheadings OI facilitator factors is not statistically significant (null hypothesis).*

*H_a: The difference between perceptions of **empsub 1** and **empsub 2** groups on the 27 subheadings OI facilitator factors is statistically significant (alternative hypothesis).*

The results for the third test are shown in Appendix-6. For Interpreting test statistics, $p < 0.05$ is seen in 4 subheading facilitator factors. These are **“government or European Union”** (incentives) with $p = 0.001$, **“accomplishing government regulations”** with $p = 0.033$, **“OI oriented portfolio management”** with $p = 0.026$ and **“tolerancing to different ideas culture”** with $p = 0.041$. For these four subheading factors H_a is accepted and H_0 is rejected. The responses of **empsub 1** and **empsub 2** groups are significantly different according to these three subheading factors. Considering the small and medium sized companies, **“government or European Union”** (incentives), **“accomplishing government regulations”** and **“OI oriented portfolio management”** subheading factors have less facilitating role for OI comparing with the large sized companies. For the other remaining 23 subheading facilitating factors H_0 is accepted and H_a is rejected.

6.3.6 Kruskal-Wallis H Test for Ages of the Companies and Subheadings of the Facilitator Factors

Kruskal-Wallis H test is appropriate to understand whether the perceptions of the surveyed companies on OI subheading facilitator factors differ depending on ages of the companies because age of the companies are analysed in three different groups.

Companies' ages less than 20 years (20 included) are taken to **age 1** as a group name. Ages between 21 and 50 (interval endpoints are included) are taken to **age 2** group. Ages more than 50 (50 excluded) are taken to **age 3** group. The results for the fourth test are specified in Appendix-7. The following hypotheses are tested using Kruskal-Wallis H test.

*H₀: The differences between perceptions of **age 1**, **age 2** and **age 3** groups on the 27 subheadings OI facilitator factors are not statistically significant (null hypothesis).*

*H_a: The differences between perceptions of **age 1**, **age 2** and **age 3** groups on the 27 subheadings OI facilitator factors are statistically significant (alternative hypothesis).*

As a result, the responses of **age 1**, **age 2** and **age 3** groups are significantly different according to **“effective communication with IPR experts”** subheading factor because the factor's p value is equal to 0.026, less than 0.05. Mean ranks are 7.2, 19.06 and 15.11 from **age 1** to **age 3** respectively. **“Effective communication with IPR experts”** subheading factor has the most facilitating role for OI according to the companies' ages between 21 and 50 years. Same subheading factor has less facilitating role according to the companies' ages more than 50 and less than 20 years. Therefore, for this subheading facilitator factor H_a is accepted (H₀ is rejected) and for the remaining 26 subheading factors H₀ is accepted (H_a is rejected).

6.3.7 Mann-Whitney U Test for Companies' Number of Employees and Main headings of the Facilitator Factors

The objective is to figure out whether the perceptions of the surveyed companies on OI main heading facilitator factors differ depending on the companies' number of

employees. This section is nearly similar with section 6.3.5 however, in 6.3.5 subheadings of the facilitator factors (totally 27) are test variables. On the other hand, in this section main headings of the facilitator factors (totally 7 main headings) are test variables. The independent variable is selected as the companies' number of employees because many significant relationships was observed in the test results explained in section 6.3.5.

Same group intervals exist with the section 6.3.5 but the groups names change to **empmain 1** and **empmain 2**. The results for the fifth test are specified in Appendix-8. The following hypotheses are tested using Mann-Whitney U Test.

*H₀: The difference between perceptions of **empmain 1** and **empmain 2** groups on the 27 subheadings OI facilitator factors is not statistically significant (null hypothesis).*

*H_a: The difference between perceptions of **empmain 1** and **empmain 2** groups on the 27 subheadings OI facilitator factors is statistically significant (alternative hypothesis).*

As a result, the responses of **empmain 1** and **empmain 2** groups are significantly different according to the main heading factor **OI funding**. Its p value is 0.001 with mean rank 4.90 for **empmain 1** and 18.13 for **empmain 2**. For the **OI funding** main heading factor H_a is accepted (H₀ is rejected). For the remaining 6 main heading facilitator factors H₀ is accepted (H_a is rejected). According to the small and medium sized companies this factor has less facilitating role for OI comparing with large sized companies.

6.4 Perceptions on the Most Important OI Facilitators

The aim of the fourth part of the survey is to analyze the perceived importance of the OI facilitators by practitioners. A common method of obtaining data on the relative importance of a number of factors is to ask respondents to rank these factors.

Totally 7 main heading and 27 subheading (second level) facilitator factors are rigorously considered and ranked according to their importance level by the survey respondents. For the first 7 main headings, all of them must be selected to rank;

however, for the 27 subheadings only 10 of them must be selected first and then must be ranked by the companies' survey respondents. In their ranking "1" corresponds to the most important OI factor.

There are many methodologies in statics for ranking techniques. Some of them are simple additive ranking (SAR), utility function, partial order ranking (POR), accumulated partial order ranking (APOR) and total ranking etc. Moreover, there exist ranking programs. The most famous one is DART software (Amutova, Carlsen, Sailaukhanuly, & Zhakupbekova, 2013). These techniques achieve selection from different criteria (they are in the method of multiple criteria decision analysis); however, in this thesis the last section only has categorical numbers (not descriptive numbers). Nevertheless, our total survey companies as 31, could be selected as criteria to form criteria/factor matrix, but this analysis did not made.

Our methodology for determining the relative importance of the main heading and subheading factors are the same. The objective is to rank the factors according to their facilitator effect. Then, calculate their scores to understand their relative importance. For example, if a factor is ranked in the first place by a respondent, then its score is $8-1=7$ for that respondent. For 7 main heading factors, the number of 8 is subtracted from the rank value. Similarly, for 10 (selected from 27) subheading factors, the number of 11 is subtracted from the rank value. Then the scores of all respondents are added to find a total score for each OI factor.

According to this analysis for main heading facilitators the scores are indicated in Table 6.4 below.

Table 6.4 The rank of the facilitator effect of the main heading OI factors according to analysis results

<u>The rank of the main heading</u>	<u>Main heading name</u>	<u>Scores</u>
1	Company's culture	185
2	OI funding	136
3	OI technological resources	132
4	OI network connections	126

Table 6.4 The rank of the facilitator effect of the main heading OI factors according to analysis results (continue)

5	Integrative organizational practices	122
6	Time management	105
7	Environment outside the company	62

According to this analysis for subheading facilitators the scores are indicated in Table 6.5 below. Every main heading, as explained in the chapter four, have (second level) subheading factor/factors. Table 6.6 summarizes the scores of all main heading OI factors and their respective subheading factors.

Table 6.5 The rank of the facilitator effect of the subheading OI factors according to analysis results

<u>The rank of the subheading</u>	<u>Subheading name</u>	<u>Scores</u>
1	Effective communication with direct customers	162
2	OI oriented new product/process development	143
3	Government or EU (incentives)	126
4	Behaving systematically	100
5	Fast decision making culture	97
6	Tolerancing to different ideas culture	96
7	Knowledge management & sharing culture	88
8	Effective communication with other network partners (universities, institutes, etc.)	87
9	Effective communication with suppliers	70
10	Agility	66
11	New machinery or other technological tools/equipment using or sharing	64

Table 6.5 The rank of the facilitator effect of the subheading OI factors according to analysis results (continue)

12	Effective communication with strategic alliances	64
13	OI employee involvement	64
14	OI long term investment	62
15	Flexibility	58
16	Information technologies	56
17	OI strategy processes	54
18	Trust (within OI network connections)	53
19	Trust (within integrative organizational practices)	53
20	Communication technologies	40
21	Accomplishing government regulations	28
22	Outsourcing R&D frequency	26
23	Effective communication with IPR experts	19
24	Effective communication with indirect customers	18
25	OI oriented portfolio management	7
26	Other geographical conditions of the company's location	4
27	Climate conditions in the company's location	0

Table 6.6 Demonstrating summary of main heading and subheading OI factors

Main heading factors' name	Company's culture		OI funding		OI technological resources		OI network connections		Integrative organizational practices		Time management		Environment outside the company			
Main heading factors' scores	185		136		132		126		122		105		62			
Subheading factors' numbers and names	25. Knowledge management & sharing culture		1. Government or European Union (as incentive)		2. Communication Technologies (for OI)		6. Effective communication with direct customers		16. OI long-term investment		23. Agility		13. Accomplishing government regulations			
	26. Tolerancing to different ideas culture				3. Information Technologies (for OI)		7. Effective communication with indirect customers		17. OI oriented new product/process development		24. Behaving systematically		14. Climate conditions in the company's location			
	27. Fast decision making culture				4. New machinery or other technological tools/equipments using or sharing		8. Effective communication with suppliers		18. OI strategy processes				15. Other geographical conditions of the company's location			
					5. Outsourcing R&D frequency		9. Effective communication with IPR experts		19. OI oriented portfolio management							
							10. Effective communication with strategic alliances		20. OI employee involvement							
							11. Effective communication with other network		21. Trust (within company's workers)							
							12. Trust (within OI network connections)		22. Flexibility							
Subheading factors' scores	25	88	1	126	2	40	6	162	16	62	23	66	13	28		
	26	96			3	56	7	18	17	143	24	100	14	0		
	27	97			4	64	8	70	18	54			15	4		
					5	26	9	19	19	7						
							10	64	20	64						
							11	87	21	53						
							12	53	22	58						

6.4.1 Findings of the Ranking the Total 7 Main Headings and 27 Subheadings of OI Facilitators

According to these 3 tables many conclusions can be established. Taking into account of the first rank for main heading OI factors, **company's culture** is seen with value 185. **Company's culture** is analysed in the group of internal facilitators. In second rank of the main heading OI factors **OI funding** is seen. The third rank of the main heading OI factors **OI technological resources** is seen. The highest facilitator effects are observed in **company's culture**, then **OI funding** and then **OI technological resources** for all sectors in Turkey.

Taking into account for the subheading OI factors the first rank is realized as **effective communication with direct customers** with value 162, the second rank is observed as **OI oriented new product/process development** and the third rank is noticed as **government or EU (incentives)**. **Effective communication with direct customers** is analysed in the group of external facilitators.

Company's culture, which refers the mission, vision, beliefs and behaviors for implementing OI approach, is very important for all companies in all sectors. As a mission, comprehensive and sustained methods are executed with encompassing all of the goals of the companies for OI. As a vision, the total accomplishments of the companies are planned to be executed for the specified coming years as assigned future points for OI. Exact and excellent executions and plans should be achieved for both mission and vision for OI. Besides, as its intangible side, beliefs and behaviors for the OI approaches are also significant. Feeling excited to discover new things, working intensively and being determined are the required behaviors for OI. Consequently, it can be interpreted that the highest score of the main headings found as **company's culture** is not an unexpected or surprised result.

OI funding refers to the total budget share for OI approaches and activities. In all sectors, companies necessarily require funding for OI. It does not matter whether the funding is received previously or at the time while the OI project begins. For this point

of view, **OI funding** is especially important for all companies. It is different when compared with subheading **OI budget** in the main heading of **integrative organizational practices** because arranging a budget inside the company for OI is more difficult than receiving the fund from other companies, agencies, organizations, institutions or government. Although in the literature there are some studies showing the complementary effect of the funding for OI in other countries, no study has been published for the companies in Turkey yet (Salmi, 2012). Therefore, finding second highest score facilitator factor as **OI funding** for OI approaches bears a new contribution for the literature.

The third highest score as **OI technological resources** represent that companies significantly need technological infrastructure for execution and completion all OI approaches and activities. Within these technological resources all of the hardware, software, documentation, machinery for information and communication are included. Besides, as indicated in chapter four, outsourcing R&D frequency is also included in this main heading factor. Every process of OI application requires technological resource, for instance, ERP software programs as Mapics, SAP, Quora for the companies in Turkey. There are more “OI specific” programs for enterprises; for instance, eZassi is one of them (eZassi open innovation with IP protection, n.d.). However, surveyed companies do not prefer “OI specific” programs in Turkey. There are some studies about this factor effect on OI in the literature; however no study has been published for the companies in Turkey yet.

Considering (second level) subheading factors, the highest scored subheading factor as **effective communication with direct customers** represents the importance of communication with direct customers during OI approaches and activities for the customers. Consulting and bringing the opinions and criticisms of the customers is required in research, innovation and other process of the OI for the companies. There are some studies in literature about the effect of this factor in Turkey (Şimşek, 2015). This finding contributes to the literature by iterating and providing intense focus on this factor.

The second highest scored subheading factor as **OI oriented new product/process development** represents the importance of the OI orientation during new product/process development. The relationship is two sided: OI orientates new product/process development and new product/process development methods and phases facilitate OI. Both cases are beneficial for OI approaches and also for companies. Unfortunately, in the literature there are few studies displaying beneficial effect of **OI oriented new product/process development** for OI. No study has been published for the companies in Turkey yet. For this reason, this finding provides an important contribution to the literature.

Government or EU (incentives) is the third highest scored subheading factor which represents the importance and necessity for OI approaches and activities. Often and sometimes regular cash flow of the companies is interrupted because of many political, financial and legal reasons. As in every operation of the company, OI also need budget to execute its activities. Funding from government or European Union is important for the companies in Turkey. There are some studies considering this subheading factor effect for OI in the literature including publications from Turkey also. This finding contributes to the literature by iterating and providing intense focus on this factor.

There is no consistency of the highest three scores of main heading and subheading factors. Highest three main heading's subfactors are not scored in first three except for the main heading **OI funding**. Its subheading has also the third highest score. Same situation also valid for the highest three scored subheadings; their main headings have not got the highest three scores. According to these findings, facilitator effect of main heading and subheading factors are different for OI, although mainheadings are the combination of the related subheadings.

The results of the survey should be interpreted carefully because of the small sample size. However, it is also important to acknowledge that convincing practitioners to participate and collecting real data from them in studies especially on innovation related subjects is very difficult. This is particularly even more difficult in Turkey. As

the number of academic studies on innovation related subjects and their benefits for practitioners in Turkey increases, data collection may get easier.



CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

Open innovation is a concept that provides and maintains knowledge inflow and outflow without boundaries not only in R&D activities but also in other operations of the companies. For this perspective, OI always has been intensively desired methodology not only for private sector but also for government from past to present. Probably, its popularity and reputation is going to continue in the future.

Reviewing the literature, it is observed that there is no publication of a comprehensive study encompassing all the related subjects for analyzing OI facilitator factors for the companies in Turkey. This gap called a need to constitute a study for analyzing facilitator factors of the OI for the companies in Turkey. Therefore, the aim of this study was to identify the facilitator factors for OI by the aid of literature and other resources and find out the most facilitating ones for OI for companies in Turkey. For the data collection, a comprehensive survey was constituted with face-to-face interviews with the companies in Turkey. Several methods as exploratory factor analysis, Kruskal-Wallis H and Mann-Whitney U Nonparametric tests and score-based analysis of rank-ordered data were used for the analysis.

There are many main heading and subheading factors facilitating OI approaches. These factors are identified from the literature and investigated in companies in Turkey. OI is not a new concept for Turkey; the findings of the survey indicated that most of the companies have been using OI for ten years or more. 31 companies were participated in the survey. Interviews were achieved with companies operating in 16 sectors as armatures (bathroom fixtures), plumbing, natural gas valves, white goods, computer and mobile technology, computer technology and electronic, small home appliance, food industry, heating and cooling systems, climatization and industrial automation, chemical industry, kitchen equipment, industrial cooking systems, automation and telemetry systems, automotive, textile industry and flat aluminum.

27 different subheading facilitator factors and 7 different main heading facilitator factors are constituted from the literature. Subheading factors are “government or European Union (as incentive)”, “communication technologies (for OI)”, “information technologies (for OI)”, “new machinery or other technological tools/equipment using or sharing”, “outsourcing R&D frequency”, “effective communication with direct customers”, “effective communication with indirect customers”, “effective communication with suppliers”, “effective communication with IPR experts”, “effective communication with strategic alliances”, “effective communication with other network partners”, “trust (within OI network connections)”, “accomplishing government regulations”, “climate conditions in the company’s location”, “other geographical conditions of the company’s location”, “OI long-term investment”, “OI oriented new product/process development”, “OI strategy processes”, “OI oriented portfolio management”, “OI employee involvement”, “trust (within company’s workers)”, “flexibility”, “agility”, “behaving systematically”, “knowledge management & sharing culture”, “tolerancing to different ideas culture” and “fast decision making culture”. On the other hand, main heading factors are “OI funding”, “OI technological resources”, “OI network connections”, “environment outside the company”, “integrative organizational practices”, “time management” and “company’s culture”. In the results, the first three main heading facilitator factors for OI according to the scores are “company’s culture”, “OI funding” and “OI technological resources”. The first three subheading factors for OI according to the scores are “effective communication with direct customers”, “OI oriented new product/process development” and “government or EU” (incentives).

The more detailed objective is to find the most facilitating main heading and subheading factors within both internal and external facilitator factor groups. Facilitator factors’ determination differs from sector, company and respondent’s position. Our results show that “company’s culture”, as it is assumed as main heading in our thesis, is the first facilitator for OI. Companies mention that without culture no OI or OI approach occur. Looking for subheadings, our results represents “effective communication with direct customers” is the first facilitator subfactor for OI. Companies from all sectors give high importance and emphasis on relationships with

the customers. They claim that for effective OI execution, effective communication with direct customers is necessary. Surveyed companies also indicate importance, interest, attention and emphasis on main heading factors as “OI funding” and “OI technological resources for OI” and subheading factors as “OI oriented new product/process development” and “government or EU” (incentives).

Besides, thinking of the nonparametric test solutions, perceived facilitator effect of “government or European Union” (incentives) factor significantly differs depending on the groups of annual R&D expenditure to sales turnover ratio, companies’ number of employees and time period that the companies have been using OI. The divided groups are significantly different according to this factor. In the ranking results, this factor has the third highest score; for this reason it can be concluded that “government or European Union” (incentives) both facilitates OI and the perceived level of this facilitating effect on OI significantly differs by annual R&D expenditure to sales turnover ratio, company size and OI usage time.

This study has many contributions to the business life. Firstly, all types either joint stock or limited, all sized and all aged companies in Turkey can utilize, get profit and lighten their business life not only in their R&D activities but also in other operations by this study. This study is completed in Turkey; however companies from other countries can also get benefit and guidance for their OI activities. Besides, this study also explains impediment factors for OI as well as facilitators. It is a comprehensive, detailed and advanced guidance for existing business owners as well as new entrepreneurs dealing with innovation or innovation related activities.

Moreover, according to the literature, the findings are important because until now there has not been any comprehensive study for investigating OI facilitators in various company types and industrial sectors in a country. Academics, researchers and other people dealing with OI approaches and activities can get benefit from this study. For recommendation, companies should always give importance to not only the first rank of the facilitators, but also the other following two ranks of the facilitator factors and subfactors for OI approaches.

As future research directions, the number of the surveyed companies can be increased in each sector and the analysis for the 4th part of the survey can be achieved for each sector. Future studies can also investigate the relationship between facilitator factors and OI performance and also overall innovation performance at company level. Another interesting research area can be an in-depth study of OI culture.



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APPENDICES

APPENDIX-1: Survey Questions

These survey questions about *Open Innovation Facilitators* are asked to Turkish companies. It is arranged in Turkish language.



Sayın Yetkili;

Bu çalışma, Dokuz Eylül Üniversitesi Endüstri Mühendisliği Bölümünde yürütülen “Türkiye’deki firmalarda Açık İnovasyonu Kolaylaştırıcı İç ve Dış Mekanizmalar” başlıklı Yüksek Lisans Tezi kapsamında oluşturulan anket sorularını içermektedir ve aşağıdaki amaçların biçimlemesi ve ölçülmesi üzerine oluşturulmuştur.

1. Firma ile ilgili genel sorular
2. Firmanızın açık inovasyona bakışı
3. Açık inovasyon kolaylaştırıcılarının belirlenmesi
4. Açık inovasyon kolaylaştırıcılarının önceliklendirilmesi

Gizlilik Politikası

1. Bu çalışmaya katılan firmaların verdikleri bilgiler ve cevaplar üçüncü firma, kurum, veya kişilerle kesinlikle paylaşılmayacaktır.
2. Bu Yüksek Lisans Tezinden üretilecek dokümanlarda, çalışmaya katılan firmaların ismi yayınlanmayacaktır. Sadece, sektör veya işletmenin faaliyet gösterdiği alana göre çeşitli belirlenen başlıklar altında istatistiksel sonuçlar yayınlanıp paylaşılacaktır.
3. Ankete katılan firmalar ile eğer isterlerse çalışmanın sonuçları geri bildirimle paylaşılacaktır.

Soruların cevaplanması yaklaşık 20 dakika sürmektedir.

Gösterdiğiniz ilgi ve destek için çok teşekkür ederiz.

Gül Özkan – Dokuz Eylül Üniversitesi Endüstri Müh. Böl. Yüksek Lisans Öğrencisi.

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ÖNEMLİ NOT: Bu anket soruları Dokuz Eylül Üniversitesi Endüstri Mühendisliği Bölümünde yürütülen “Türkiye’deki firmalarda Açık İnovasyonu Kolaylaştırıcı İç ve Dış Mekanizmalar” başlıklı Yüksek Lisans Tezi kapsamında oluşturulmuştur ve tüm hakları saklıdır. İzinsiz şekilde kopyalanması ve çoğaltılması kesinlikle yasaktır.

Firmanızın ticari yazışma adı:

Firma adresi:

Adınız Soyadınız:

Firmada çalıştığınız alan:

Firmada hangi pozisyonda çalışmaktasınız?

- ☐ CEO/Üst Yönetim
- ☐ Bölüm Yöneticisi
- ☐ Bölüm Uzmanı/Mühendisi
- ☐ Bölüm Elemanı

Telefon numaranız:

e-mail adresiniz:

Anketin tümünde uygulanan kısaltmalar

Aİ: Açık inovasyon

1. Firma ile ilgili genel sorular

Lütfen aşağıdaki sorulara cevaplarınızı sorunun yan tarafında verilen boşluğa yazınız.

1.1 Firmanızın kuruluş yılı nedir?

1.2 Firmanız herhangi bir sanayi bölgesi, teknoloji parkı, serbest bölge içinde midir?
(Öyle ise lütfen nerede yer aldığını belirtiniz.)

1.3 Firmanızın faaliyet gösterdiği sektör/alan nedir?

1.4 Firmanızdaki toplam tam zamanlı çalışan sayısı nedir?

1.5 Firmanızda kaç adet beyaz yakalı çalışan bulunmaktadır?

1.6 Firmanızda kaç adet mavi yakalı çalışan bulunmaktadır?

Aşağıdaki soruları lütfen ilgili şıkkı işaretlererek cevaplayınız.

1.7 Firmanızı nasıl tanımlarsınız?

- ☐ Bağımsız kuruluş

() Başka firmanın yan kuruluşu

1.8 Firmanızın yıllık cirosu yaklaşık olarak ne kadardır?

() 250.000 TL den az

() 250.000 TL - 500.000 TL arası

() 500.000 TL – 1 milyon TL arası

() 1 milyon TL – 5 milyon TL arası

() 5 milyon TL – 10 milyon TL arası

() 10 milyon TL den büyük

1.9 Firmanızın araştırma ve geliştirme (R&D) için ayrılan yıllık harcaması cironun yaklaşık % kaçdır?

1.10 Firmanızın aktif rol oynadığı ve faaliyet sürdüğü pazar türü nasıldır?

() İç pazar (yurtiçine yönelik)

() Dış pazar (yurtdışına yönelik)

() Hem iç hem de dış Pazar (hem yurtiçi hem de yurtdışına yönelik)

1.11 Firmanızda satışını yaptığınız toplam ürün çeşitliliği yaklaşık ne kadardır? (Bu ürün çeşitliliğine sizin satış işleminize göre bitmiş ürün, yarı ürün, hammadde girebilir.)

() 1- 100 adet arası farklı türde satış ürünü

() 100 – 1.000 adet arası farklı türde satış ürünü

() 1.000 – 10.000 adet arası farklı türde satış ürünü

() 10.000 – 50.000 adet arası farklı türde satış ürünü

() 50.000 den fazla

2. Firmanızın açık inovasyona bakışı

Aşağıda belirtilen tanımlar 2.1- 2.25 nolu sorular için geçerlidir.

İnovasyonun Tanımı: İnovasyon işletme içi uygulamalarda, iş yeri organizasyonunda veya dış ilişkilerde yeni veya önemli derecede iyileştirilmiş bir ürün (mal veya hizmet) veya süreç, yeni bir pazarlama yöntemi ya da yeni bir organizasyonel yöntemin gerçekleştirilmesi veya ortaya konulmasıdır (defining innovation, 2008).

İnovasyon Çeşitleri: En çok kullanılan iki inovasyon çeşidinin açıklaması şu şekildedir. 1. **Ürün inovasyonu:** Mevcut özellikleri veya öngörülen kullanımlarına göre yeni ya da önemli derecede iyileştirilmiş bir mal veya hizmetin ortaya konulmasıdır.

2. **Süreç inovasyonu:** Üretim ya da dağıtım methodlarının uygulamalarında yapılan önemli derecede geliştirme, iyileştirme çalışmaları ya da yepyeni bir süreç oluşturmaktır (inovasyonun özellikleri ve türleri, n.d.).

Kapalı İnovasyon: Firmanın yeni ürün/süreç geliştirirken tamamen iç kaynaklarını kullandığı, hiçbir dış partner (birey, kurum, merkez, diğer firmalar vb.) ile birlikte çalışmadığı, aynı zamanda kendi inovasyon faaliyetleri sonucunda ortaya çıkan patent, fikri mülkiyet hakkı veya diğer yasal haklarını hiçbir dış partner ile paylaşmadığı inovasyon yaklaşımıdır (inovasyonun özellikleri ve türleri, n.d.).

Açık İnovasyon: Firma dışından firma içine ve/veya firma içinden dışarıya yeni fikir ve bilgi akışının olduğu inovasyon yaklaşımıdır (open innovation, n.d.).

Dış Partnerler: Dış partnerler firmanın bilgi, inovasyon (yenilik) veya fikir paylaştığı tedarikçiler, direkt müşteriler, dolaylı müşteriler, enstitüler, fikri mülkiyet hakları uzmanları, üniversiteler, rakip firmalar ve diğer kurum ve kuruluşlardır (Brunswick & Vanhaverbeke, 2015), (Jarvenpaa & Wernick, 2012).

İç Partnerler: İç partnerler firmanın baştaki yöneticilerinden (hissedar, CEO vb.) içindeki tüm departmanların yönetici ve çalışanlarına (gerek beyaz yaka, gerekse mavi yaka) dek olan bireylerdir (Brunswick & Chesbrough, 2013).

İşbirliği: Firma ile çeşitli kişi, kurum veya kuruluşların birlikte iş, proje, plan gibi çalışmalar gerçekleştirmesi (Ahonen, Antikainen, & Mäkipää, 2010).

Açık İnovasyon Aracıları: Açık inovasyona destek vererek ve kolaylaştırarak etki eden işbirlikçi insanlara AI araçları denir (Sağ, 2016).

Aşağıdaki tüm soruları lütfen ilgili şıkla işaretleyerek cevaplayınız

Sorular	Hiçbir Zaman	Nadiren	Bazen	Sık sık	Her zaman
2.1 Yeni ürün/süreç geliştirirken inovasyon projesi kapsamında yeni dış partnerler ile yeni işbirlikleri oluşturabiliyoruz.	()	()	()	()	()
2.2 Yeni ürün/süreç geliştirirken inovasyon projesi kapsamında sadece mevcut dış partnerlerimizle çalışıyoruz.	()	()	()	()	()

2.3 <u>Yeni ürün/süreç geliştirirken fikri mülkiyet hakkının veya teknolojinin</u> dışarıdan lisansını alıyoruz veya tümüyle satın alıyoruz (Portilla, 2016), (Şimşek, 2015).	()	()	()	()	()
2.4 <u>Yeni ürün/süreç geliştirirken fikri mülkiyet hakkını veya teknolojiyi</u> dışarıya lisanslıyoruz veya satıyoruz (Portilla, 2016), (Şimşek, 2015).	()	()	()	()	()
2.5 <u>Firmamızın genel işleğinde</u> gerektiğinde çeşitli konulara ilişkin <u>fikri mülkiyet hakkının veya teknolojinin</u> dışarıdan lisansını alıyoruz veya tümüyle satın alıyoruz. (Portilla, 2016) (Şimşek, 2015)	()	()	()	()	()
2.6 <u>Firmamızın genel işleğinde</u> gerektiğinde çeşitli konulara ilişkin <u>fikri mülkiyet hakkını veya teknolojiyi</u> dışarıya lisanslıyoruz veya satıyoruz. (Portilla, 2016) (Şimşek, 2015)	()	()	()	()	()
2.7 Firmamız dış partnerlerinden veya başka yabancı firmalardan <u>teknik ya da bilimsel alanda</u> (ArGe dahil) <u>destek hizmeti</u> satın alıyor. (Portilla, 2016)	()	()	()	()	()
2.8 Firmamız dış partnerlerine veya başka yabancı firmalara <u>teknik ya da bilimsel alanda</u> (ArGe dahil) <u>destek hizmeti</u> satıyor (Portilla, 2016).	()	()	()	()	()
2.9 <u>Yeni ürün/süreç geliştirirken yeni trend ve teknolojileri</u> yakından takip ediyoruz. (Portilla, 2016)	()	()	()	()	()
2.10 <u>Firmamızın genel işleğinde</u> gerektiğinde çeşitli konulara ilişkin <u>yeni trend ve teknolojileri</u> yakından takip ediyoruz (Portilla, 2016).	()	()	()	()	()
2.11 <u>Yeni ürün/süreç geliştirirken</u> açık inovasyon araçlarını (broker, şampiyon gibi) etkin bir şekilde kullanıyoruz (Şimşek, 2015).	()	()	()	()	()
2.12 <u>Yeni ürün/süreç geliştirirken müşterilerimizin görüş ve fikirlerini</u> önemsiyor ve bunlardan yararlanıyoruz (yarışmalar düzenlemek, iletişim platformu oluşturmak, son kullanıcıların fikirlerine başvurmak vb.) (Şimşek, 2015).	()	()	()	()	()
2.13 <u>Firmamızın genel işleğinde</u> gerektiğinde çeşitli konulara ilişkin <u>müşterilerimizin görüş ve fikirlerini</u> önemsiyor ve bunlardan yararlanıyoruz (yarışmalar düzenlemek, iletişim platformu oluşturmak, son kullanıcıların fikirlerine başvurmak vb.) (Şimşek, 2015).	()	()	()	()	()

Aşağıdaki tüm soruları lütfen ilgili şıkta işaretleyerek cevaplayınız.

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
2.14 Yeni ürün/süreç geliştirirken ve diğer zamanlarda iç partnerlerimizin yeni düşünce ve fikirlerine çok önem veririz. (Şimşek, 2015)	☐	☐	☐	☐	☐
2.15 Yeni ürün/süreç geliştirirken ve diğer zamanlarda dış partnerlerimizin yeni düşünce ve fikirlerine çok önem veririz. (Şimşek, 2015)	☐	☐	☐	☐	☐
2.16 Yeni ürün/süreç geliştirirken ve diğer zamanlarda iç partnerimiz ve dış partnelerimiz ile aramızda çok sıkı ve yoğun bir iletişim ve etkileşimimiz (işbirliği) vardır. (Şimşek, 2015)	☐	☐	☐	☐	☐
2.17 Firmamızın <u>tüm çalışanları</u> açık inovasyon yaklaşımını etkin ve verimli bir şekilde kullanıyor.	☐	☐	☐	☐	☐
2.18 Firmamızın <u>sadece ilgili (görevlendirilen) çalışanları</u> açık inovasyon yaklaşımını etkin ve verimli bir şekilde kullanıyor.	☐	☐	☐	☐	☐
2.19 Firmamızın <u>tüm çalışanları</u> açık inovasyon mekanizma ve süreçlerini çok iyi biliyor. (Şimşek, 2015)	☐	☐	☐	☐	☐
2.20 Firmamızın <u>sadece ilgili (görevlendirilen) çalışanları</u> açık inovasyon mekanizma ve süreçlerini çok iyi biliyor. (Şimşek, 2015)	☐	☐	☐	☐	☐
2.21 Firmamızın <u>tüm çalışanları</u> açık inovasyon yaklaşımının avantajlarını çok iyi biliyor.	☐	☐	☐	☐	☐
2.22 Firmamızın <u>sadece ilgili (görevlendirilen) çalışanları</u> açık inovasyon yaklaşımının avantajlarını çok iyi biliyor.	☐	☐	☐	☐	☐

2.23 Firmanız açık inovasyonu kaç yıldan beri kullanıyor? (Şimşek, 2015)

- ☐ 1 yıldan az
☐ 1-2 yıl arası
☐ 2-5 yıl arası
☐ 5-10 yıl arası
☐ 10 yıldan fazla

2.24 Firmanız yeni ürün/süreç geliştirirken ve diğer genel işleyişinde yaklaşık yüzde kaç açık inovasyon yaklaşımını kullanıyor? (Şimşek, 2015)

- ☐ %20 den az açık inovasyon %80 den fazla kapalı inovasyon yaklaşımı
☐ %20-%40 arası açık inovasyon %80-%60 arası kapalı inovasyon yaklaşımı
☐ %40-%60 arası açık inovasyon %60-%40 arası kapalı inovasyon yaklaşımı

() %60-%80 arası açık inovasyon %40-%20 arası kapalı inovasyon yaklaşımı

() %80-%100 arası açık inovasyon %20-%0 arası kapalı inovasyon yaklaşımı

2.25 Firmanızın yeni ürün/süreç geliştirirken ve diğer genel işleyişi için oluşturduğu yıllık toplam inovasyon bütçesinin yüzde kaçını açık inovasyona ayırmaktadır?

(Şimşek, 2015)

() Firmamızda önceden yıllık bir inovasyon bütçesi oluşturulmamaktadır.

() %10 dan az açık inovasyon %90 dan fazla kapalı inovasyon faaliyetleri

() %10-%30 arası açık inovasyon %90-%70 arası kapalı inovasyon faaliyetleri

() %30-%60 arası açık inovasyon %70-%40 arası kapalı inovasyon faaliyetleri

() %60-%80 arası açık inovasyon %40-%20 arası kapalı inovasyon faaliyetleri

() %80-%100 arası açık inovasyon %20-%0 arası kapalı inovasyon faaliyetleri

3. Açık inovasyon kolaylaştırıcılarının belirlenmesi

Bu bölümde her bir sorudan önce ilgili terimin/terimlerin tanımları yazılmıştır. Soruları lütfen bu bilgilere göre cevaplayınız.

Dış Kaynaklı Açık İnovasyon (Aİ) Bütçesi: Açık inovasyonun süreçleri, mekanizmaları, aktivitelerinde kullanılmak üzere dış partnerler, organizasyonlar, topluluklar veya devlet, yabancı devletler, organizasyonlar veya topluluklardan sağlanan maddi kaynaklardır. Türkiye’de genellikle bu kaynaklar Avrupa Birliği destekleri veya ilgili devlet destekleri olabiliyor (Piller & Wielens, 2013).

Aşağıdaki soruları lütfen ilgili şıkkı işaretleyerek cevaplayınız.

3.1 Firmanızda açık inovasyonun süreçlerini ve aktivitelerini uygularken dış kaynaklı Aİ bütçesi kullandınız mı? Bu devlet teşviki ve/veya Avrupa Birliği teşviki olabilir?

Evet () Hayır ()

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.2 Firmanızdaki Aİ yaklaşımının uygulamalarında devlet teşviki ya da Avrupa Birliği teşvik program ya da paketlerini kullanmak fayda, kolaylık sağlar.	()	()	()	()	()

Aİ teknolojik kaynakları: Açık inovasyonun süreç ve aktivitelerinde kullanılan ürün/süreç yeniliklerinde bilgi ve iletişim sağlayan ekipman, donanım ve yazılımların tümüdür. Aİ iletişim teknolojisi ve Aİ bilgi teknolojisi olarak iki gruba ayrılır. Örneğin, telefon, mobil teknolojiler, faks cihazları, çeşitli ağ bağlantıları, çeşitli donanım ve yazılımlar (What are technological resources?, n.d.).

Aİ iletişim teknolojisi (CT): Açık inovasyonun süreç ve aktivitelerinde bilgi edinimi ve aktarımı için kullanılan her türlü teknolojik iletişim sistemi ve araçlardır. Örneğin, mobil telefonlar, telefon, telsiz, e-posta, vb. (İletişim teknolojileri nedir ve iletişim teknolojilerinin amaçları nelerdir?, n.d.).

Aİ bilgi teknolojisi (IT): Açık inovasyonun süreç ve aktivitelerinde bilgiyi üretmek, işlemek, kayıt etmek, tekrar kullanmak için kullanılan bilgisayar, kayıt alanları, ağ (network) veya diğer aygıtlardır. Örneğin, çeşitli bilgisayar ve mobil yazılımları, veri tabanı araçları, çeşitli bilgisayar ve mobil donanımları (Bilgi teknolojisi nedir?, n.d.).

3.3 Firmanızda açık inovasyon süreçlerini ve aktivitelerini uygularken dış kaynaklı Aİ bilgi veya iletişim teknolojisi kullandınız mı? (ikisini de veya sadece birini kullandı iseniz lütfen evet seçeneğini işaretleyiniz.)

Evet () Hayır ()

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum

3.4 Firmanızdaki AI yaklaşımının uygulamalarında AI İletişim Teknolojilerini kullanmak fayda, kolaylık sağlar.	()	()	()	()	()
3.5 Firmanızdaki AI yaklaşımının uygulamalarında AI Bilgi Teknolojilerini kullanmak fayda, kolaylık sağlar.	()	()	()	()	()

3.6 Firmanızda açık inovasyonun süreç ve aktivitelerini uygularken yeni makina ve bunun teknolojik tüm teçhizatlarını dış ağ bağlantılarınızla paylaştınız mı ya da dış ağ bağlantılarınız sayesinde kullandınız mı? (Portilla, 2016)

Evet () Hayır ()

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.7 Firmanızdaki AI yaklaşımının uygulamalarında yeni makina ve teçhizatları dış ağ bağlantıları ile paylaşmak veya dış ağ bağlantıları sayesinde kullanmak fayda, kolaylık sağlar.	()	()	()	()	()

Ar-Ge Outsourcing sıklığı: Yeni ürün/süreç geliştirme süreç ve aktivitelerini yürütürken gereken Ar-Ge uygulamalarını firmanın tek başına yapmaması, bunun yerine dış kaynak ya da kaynakları kullanma sıklığıdır. Bu sıklık miktarı firmanın faaliyet gösterdiği alan, ürün veya hizmete göre değişir (Piller & Wielens, 2013), (Portilla, 2016).

3.8 Firmanızda açık inovasyonun süreçlerini ve aktivitelerini uygularken Ar-Ge outsourcing'i gerçekleştirdiniz mi?

Evet () Hayır ()

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.9 Firmanızda AI yaklaşımının uygulamalarında Ar-Ge outsourcing'i sıklıkla kullanmak fayda, kolaylık sağlar. (Portilla, 2016)	()	()	()	()	()
3.10 Firmanızdaki AI yaklaşımının uygulamalarında AI teknolojik kaynaklarının kullanımı fayda, kolaylık sağlar.	()	()	()	()	()

Aİ Dış Ağ Bağlantıları: Firmanın iletişim, etkileşim ve işbirliği içersinde olduğu direkt müşteriler, indirekt müşteriler, tedarikçiler, fikri mülkiyet hakları uzmanları, stratejik ortaklar ve diğer dış partnerler şeklindeki dış bağlantılardır. (Jarvenpaa and Wernick, 2012), (Brunswicker & Vanhaverbeke, 2015)

Fikri Mülkiyet Hakları: Fikri mülkiyet hakları herhangi bir eser için sahip olunabilecek tüm maddi ve manevi haklardır. Bu haklar bir kişiye ya da bir kuruluşa ait olabilir (Fikri ve sınai mülkiyet hakları nedir?, 2013).

Sınai Mülkiyet Hakları: Sanayi ve tarımdaki buluş ve yeniliklerin ilk uygulayıcılarının tescil işlemleri, ürünü üretme ve satma hakkına belirli bir süre sahip olmalarını sağlayan gayri maddi bir haktır (Fikri ve sınai mülkiyet hakları nedir?, 2013).

3.11 Firmanızda açık inovasyonun süreçlerini ve aktivitelerini uygularken hangi Aİ dış ağ bağlantıları ile temastasınız? (bu soruda seçeneklerden bir, birden çok ya da hepsini işaretleyebilirsiniz.)

☐ direkt müşteriler ☐ indirekt müşteriler ☐ tedarikçiler

☐ fikri mülkiyet hakları uzmanları ☐ stratejik ortaklar ☐ diğer dış ağ bağlantıları

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.12 Firmanızdaki Aİ yaklaşımının uygulamalarında direkt müşterilerle etkin iletişim fayda, kolaylık sağlar.	☐	☐	☐	☐	☐
3.13 Firmanızdaki Aİ yaklaşımının uygulamalarında indirekt müşterilerle etkin iletişim fayda, kolaylık sağlar.	☐	☐	☐	☐	☐
3.14 Firmanızdaki Aİ yaklaşımının uygulamalarında tedarikçilerle etkin iletişim fayda, kolaylık sağlar.	☐	☐	☐	☐	☐
3.15 Firmanızdaki Aİ yaklaşımının uygulamalarında fikri ve sınai mülkiyet hakları uzmanlarıyla etkin iletişim fayda, kolaylık sağlar.	☐	☐	☐	☐	☐

3.16 Firmanızdaki Aİ yaklaşımının uygulamalarında stratejik ortaklarla etkin iletişim fayda, kolaylık sağlar.	()	()	()	()	()
3.17 Firmanızdaki Aİ yaklaşımının uygulamalarında diğer dış ağ partnerleriyle etkin iletişim fayda, kolaylık sağlar.	()	()	()	()	()
3.18 Firmanızdaki Aİ yaklaşımının uygulamalarında Aİ ağ bağlantıları arasındaki güven faktörü fayda, kolaylık sağlar.	()	()	()	()	()
3.19 Firmanızdaki Aİ yaklaşımının uygulamalarında Aİ ağ bağlantılarıyla etkin iletişim fayda, kolaylık sağlar.	()	()	()	()	()

Firmanın dış çevresi: Firma ya da kuruluşun kendisine ya da aktivitelerine etki eden tüm dış faktörler (Riley, 2015).

Devlet düzenlemeleri: Aİ'nun işleyişine veya yönetimine etki eden veya temelini oluşturan devlet tarafından oluşturulmuş kanunlar, yönetmelikler, prosedürler ve diğer kurallardır.

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.20 Firmanızdaki Aİ yaklaşımının uygulamalarında devlet düzenlemelerini yerine getirmek fayda kolaylık sağlar.	()	()	()	()	()
3.21 Firmanızdaki Aİ yaklaşımının uygulamalarında firmanın yerleşim yerindeki firmanın bulunduğu bölgedeki iklim koşulları fayda kolaylık sağlar.	()	()	()	()	()
3.22 Firmanızdaki Aİ yaklaşımının uygulamalarında firmanın yerleşimi ile ilgili diğer coğrafik faktörler (ulaşım yollarına yakın olması, dağlık veya ovalık arazide bulunması vb.) fayda kolaylık sağlar.	()	()	()	()	()
3.23 Firmanızdaki Aİ yaklaşımının uygulamalarında firmanın dış çevresi fayda, kolaylık sağlar.	()	()	()	()	()

Bütünsel organizasyonel uygulamalar: Firmanın ya da kuruluşun kendi amaç ve hedefi için stratejik ya da operasyonel kısımları olan Aİ nun uzun vadeli yatırımları,

Aİ kapsamında yeni ürün/süreç geliştirme, Aİ nun stratejik işlemleri, Aİ kapsamındaki portföy yönetimi, Aİ kapsamında firmanın çalışanlarının dahil edilmesi, güven (iç partnerler arası) ve esneklik (değişen koşullara kolay adapte olma özelliği) **bütünsel organizasyonel uygulamaları** oluşturur (Brunswicker & Vanhaverbeke, 2015).

Aİ kapsamında yeni ürün/süreç geliştirme: Aİ kapsamında yeni/ürün/servis/süreç geliştirmek, iki seçenek olarak, var olan ürün veya süreci geliştirmek, eklentiler yapmak ya da yeni buluş yaparak yeni pazar alanları yaratmaktır. Aİ kapsamındaki yeni ürün/süreç geliştirme beşe ayrılır (Product development (new product development, or NPD), n.d.). Bunlar;

1. Fikir yönetimi, takım eğitimi ve koçluk
2. Planlama ve entegre (bütünleme) etme
3. Test etme ve kalite kontrol
4. Pazarlama ve ticarileştirme
5. Fikri/sınai mülkiyet, patent, marka vb. haklarını yönetme ve kontrol etmedir.

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.24 Firmanızdaki Aİ yaklaşımının uygulamalarında firma tarafından belirlenen Aİ bütçesi kullanmak fayda kolaylık sağlar.	()	()	()	()	()
3.25 Aİ nun uzun vadeli yatırımlarını Aİ yaklaşımındaki aktiviteler (projeler, karar verme teknikleri vb.) için oluşturmak fayda kolaylık sağlar.	()	()	()	()	()
3.26 Firmanızdaki Aİ kapsamında yeni ürün/süreç geliştirme çalışmalarında çalışanların süreçteki motivasyonu fayda kolaylık sağlar.	()	()	()	()	()
3.27 Firmanızdaki Aİ kapsamında yeni ürün/süreç geliştirme çalışmalarında fikir yönetimi, takım eğitimi ve koçluk, planlama ve entegre (bütünleme) etme, test etme ve kalite kontrol adımlarını izlemek fayda kolaylık sağlar.	()	()	()	()	()

3.28 Firmanızdaki Aİ kapsamında yeni ürün/süreç geliştirme çalışmalarında pazarlama ve ticarileştirme uygulamaları fayda, kolaylık sağlar.	()	()	()	()	()
3.29 Firmanızdaki Aİ kapsamında yeni ürün/süreç geliştirme çalışmalarında fikri/sınai mülkiyet, patent, marka vb. haklarını yönetme ve kontrol etme fayda, kolaylık sağlar.	()	()	()	()	()
3.30 Firmanızdaki Aİ yaklaşımının uygulamalarında Aİ kapsamında yeni ürün/süreç geliştirme uygulamaları fayda, kolaylık sağlar.	()	()	()	()	()

Aİ nun stratejik işlemleri: Gelecekteki uygun iş fırsatlarını araştırmak, yeni teknolojileri keşfetmek, pazar şartlarını sürekli analiz etmek gibi firma için birçok avantaj ve kar sağlayacak aktivite ve eylemlerin tümüne Aİ nun stratejik işlemleri denir (Brunswick & Vanhaverbeke, 2015).

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.31 Firmanızın gelecekteki iş fırsatlarını araştırması Aİ yaklaşımının uygulanmasına fayda kolaylık sağlar.	()	()	()	()	()
3.32 Firmanızdaki Aİ nun stratejik işlemlerinin icra edilmesi Aİ yaklaşımının uygulanmasına fayda kolaylık sağlar.	()	()	()	()	()

Aİ kapsamındaki portföy yönetimi: Aİ kapsamındaki portföy yönetimi açık inovasyonun stratejik operasyon ve aktivitelerini proje bazlı Aİ operasyon ve aktivitelerine dönüştüren ve bunların getirisini maksimum eden sistemlerdir. Pekçok çeşidi vardır; örneğin Aİ marka portföy yönetimi, Aİ projesi portföy yönetimi vb. (McFarthing and Ohr, 2013).

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
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3.33 Firmanıza Aİ kapsamındaki portföy yönetiminin adapte edilmesi Aİ yaklaşımının uygulanmasına fayda kolaylık sağlar.	()	()	()	()	()
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Aİ kapsamında firmanın çalışanlarının dahil edilmesi: Firmanın kendi çalışanlarını Aİ işleyiş ve süreçlerinde danışarak, fikirlerini alıp yorumlayarak ve bu Aİ aktiviteleri için uygun platform oluşturarak yürütülen avantajlı ve pozitif adımlardır. Aİ kapsamında firmanın çalışanları, Aİ brokerleri, Aİ şampiyonları ve diğer tüm firma çalışanları olarak 3 grupta incelenir (El-Ella, 2014).

Aİ brokerleri: Genel olarak, Aİ brokerleri Aİ süreçlerini izleme, sorun azaltma ve çözme, Aİ vizyon ve misyonuna göre hareket etme ve Aİ aktivitelerini planlama, kontrol etme gibi görevlerde bulunan firma içi çalışanlardır (Gildemacher & Klerkx, 2012).

Aİ şampiyonları: Aİ şampiyonları yine firmanın kendi çalışanlarından görevlendirilen Aİ nun tüm aktivite ve süreçlerine düşünceleri ile katkıda bulunan ve Aİ nun kritik durumlarında gelişmesini sağlayan insanlardır (Aarts & Klerkx, 2013).

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.34 Firmanızdaki Aİ yaklaşımının uygulamalarında Aİ brokerleri fayda kolaylık sağlar.	()	()	()	()	()
3.35 Firmanızdaki Aİ yaklaşımının uygulamalarında Aİ şampiyonları fayda kolaylık sağlar.	()	()	()	()	()
3.36 Diğer tüm firma çalışanlarının Aİ yaklaşımı uygulamalarına katılımının sağlanması fayda kolaylık sağlar.	()	()	()	()	()
3.37 Firmanızdaki Aİ yaklaşımının uygulamalarında firmanın çalışanlarının dahil edilmesi fayda kolaylık sağlar.	()	()	()	()	()
3.38 Firmanızdaki Aİ yaklaşımının uygulamalarında güven (iç	()	()	()	()	()

partnerler arası) fayda kolaylık sağlar.					
3.39 Firmanızdaki Aİ yaklaşımının uygulamalarında esneklik (değişen koşullara kolay adapte olma özelliği) fayda, kolaylık sağlar.	()	()	()	()	()
3.40 Firmanızdaki Aİ yaklaşımının uygulamalarında bütünsel organizasyonel uygulamalar fayda, kolaylık sağlar.	()	()	()	()	()

Zaman yönetimi: Aİ kapsamındaki zaman yönetimi başlayış ve bitiş zamanı belli olan Aİ aktivitelerinde her bir adımı oluşturduğu iş süresi içerisinde değerlendirme ve yönetmektir. Aİ kapsamında zaman yönetimi kolaylaştırıcıları çeviklik ve sistematik olmaktır (Ahonen et al., 2010).

Ceviklik: Aİ yaklaşımı uygulamalarında çabuk, dikkatli ve kolay bir şekilde tepki verme ve hareket etme eylemleridir (Agility, n.d.).

Sistematik davranmak: Aİ yaklaşımı uygulamalarında belli bir system veya planın içerisinde (metodlu olarak) Aİ süreç ve aktivitelerinin yürütülmesidir (Systematic, n.d.).

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.41 Çevik davranmak firmanızdaki Aİ yaklaşımının uygulamalarında fayda, kolaylık sağlar.	()	()	()	()	()
3.42 Sistematik davranmak firmanızdaki Aİ yaklaşımının uygulamalarında fayda, kolaylık sağlar.	()	()	()	()	()
3.43 Firmanızdaki Aİ yaklaşımının uygulamalarında zaman yönetimi fayda, kolaylık sağlar.	()	()	()	()	()

Firmanızın Aİ kültürü: Açık inovasyonun gerektirdiği her türlü maddi ve manevi öge ve özelliklerdir. 3 grupta incelenir; hızlı karar alma kültürü, farklı fikirlere toleranslı olma kültürü ve bilgi yönetimi ve paylaşımı kültürüdür (Kültür nedir? n.d. <https://www.frmtr.com/kultur/901435-kultur-nedir.html>).

Hızlı karar alma kültürü: AI yaklaşımı uygulamalarında olabildiğince daha dakik (tam zamanında) ve hızlı bir şekilde uygun kararlar almaktır (Mires, n.d.).

Sorular	Kesinlikle katılmıyorum	Kısmen katılmıyorum	Kararsızım	Kısmen katılıyorum	Kesinlikle katılıyorum
3.44 Firmanızdaki AI yaklaşımının uygulamalarında bilgi yönetimi ve paylaşımı kültürü fayda kolaylık sağlar.	()	()	()	()	()
3.45 Firmanızdaki AI yaklaşımının uygulamalarında farklı fikirlere toleranslı olma (benimseyebilme veya kabul edebilme) kültürü fayda kolaylık sağlar.	()	()	()	()	()
3.46 Hızlı karar alma kültürü firmanızdaki AI yaklaşımının uygulamalarında fayda, kolaylık sağlar.	()	()	()	()	()
3.47 Firmanızdaki AI yaklaşımının uygulamalarında firmanızın AI kültürü fayda, kolaylık sağlar.	()	()	()	()	()

4. Açık inovasyon kolaylaştırıcılarının önceliklendirilmesi

4.1 Aşağıdaki yedi adet temel faktörü (3. bölümde tanımlanan) açık inovasyon uygulamayı kolaylaştırma açısından en önemliden en az önemliye doğru sıralayınız. **1 en önemli** faktör, **7 ise en az önemli** faktörü ifade etmektedir. Her faktör için sıralamanızı faktörün yanındaki kutucuğa yazınız. İlgili sıralama için görüşünüzün nedenini kısaca belirtiniz. Sıralama yaparken lütfen birden fazla faktörün aynı önem derecesine sahip olamayacağını dikkate alınız.

<u>Faktörler</u>	<u>Sıralama</u> <u>(1 den 7 ye</u> <u>kadar)</u>	<u>Nedeni</u>
Dış kaynaklı AI bütçesi		
AI teknolojik kaynakları		

Aİ ağ bağlantıları		
Firmanın dış çevresi		
Bütünsel organizasyonel uygulamalar		
Aİ kapsamında zaman yönetimi		
Firmanızın Aİ kültürü		

4.2 Aşağıdaki tabloda belirtilen 27 adet alt faktör (3. bölümde tanımlanan) içinden açık inovasyon uygulamayı kolaylaştırma açısından size göre olan ilk on faktörü seçiniz. Bu faktörleri alttaki tabloda **1 en önemli** faktör, **10 ise en az önemli** faktörü ifade edecek şekilde sıralayınız ve görüşünüzün nedenini kısaca belirtiniz. Sıralama yaparken lütfen birden fazla faktörün aynı önem derecesine sahip olamayacağını dikkate alınız.

Faktör No	Faktör adı
1	Devlet teşviki ya da Avrupa Birliği teşvik program ya da paketleri
2	Aİ iletişim teknolojisi (CT)
3	Aİ bilgi teknolojisi (IT)
4	Yeni makina ve teçhizatları dış ağ bağlantıları ile paylaşmak veya dış ağ bağlantıları sayesinde kullanmak
5	Ar-Ge outsourcing sıklığı
6	Direk müşterilerle etkin iletişim
7	İndirek müşterilerle etkin iletişim
8	Tedarikçilerle etkin iletişim
9	Fikri ve sınai mülkiyet hakları uzmanlarıyla etkin iletişim
10	Stratejik ortaklarla etkin iletişim
11	Diğer dış ağ partnerleriyle etkin iletişim
12	Aİ ağ bağlantıları arasındaki güven
13	Devlet düzenlemelerini yerine getirmek
14	Firmanın bulunduğu bölgedeki iklim koşulları
15	Firmanın yerleşimi ile ilgili diğer coğrafik faktörler
16	Aİ nun uzun vadeli yatırımları
17	Aİ kapsamında yeni ürün/süreç geliştirme
18	Aİ nun stratejik işlemleri
19	Aİ kapsamındaki portföy yönetimi
20	Aİ kapsamında firmanın çalışanlarının dahil edilmesi
21	Güven (iç partnerler arası)

22	Esneklik (değişen koşullara kolay adapte olma özelliği)
23	Çeviklik
24	Sistematik davranmak
25	Bilgi yönetimi ve paylaşımı kültürü
26	Farklı fikirlere toleranslı olma kültürü
27	Hızlı karar alma kültürü

<u>İlk 10 a seçilen faktörün sırası</u>	<u>İlk 10 a seçilen faktörün numarası</u>	<u>Nedeni</u>
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

APPENDIX-2: Shapiro Wilks W Test for Testing Normality of Main Headings and Subheadings of the Facilitator Factors

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SF1	.327	31	.000	.683	31	.000
SF2	.450	31	.000	.585	31	.000
SF3	.466	31	.000	.550	31	.000
SF4	.386	31	.000	.614	31	.000
SF5	.241	31	.000	.896	31	.006
SF6	.381	31	.000	.670	31	.000
SF7	.185	31	.008	.862	31	.001
SF8	.340	31	.000	.734	31	.000
SF9	.216	31	.001	.834	31	.000
SF10	.329	31	.000	.708	31	.000
SF11	.306	31	.000	.721	31	.000
SF12	.331	31	.000	.658	31	.000
SF13	.227	31	.000	.859	31	.001
SF14	.166	31	.029	.870	31	.001
SF15	.263	31	.000	.775	31	.000
SF16	.333	31	.000	.761	31	.000
SF17	.311	31	.000	.616	31	.000
SF18	.230	31	.000	.789	31	.000
SF19	.274	31	.000	.791	31	.000
SF20	.324	31	.000	.730	31	.000
SF21	.292	31	.000	.729	31	.000
SF22	.332	31	.000	.643	31	.000
SF23	.293	31	.000	.686	31	.000
SF24	.343	31	.000	.692	31	.000
SF25	.418	31	.000	.640	31	.000
SF26	.414	31	.000	.484	31	.000
SF27	.357	31	.000	.716	31	.000
MF1	.327	31	.000	.683	31	.000
MF2	.279	31	.000	.769	31	.000
MF3	.361	31	.000	.674	31	.000
MF4	.249	31	.000	.851	31	.001
MF5	.356	31	.000	.735	31	.000
MF6	.361	31	.000	.640	31	.000
MF7	.418	31	.000	.640	31	.000

a. Lilliefors Significance Correction

APPENDIX-3: Exploratory Factor Analysis of the Main Headings of the Facilitator Factors

Correlation Matrix^a

	Main factor 1	Main factor 2	Main factor 3	Main factor 4	Main factor 5	Main factor 6	Main factor 7
Correlation							
Main factor 1	1.000	-.028	-.034	-.309	-.158	-.073	.073
Main factor 2	-.028	1.000	.041	.561	-.082	.084	.253
Main factor 3	-.034	.041	1.000	.402	.199	.356	.558
Main factor 4	-.309	.561	.402	1.000	.198	.083	.182
Main factor 5	-.158	-.082	.199	.198	1.000	.181	.198
Main factor 6	-.073	.084	.356	.083	.181	1.000	.451
Main factor 7	.073	.253	.558	.182	.198	.451	1.000
Sig. (1-tailed)							
Main factor 1		.440	.429	.045	.198	.348	.348
Main factor 2	.440		.414	.001	.331	.326	.085
Main factor 3	.429	.414		.012	.142	.025	.001
Main factor 4	.045	.001	.012		.143	.329	.164
Main factor 5	.198	.331	.142	.143		.165	.143
Main factor 6	.348	.326	.025	.329	.165		.005
Main factor 7	.348	.085	.001	.164	.143	.005	

a. Determinant = .173

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.442
Bartlett's Test of Sphericity	Approx. Chi-Square	47.140
	df	21
	Sig.	.001

Communalities

	Initial	Extraction
Main factor 1	1.000	.251
Main factor 2	1.000	.587
Main factor 3	1.000	.637
Main factor 4	1.000	.833
Main factor 5	1.000	.186
Main factor 6	1.000	.527
Main factor 7	1.000	.689

Extraction Method:

Principal Component

Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.332	33.309	33.309	2.332	33.309	33.309	2.139
2	1.379	19.700	53.009	1.379	19.700	53.009	1.707
3	1.166	16.658	69.668				
4	.782	11.176	80.844				
5	.698	9.971	90.815				
6	.459	6.564	97.379				
7	.183	2.621	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Component Matrix^a

	Component	
	1	2
Main factor 1	-.223	.448
Main factor 2	.464	-.610
Main factor 3	.750	.274
Main factor 4	.671	-.619
Main factor 5	.400	.163
Main factor 6	.589	.424
Main factor 7	.740	.375

Extraction Method:

Principal Component

Analysis.

a. 2 components extracted.

Pattern Matrix^a

	Component	
	1	2
Main factor 1	.083	.507
Main factor 2	.018	-.763
Main factor 3	.778	-.093
Main factor 4	.182	-.866
Main factor 5	.425	-.034
Main factor 6	.735	.116
Main factor 7	.831	.003

Extraction Method:

Principal Component

Analysis.

Rotation Method: Oblimin
with Kaiser Normalization.

Structure Matrix

	Component	
	1	2
Main factor 1	.002	.494
Main factor 2	.140	-.766
Main factor 3	.793	-.218
Main factor 4	.321	-.895
Main factor 5	.430	-.103
Main factor 6	.717	-.003
Main factor 7	.830	-.131

Extraction Method:

Principal Component

Analysis.

Rotation Method: Oblimin
with Kaiser Normalization.

Component Correlation
Matrix

Component	1	2
1	1.000	-.161
2	-.161	1.000

Extraction Method:

Principal Component

Analysis.

Rotation Method:

Oblimin with Kaiser
Normalization.

APPENDIX-4: Mann-Whitney U Test for Time Period That the Companies Have Been Using OI and Subheadings of the Facilitator Factors

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
SF1	31	4.0645	1.41269	1.00	5.00
SF2	31	4.7097	.52874	3.00	5.00
SF3	31	4.7419	.51431	3.00	5.00
SF4	31	4.3871	1.11587	1.00	5.00
SF5	31	3.5484	1.09053	1.00	5.00
SF6	31	4.5161	.76902	2.00	5.00
SF7	31	3.4194	1.36074	1.00	5.00
SF8	31	4.4516	.67521	3.00	5.00
SF9	31	3.7742	1.25724	1.00	5.00
SF10	31	4.3226	1.01282	1.00	5.00
SF11	31	4.2581	1.06357	1.00	5.00
SF12	31	4.4516	.80989	2.00	5.00
SF13	31	3.6129	1.33360	1.00	5.00
SF14	31	2.5161	1.33843	1.00	5.00
SF15	31	4.0323	1.19677	1.00	5.00
SF16	31	3.8065	1.30178	1.00	5.00
SF17	31	4.3226	1.01282	1.00	5.00
SF18	31	4.0323	1.11007	1.00	5.00
SF19	31	4.0000	1.12546	1.00	5.00
SF20	31	3.6774	1.55750	1.00	5.00
SF21	31	3.9355	1.41269	1.00	5.00
SF22	31	4.1290	1.31001	1.00	5.00
SF23	31	4.3871	.80322	2.00	5.00
SF24	31	4.4839	.72438	2.00	5.00
SF25	31	4.6452	.55066	3.00	5.00
SF26	31	4.6452	.79785	1.00	5.00
SF27	31	4.4194	.76482	3.00	5.00
YearsofOI	31	1.74	.445	1	2

Mann-Whitney Test

Ranks

	Time	N	Mean Rank	Sum of Ranks
SF1	1	8	9.31	74.50
	2	23	18.33	421.50
	Total	31		
SF2	1	8	12.50	100.00
	2	23	17.22	396.00
	Total	31		
SF3	1	8	13.88	111.00
	2	23	16.74	385.00
	Total	31		
SF4	1	8	13.19	105.50
	2	23	16.98	390.50
	Total	31		
SF5	1	8	18.63	149.00
	2	23	15.09	347.00
	Total	31		
SF6	1	8	10.69	85.50
	2	23	17.85	410.50
	Total	31		
SF7	1	8	13.13	105.00
	2	23	17.00	391.00
	Total	31		
SF8	1	8	13.38	107.00
	2	23	16.91	389.00
	Total	31		
SF9	1	8	11.25	90.00
	2	23	17.65	406.00
	Total	31		
SF10	1	8	11.69	93.50
	2	23	17.50	402.50
	Total	31		

Mann-Whitney Test (continue)

SF11	1	8	13.06	104.50
	2	23	17.02	391.50
	Total	31		
SF12	1	8	18.06	144.50
	2	23	15.28	351.50
	Total	31		
SF13	1	8	17.00	136.00
	2	23	15.65	360.00
	Total	31		
SF14	1	8	17.06	136.50
	2	23	15.63	359.50
	Total	31		
SF15	1	8	15.06	120.50
	2	23	16.33	375.50
	Total	31		
SF16	1	8	17.50	140.00
	2	23	15.48	356.00
	Total	31		
SF17	1	8	13.50	108.00
	2	23	16.87	388.00
	Total	31		
SF18	1	8	15.31	122.50
	2	23	16.24	373.50
	Total	31		
SF19	1	8	16.00	128.00
	2	23	16.00	368.00
	Total	31		
SF20	1	8	17.25	138.00
	2	23	15.57	358.00
	Total	31		
SF21	1	8	17.38	139.00
	2	23	15.52	357.00
	Total	31		
SF22	1	8	16.75	134.00
	2	23	15.74	362.00
	Total	31		
SF23	1	8	14.44	115.50

Mann-Whitney Test (continue)

	2	23	16.54	380.50
	Total	31		
SF24	1	8	14.50	116.00
	2	23	16.52	380.00
	Total	31		
SF25	1	8	17.25	138.00
	2	23	15.57	358.00
	Total	31		
SF26	1	8	13.88	111.00
	2	23	16.74	385.00
	Total	31		
SF27	1	8	16.00	128.00
	2	23	16.00	368.00
	Total	31		

Test Statistics^{a,b}

	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16	SF17	SF18	SF19	SF20	SF21	SF22	SF23	SF24	SF25	SF26	SF27
Mann-Whitney U	38.500	64.000	75.000	69.500	71.000	49.500	69.000	71.000	54.000	57.500	68.500	75.500	84.000	83.500	84.500	80.000	72.000	86.500	92.000	82.000	81.000	86.000	79.500	80.000	82.000	75.000	92.000
Wilcoxon W	74.50	100.00	111.00	105.50	347.00	85.50	105.00	107.00	90.00	93.50	104.50	351.50	360.00	359.50	120.50	356.00	108.00	122.50	368.00	358.00	357.00	362.00	115.50	116.00	358.00	111.00	368.00
Z	-2.708	-1.659	-1.055	-1.228	-.988	-2.269	-1.072	-1.066	-1.789	-1.756	-1.178	-.854	-.373	-.396	-.362	-.580	-1.016	-.264	.000	-.479	-.535	-.300	-.635	-.621	-.553	-1.007	.000
Asymp. Sig. (2-tailed)	.007	.097	.291	.220	.323	.023	.284	.286	.074	.079	.239	.393	.709	.692	.717	.562	.309	.792	1.000	.632	.592	.764	.525	.534	.580	.314	1.000
Exact Sig. [2*(1-tailed Sig.)]	.013 ^b	.219 ^b	.464 ^b	.317 ^b	.362 ^b	.054 ^b	.317 ^b	.362 ^b	.091 ^b	.121 ^b	.295 ^b	.464 ^b	.740 ^b	.707 ^b	.740 ^b	.611 ^b	.386 ^b	.808 ^b	1.000 ^b	.674 ^b	.642 ^b	.808 ^b	.580 ^b	.611 ^b	.674 ^b	.464 ^b	1.000 ^b

a. Grouping variable: Years of OI

b. Not corrected for ties.

APPENDIX-5: Mann-Whitney U Test for Annual R&D Expenditure to Sales Turnover Ratio and Subheadings of the Facilitator Factors

Mann-Whitney Test

Ranks				
	Rdtosales	N	Mean Rank	Sum of Ranks
SF1	1	21	18.12	380.50
	2	10	11.55	115.50
	Total	31		
SF2	1	21	16.95	356.00
	2	10	14.00	140.00
	Total	31		
SF3	1	21	16.48	346.00
	2	10	15.00	150.00
	Total	31		
SF4	1	21	15.17	318.50
	2	10	17.75	177.50
	Total	31		
SF5	1	21	16.02	336.50
	2	10	15.95	159.50
	Total	31		
SF6	1	21	15.93	334.50
	2	10	16.15	161.50
	Total	31		
SF7	1	21	14.81	311.00
	2	10	18.50	185.00
	Total	31		
SF8	1	21	16.67	350.00
	2	10	14.60	146.00
	Total	31		
SF9	1	21	17.52	368.00
	2	10	12.80	128.00
	Total	31		
SF10	1	21	16.76	352.00
	2	10	14.40	144.00
	Total	31		

Mann-Whitney Test (continue)

SF11	1	21	16.81	353.00
	2	10	14.30	143.00
	Total	31		
SF12	1	21	15.98	335.50
	2	10	16.05	160.50
	Total	31		
SF13	1	21	16.48	346.00
	2	10	15.00	150.00
	Total	31		
SF14	1	21	14.07	295.50
	2	10	20.05	200.50
	Total	31		
SF15	1	21	14.98	314.50
	2	10	18.15	181.50
	Total	31		
SF16	1	21	14.81	311.00
	2	10	18.50	185.00
	Total	31		
SF17	1	21	15.55	326.50
	2	10	16.95	169.50
	Total	31		
SF18	1	21	14.29	300.00
	2	10	19.60	196.00
	Total	31		
SF19	1	21	16.05	337.00
	2	10	15.90	159.00
	Total	31		
SF20	1	21	15.71	330.00
	2	10	16.60	166.00
	Total	31		
SF21	1	21	15.17	318.50
	2	10	17.75	177.50
	Total	31		
SF22	1	21	15.36	322.50
	2	10	17.35	173.50
	Total	31		

Mann-Whitney Test (continue)

SF23	1	21	16.57	348.00
	2	10	14.80	148.00
	Total	31		
SF24	1	21	15.67	329.00
	2	10	16.70	167.00
	Total	31		
SF25	1	21	16.48	346.00
	2	10	15.00	150.00
	Total	31		
SF26	1	21	16.43	345.00
	2	10	15.10	151.00
	Total	31		
SF27	1	21	15.38	323.00
	2	10	17.30	173.00
	Total	31		

Test Statistics^{a,b}

	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16	SF17	SF18	SF19	SF20	SF21	SF22	SF23	SF24	SF25	SF26	SF27
Mann-Whitney U	60.50	85.00	95.00	87.50	104.5	103.5	80.00	91.00	73.00	89.00	88.00	104.5	95.00	64.50	83.50	80.00	95.50	69.00	104.0	99.00	87.50	91.50	93.00	98.00	95.00	96.00	92.0
Wilcoxon W	115.5	140.0	150.0	318.5	159.5	334.5	311.0	146.0	128.0	144.0	143.0	335.5	150.0	295.5	314.5	311.0	326.5	300.0	159.0	330.0	318.5	322.5	148.0	329.0	150.0	151.0	323.0
Z	-2.109	-1.109	-.581	-.894	-.022	-.075	-1.091	-.665	-1.410	-.762	-.798	-.024	-.437	-1.767	-.972	-1.131	-.452	-1.616	-.045	-.269	-.797	-.631	-.571	-.339	-.518	-.499	-.621
Asymp. Sig. (2-tailed)	.035	.267	.561	.371	.982	.940	.275	.506	.158	.446	.425	.981	.662	.077	.331	.258	.651	.106	.964	.788	.425	.528	.568	.734	.604	.618	.535
Exact Sig. [2*(1-tailed Sig.)]	.059 ^b	.416 ^b	.693 ^b	.466 ^b	.983 ^b	.950 ^b	.306 ^b	.574 ^b	.186 ^b	.519 ^b	.492 ^b	.983 ^b	.693 ^b	.087 ^b	.370 ^b	.306 ^b	.693 ^b	.135 ^b	.983 ^b	.819 ^b	.466 ^b	.574 ^b	.633 ^b	.787 ^b	.693 ^b	.724 ^b	.603 ^b

a. Grouping variable: RD to sales turnover

b. Not corrected for ties.

APPENDIX-6: Mann-Whitney U Test for Companies' Number of Employees and Subheadings of the Facilitator Factors

Mann-Whitney Test

Ranks

	Empsub	N	Mean Rank	Sum of Ranks
SF1	1	5	4.90	24.50
	2	26	18.13	471.50
	Total	31		
SF2	1	5	14.00	70.00
	2	26	16.38	426.00
	Total	31		
SF3	1	5	16.50	82.50
	2	26	15.90	413.50
	Total	31		
SF4	1	5	11.10	55.50
	2	26	16.94	440.50
	Total	31		
SF5	1	5	14.40	72.00
	2	26	16.31	424.00
	Total	31		
SF6	1	5	17.40	87.00
	2	26	15.73	409.00
	Total	31		
SF7	1	5	16.00	80.00
	2	26	16.00	416.00
	Total	31		
SF8	1	5	16.00	80.00
	2	26	16.00	416.00
	Total	31		
SF9	1	5	12.00	60.00
	2	26	16.77	436.00
	Total	31		

Mann-Whitney Test (continue)

SF10	1	5	14.10	70.50
	2	26	16.37	425.50
	Total	31		
SF11	1	5	10.80	54.00
	2	26	17.00	442.00
	Total	31		
SF12	1	5	15.40	77.00
	2	26	16.12	419.00
	Total	31		
SF13	1	5	8.30	41.50
	2	26	17.48	454.50
	Total	31		
SF14	1	5	19.40	97.00
	2	26	15.35	399.00
	Total	31		
SF15	1	5	16.60	83.00
	2	26	15.88	413.00
	Total	31		
SF16	1	5	16.90	84.50
	2	26	15.83	411.50
	Total	31		
SF17	1	5	17.70	88.50
	2	26	15.67	407.50
	Total	31		
SF18	1	5	16.50	82.50
	2	26	15.90	413.50
	Total	31		
SF19	1	5	8.20	41.00
	2	26	17.50	455.00
	Total	31		
SF20	1	5	15.10	75.50
	2	26	16.17	420.50
	Total	31		
SF21	1	5	18.20	91.00
	2	26	15.58	405.00
	Total	31		

Mann-Whitney Test (continue)

SF22	1	5	15.40	77.00
	2	26	16.12	419.00
	Total	31		
SF23	1	5	17.70	88.50
	2	26	15.67	407.50
	Total	31		
SF24	1	5	16.70	83.50
	2	26	15.87	412.50
	Total	31		
SF25	1	5	15.00	75.00
	2	26	16.19	421.00
	Total	31		
SF26	1	5	10.20	51.00
	2	26	17.12	445.00
	Total	31		
SF27	1	5	17.30	86.50
	2	26	15.75	409.50
	Total	31		

Test Statistics^{a,b}

	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16	SF17	SF18	SF19	SF20	SF21	SF22	SF23	SF24	SF25	SF26	SF27
Mann-Whitney U	9.50	55.00	62.50	40.50	57.00	58.00	65.00	65.00	45.00	55.50	39.00	62.00	26.50	48.00	62.00	60.50	56.50	62.50	26.00	60.50	54.00	62.00	56.50	61.50	60.00	36.00	58.50
Wilcoxon W	24.5	70.0	413.5	55.50	72.00	409.00	416.00	416.00	60.00	70.50	54.00	77.00	41.50	399.00	413.00	411.50	407.50	413.50	41.00	75.50	405.00	77.00	407.50	412.50	75.00	51.00	409.50
Z	-3.342	-.705	-.185	-1.590	-.448	-.445	.000	.000	-1.120	-.575	-1.551	-.185	-2.138	-.943	-.172	-.259	-.514	-.143	-2.230	-.257	-.637	-.178	-.514	-.216	-.329	-2.044	-.394
Asymp. Sig. (2-tailed)	.001	.481	.854	.112	.654	.657	1.000	1.000	.263	.565	.121	.853	.033	.346	.863	.796	.607	.887	.026	.797	.524	.858	.607	.829	.742	.041	.693
Exact Sig. (2*(1-tailed Sig.))	.001 ^b	.620 ^b	.897 ^b	.195 ^b	.696 ^b	.735 ^b	1.000 ^b	1.000 ^b	.305 ^b	.620 ^b	.176 ^b	.897 ^b	.036 ^b	.387 ^b	.897 ^b	.815 ^b	.658 ^b	.897 ^b	.036 ^b	.815 ^b	.584 ^b	.897 ^b	.658 ^b	.856 ^b	.815 ^b	.129 ^b	.735 ^b

a. Grouping variable: Total employees

b. Not corrected for ties.

APPENDIX-7: Kruskal-Wallis H Test for Ages of the Companies and Subheadings of the Facilitator Factors

Kruskal-Wallis Test

Ranks

	Age	N	Mean Rank
SF1	1	5	8.90
	2	17	16.06
	3	9	19.83
	Total	31	
SF2	1	5	14.00
	2	17	15.35
	3	9	18.33
	Total	31	
SF3	1	5	16.50
	2	17	14.88
	3	9	17.83
	Total	31	
SF4	1	5	11.90
	2	17	18.85
	3	9	12.89
	Total	31	
SF5	1	5	12.60
	2	17	15.21
	3	9	19.39
	Total	31	
SF6	1	5	17.40
	2	17	15.97
	3	9	15.28
	Total	31	
SF7	1	5	14.40
	2	17	15.97
	3	9	16.94
	Total	31	

Kruskal-Wallis Test (continue)

SF8	1	5	16.00
	2	17	14.76
	3	9	18.33
	Total	31	
SF9	1	5	7.20
	2	17	19.06
	3	9	15.11
	Total	31	
SF10	1	5	11.50
	2	17	15.74
	3	9	19.00
	Total	31	
SF11	1	5	8.20
	2	17	18.09
	3	9	16.39
	Total	31	
SF12	1	5	15.40
	2	17	15.68
	3	9	16.94
	Total	31	
SF13	1	5	9.20
	2	17	15.76
	3	9	20.22
	Total	31	
SF14	1	5	19.40
	2	17	15.59
	3	9	14.89
	Total	31	
SF15	1	5	14.20
	2	17	14.15
	3	9	20.50
	Total	31	
SF16	1	5	17.70
	2	17	15.44
	3	9	16.11
	Total	31	

Kruskal-Wallis Test (continue)

SF17	1	5	14.80
	2	17	15.38
	3	9	17.83
	Total	31	
SF18	1	5	12.60
	2	17	17.47
	3	9	15.11
	Total	31	
SF19	1	5	11.10
	2	17	17.74
	3	9	15.44
	Total	31	
SF20	1	5	16.30
	2	17	14.53
	3	9	18.61
	Total	31	
SF21	1	5	14.50
	2	17	15.97
	3	9	16.89
	Total	31	
SF22	1	5	12.70
	2	17	15.82
	3	9	18.17
	Total	31	
SF23	1	5	14.80
	2	17	16.68
	3	9	15.39
	Total	31	
SF24	1	5	13.80
	2	17	16.18
	3	9	16.89
	Total	31	
SF25	1	5	15.00
	2	17	15.71
	3	9	17.11
	Total	31	

Kruskal-Wallis Test (continue)

SF26	1	5	10.20
	2	17	17.35
	3	9	16.67
	Total	31	
SF27	1	5	17.30
	2	17	15.24
	3	9	16.72
	Total	31	



Test Statistics^{a,b}

	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16	SF17	SF18	SF19	SF20	SF21	SF22	SF23	SF24	SF25	SF26	SF27
Chi-Square	5.846	1.586	1.205	5.470	2.260	.246	.269	1.147	7.281	2.820	5.664	.185	5.075	.926	3.555	.275	.673	1.388	2.385	1.345	.258	1.440	.281	.507	.320	4.236	.356
df	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.054	.453	.547	.065	.323	.884	.874	.564	.026	.244	.059	.912	.079	.629	.169	.871	.714	.500	.303	.510	.879	.487	.869	.776	.852	.120	.837

a. Kruskal Wallis test

b. Grouping variable: Foundation years

APPENDIX-8: Mann-Whitney U Test for Companies' Number of Employees and Main Headings of the Facilitator Factors

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Min	Max
MF1	31	4.06	1.413	1	5
MF2	31	4.13	1.056	2	5
MF3	31	4.52	.724	2	5
MF4	31	3.90	.978	1	5
MF5	31	3.84	1.293	1	5
MF6	31	4.55	.675	2	5
MF7	31	4.65	.551	3	5
Numberofemployees	31	1.84	.374	1	2

Mann-Whitney Test

Ranks

	Empmain	N	Mean Rank	Sum of Ranks
MF1	1	5	4.90	24.50
	2	26	18.13	471.50
	Total	31		
MF2	1	5	16.10	80.50
	2	26	15.98	415.50
	Total	31		
MF3	1	5	15.10	75.50
	2	26	16.17	420.50
	Total	31		
MF4	1	5	20.60	103.00
	2	26	15.12	393.00
	Total	31		
MF5	1	5	19.00	95.00
	2	26	15.42	401.00
	Total	31		
MF6	1	5	16.00	80.00
	2	26	16.00	416.00
	Total	31		
MF7	1	5	14.00	70.00
	2	26	16.38	426.00
	Total	31		

Test Statistics^a

	MF1	MF2	MF3	MF4	MF5	MF6	MF7
Mann-Whitney U	9.500	64.500	60.500	42.000	50.000	65.000	55.000
Wilcoxon W	24.500	415.500	75.500	393.000	401.000	416.000	70.000
Z	-3.342	-.029	-.282	-1.309	-.873	.000	-.658
Asymp. Sig. (2-tailed)	.001	.977	.778	.191	.383	1.000	.510
Exact Sig. [2*(1-tailed Sig.)]	.001 ^b	.979 ^b	.815 ^b	.235 ^b	.448 ^b	1.000 ^b	.620 ^b

a. Grouping variable: Number of employees

b. Not corrected for ties.