

**TECHNOLOGY INTELLIGENCE PROCESS IN TECHNOPARK FIRMS:  
AN EMPIRICAL RESEARCH IN TURKEY**

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**—Abstract—**

The new age is characterized by a knowledge based economy and rapid technological changes. In this complex environment, technology intelligence (TI)

and forecasting the future technologies are important for being proactive against the rapid technological changes and generating new innovations. TI is a vital process to sustain the firm's competitiveness. This paper examines the technology intelligence process in scope of Turkish technopark firms. The empirical data was obtained from 136 technopark firms and evaluated by the context of TI model synthesized by the researchers based on the literature. According to the results it is determined that, TI mechanisms of the technopark firms are unstructured and technopark firm's don't allocate enough resources for TI, they use the environments that can be easily reached such as internet and periodical magazines, and analyze the data about technology by using heuristic methods mostly. This could be related to characteristics of the technopark firms such as being micro size and owner-manager, insufficient personnel and financial sources etc. Because in developing countries like Turkey most of the firms are SMEs, a further research might be useful to develop a specialized TI model for SMEs

**Key words:** *Technology Intelligence, Technology Watch, Technology Scanning*

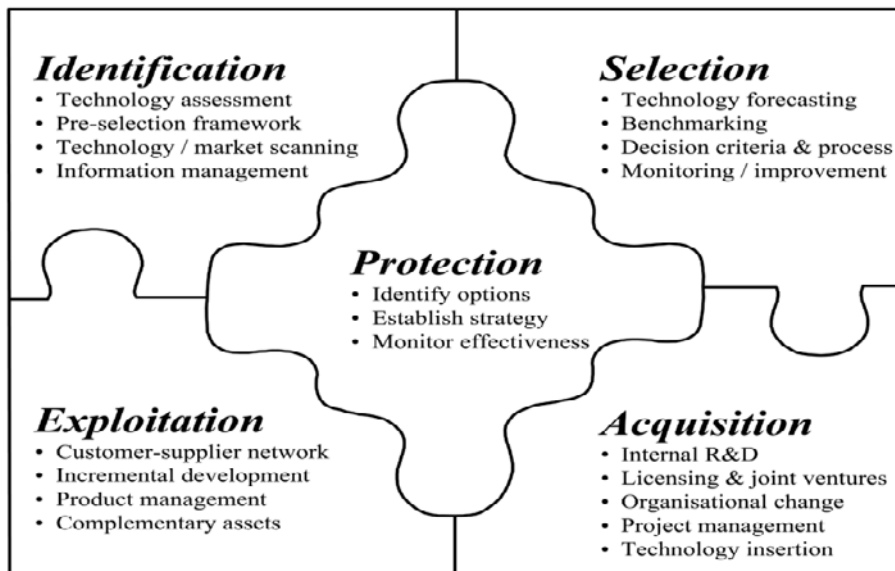
## 1. INTRODUCTION

Although Technology Management (TM) process defined as activities that do not have a starting and ending point in the TM model created by Gregory (1995), it is sure that, it will have a starting point at least for the organizations that will use the process for the first time. After Gregory, Çetindamar et al. (2010) defined TM process as a puzzle that does not pursue an order. Subprocess of TM which was generated by Gregory is given below.

Although the puzzle approach is accepted in TM literature, it is possible to assume that this approach was intrinsically designed to show TM process has continuous and never ending activities in technology age. In this approach, TI processes is comprised of actions which are necessary for the firms to allocate resources and conducted continuously.

TM discipline has still a long way to respond its basic theoretical questions about the technology environment. One of the basic questions is “How to give a proactive and smart reaction against the technological change?” Despite technological innovation can create new industries and transform or destroy existing ones, anticipating the direction and impact of technological change is one of the most difficult problems of TM (Utterback and Brown, 1972: 5, Cooper and Schendel 1976: 61).

Figure-1: TM Activities (Gregory, 1995)



The effectiveness of technology management is fundamentally influenced by observations made about current and future technology trends (Tschirky, 1994). Industry and government must anticipate radical technological changes that sweep aside existing practices and open new opportunities or create new problems. The company that neglects this task runs a serious risk (Bright, 1970: 62). In scientific literature and management practice, there is considerable agreement on the importance of accurate and early anticipation of future needs and technological developments/trends (Reger, 2001). This is due to globalization of market and technology, the increasing speed of innovation and product life cycles, growing

R&D expenditures and others (Arman and Foden, 2010). Smart organizations do not wait for change to happen but actively monitor and take advantage of changing environments and new innovations (Chesbrough, 2003). A system to gather early intelligence on disruptive technologies and a correct timing of access to those disruptive technologies might facilitate successful adoption of these technologies, leading to a competitive advantage (Veugelers et al., 2010).

According to the accepted TM models in literature, one of the core activities within TM is “identification of technologies” which includes search, auditing, data collection and intelligence processes for technologies and markets (Çetindamar, et al., 2010: 10). The dynamics of environmental alterations may lead to radical changes of the foundations on which the technology strategy of a company is based. Therefore, at least, foresight of future technologies is one of important part of corporate-level technology strategies of the companies (Edler, Kraemer, Reger, 2002: 155). However the complexity and dynamism of technological development make it difficult to generate an information base of relevant technological trend. Therefore, already in the 1970's, several authors called a systematic and continuous observation and evaluation of technological trends (Lichtenthaler, 2003:361).

Today, goals like increasing market share and profitability, and surviving in the competitive environment, compel the firms to develop, devise and produce high-tech products with high added value. Regarding to this fact, developing countries targeted and oriented towards establishing technoparks which are used by developed countries for a few decades. Technoparks, under government incentives and protective laws, include firms, academic institutions, brokerage firms (TTO, finance providers, NGOs etc.) (Etzkowitz and Leydesdorff, 2000; Chan et al., 2010). Although there are many reasons (tax cuts, financial incentives etc.) for the firms to take part in technoparks, the main reason seems likely to be following technology and technology generating organizations closely in order to increase the profitability by using these technologies (Siegel et al., 2003: 178; Almeida et al. 2008: 5). By the way, Turkish law supports Science and Technology Parks in Turkey to foster the university-industry cooperation and thus facilitate the commercialization of knowledge generated in universities and the production of high value added products and services by local firms (Kocak and Can, 2007).

The firms stationed in technoparks are encouraged to develop new technologies by the operational links designed among the firms, universities, research centers and government agencies in a geographical proximity. Therefore it is conceived that, technopark firms should have a strong instinct for monitoring and scanning the technological trends and adopting an internalized and systematic technology intelligence process. In order to investigate this assumption, the technopark firms in Turkey are inquired within the scope of commonly accepted technology intelligence process in the literature.

In this research we focus on these questions; (1) what are the motivation factors for TI process, and does the firms have the organizational capabilities (or elements) (budget, staffing, infrastructure etc.) to make TI,(2) while scanning and monitoring for technology which data sources do the firms use and which data sources are used more frequently, (3) after gathering technology data's which analyzing tools do the firms use to transform them into meaningful information, (4) how do the firms integrate this valuable information to their decision systems? Basically these questions constitute the foundation of this study.

For the main purposes which are given above, we organized our research as follows; past research on technology intelligence and the accepted technology intelligence process and tools are discussed in Section 2. In Section 3, the research methodology is outlined and the empirical results of the research are presented in Section 4. Finally, Section 5 draws the conclusion of this paper and our advice for future research.

## **2. TECHNOLOGY INTELLIGENCE AND SOME WORKS ON TECHNOLOGY INTELLIGENCE PROCESS**

Such systematic approaches on technology intelligence are generated and called in different terms in past researches: Technology Forecasting (Porter at al., 1991), Technology Scouting (Wolff, 1992), Technology Assessment (Lichtenthaler,

2004), Technological Environmental Scanning, Technology Scanning, Technology Watch, Technology Monitoring (Pena, 2009: 14). “Technology Intelligence” is more general and consistent term and also the most appearing term in literature between the above-mentioned approaches.

Throughout the past research on technology watch, monitoring, scanning or intelligence, it is evident that there are no exact definitions accepted generally about technology watch, monitoring, scanning or intelligence. However, considering the broad and strong background on technology intelligence, it could be accepted that technology watching, monitoring and scanning are consecutive processes linked to technology intelligence.

In order to understand the differences among technology watching, monitoring, scanning and intelligence, Aguilar (1967: 19-21) distinguishes four behavioral modes of intelligence activities:

- Undirected viewing: General exposure to information with no specific purpose or informational need in mind.
- Conditioned viewing: Exposure to information about selected areas or certain types of information.
- Informal search: The limited and unstructured efforts to obtain specific information.
- Formal search: Deliberate efforts following a pre-established plan, procedure or methodology to secure specific information.

Undirected and conditioned viewing can be referred to as “scanning”, informal and formal search as “monitoring” (Savioz, Luggen, Tschirky, 2003: 42). Besides the lack of common understanding of the difference between technology “intelligence” and “watch”, some authors define technology watch or monitoring activity as a fundamental element of technology intelligence process (Savioz, Luggen, Tschirky, 2003: 45).

According to some other researches, the activity of collecting and evaluating information on technology developments has been defined as TI (Ashton and Klavans, 1997; Savioz et al., 2003). Because of its exploratory nature, the process

steps for TI are often difficult to formalize such that TI can be explicitly used within an organization to support technology managers in decision making (Arman and Foden, 2010). In the same manner, Savioz (2002: 155) defines TI as “activities that support decision-making of technological and general management concerns by taking advantages of a well-timed preparation of relevant information on technological facts and trends (opportunities and threats) of the organization’s environment by means of collection, analysis and dissemination”. Kerr et al. (2006) articulates TI as “the capture and delivery of technological information as part of the process whereby a company develops an awareness of technology threats and opportunities”.

Technology intelligence encompasses the activities related to the collection, analysis and communication of relevant information on technological trends to support technological and more general decisions of the company (Lichtenthaler, 2004). The goal of technology intelligence is to exploit potential opportunities and to defend against potential threats, through prompt delivery of relevant information about technological trends in the environment of the company (Lichtenthaler, 2004). TI deals mainly with one question: “Are there any potential opportunities and threats in the technological environment?” To answer this question, each employee contributes with knowledge built during daily work (Savioz, Luggen, Tschirky, 2003: 45). That is to observe the technological change in a systematic way, which could be done through TI. Porter and Cunningham (2005:18) define technology TI (and monitoring) as a technology analysis process: “TI (also known technology watch, monitoring or environmental scanning) cataloguing, characterizing, and interpreting technology development activities.” Bright deals with TI (monitoring and scanning) in 1970, “to anticipate innovation, the political, social and other factors influencing its progress must be systematically monitored” and defines it in context of four activities (Bright, 1970: 64):

- Searching the environment for signals that may be forerunners of significant technological change.
- Identifying the possible consequences of the signals (assuming that these signals are not false and the trends that they suggest persist).

- Choosing the parameters, policies, events, and decisions that should be observed and followed to verify the true speed and direction of technology and the effects of employing it.
- Presenting the data from the foregoing steps in a timely and appropriate manner for management's use in decisions about the organization's reaction.

The approach of “signals”, defined by Utterback and Brown in 1972, stated that monitoring technological development has two fundamental activities (1972: 6):

- Identifying signals of change in embryonic stages,
- Gathering information on phenomena and parameters to determine the rate of advance as well as the character and form potential impacts of the change might take.

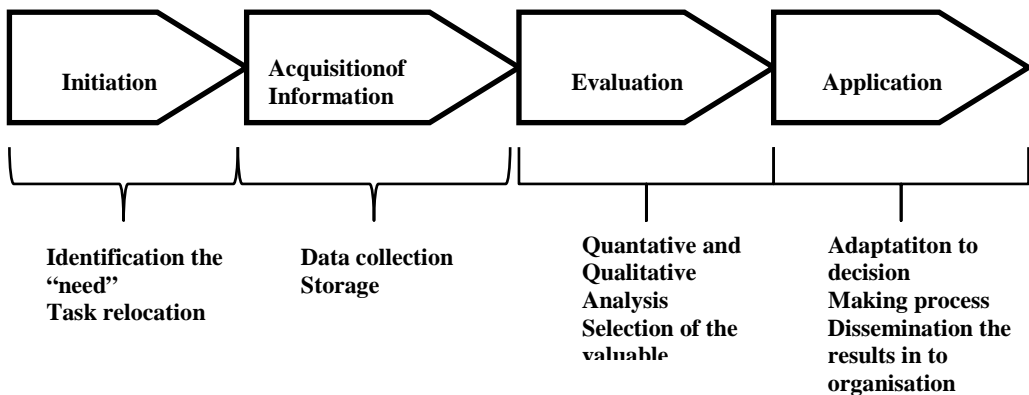
The signals or trend of objective observations on technological change could thus be used in managerial decisions relating to technologies in more objective manner. Fundamentally, the literature on technology intelligence consists of the description of the process formulated by Ashton et al. (1991). This process represents rather formalistic view of the technology intelligence process, including the acquisition (both, broad scanning and in-depth monitoring), valuation, and communication of technology-relevant information. However, their process seems to be over-formalized and not able to cope with a highly dynamic environment (Bucher et al., 2003: 150). Ashton and Stacey (1995) describe a customer orientated outlook that utilizes a systematic process which starts with planning for the TI activities, then data collection, analysis, dissemination and application. Although Ashton and Stacey (1995) portray a generic process that is easy to understand in practice, no specific tool at each stage is selected.

Bucher et al.(2003: 150), also present several steps which are flowed as (1) the initiation of technology intelligence activities, (2) the acquisition, (3) valuation, and (4) preselecting of technology-relevant information. Another technology intelligence process defined by AENOR, an ISO associated organization, has established a standardized process similar to other standard norms like 9001 for



Quality or 14001 for Environmental Issues, which overlaps with the above-mentioned steps (Pena, 2009: 15). Five stages can be distinguished in the TI cycle: planning and management, identification of sources, primary source collection, analysis and production, reporting and information (Veugelers et al., 2010). Differently, Lichtenthaler (2007), identified three types of TI processes in the context of radical technological change: the hierarchical, the participatory, and the hybrid technology intelligence processes. By evaluation and synthesis of these approaches, the steps flow in to our research framework generated as below:

Figure-2: Formed TI Process of the Research



*Initiation* phase consists of identification of the needs of information compliant with the objectives of the organization. Identification can be done through the information from external and internal environment of the organization such as the customers, the experts in the organization or even with the evolution of the products and environment. Identification of the need is followed by the identification of the sources for the data to be watched. Tasks and data sources are relocated through the plans and work breakdown structures.

Following step, *acquisition of information*, is searching for data and storing it in a form that may be retrieved when needed and accessible within the organization. Information is distilled through the objectives defined in previous step. Information sources should be scanned and watched periodically mostly on scientific publications, standards, customer and supplier feedbacks. Related information sources can be defined as periodical magazines, books, patents, standard documentaries, forums, societies etc. Informal sources such as fairs, congress, customer audits, supplier quotations, product briefings are also watched.

At *evaluation* step, information then should be generated by extrapolative, explorative or normative ways. Methods such as publication frequency analysis, publication citation analyses, quantitative conference analyses, patent frequency analyses, S-curve analyses, benchmarking, portfolio analyses, roadmap analyses, experience curve analyses, Delphi studies, expert panels, flexible expert interviews, lead user analyses and quality function deployment etc. (Lichtenthaler, 2005: 395).

Analysis on the information should be summed up on reports in order to be a part of *decision making process*. The key factors that will be considered in the relevance of the information will be: Awareness, risk reduction, required developments, innovation and cooperation and fit with the organization objectives. Not only will the information treated individually, but also synergy between different areas of knowledge should be explored. A close look will be held to check signs and factors that can impact the organization (Pena, 2009: 16).

### **3. RESEARCH FRAMEWORK: TECHNOLOGY INTELLIGENCE IN TECHNOPARKS**

This study is a hatching survey which aims to determine to what extent the determined actions in TI process model are implemented by the sample technopark firms. Hatching surveys aim to take instant picture of the situation in determined focused sample (Karasar, 2010). For analyzing the data, SPSS version 18 is used and 5 research questions were answered.

SMEs are essential for economic development of countries. In recent times, within the developing countries where prime mode of production depends upon basic technologies, here, Turkey is the case at hand, the small scale firms that are on the pursuit of attaining innovative product development choose to be inside the technoparks due to technical, logistical and administrative concerns. Considering the technopark firms' role over acquisition of advanced technology, innovative capacity, positive attitudes and trends on new product and process development, this study focused on technopark firms. These firms are supposed to be more aware of TM processes and TI activities due to being in technoparks. In Turkey, by the end of July 2014, 2,956 firms continue to operate in 41 technoparks (MSIT, 2014). A field survey method was used to collect data, conducted on firms operating in technoparks between August and December of 2014.

By adhering to synthesized TI model in the study, questionnaire consists of 4 main parts (excluding demographic questions). First part of the questionnaire consists of starting phase questions that address the motivation elements for firms to do TI (making TI for realizing what goals) and structural elements that the firms created to realize TI processes (budgeting, staffing, creating infrastructure). This phase consists of 11 items (6 for motivations of making TI, 5 for existence of organizational elements). In the same manner, for the acquisitions phase 8 items, for evaluating phase 8 items and for the integration phase 10 items were generated.

Following the construction of the questionnaire in congruence with the purpose of the study, 6 specialists in the area of TM and scientific research methods were consulted about the viability and sufficiency of the scale subjects on the way towards collecting data. It was planned to be sent to 32 technoparks in Turkey. Technopark administrations were contacted via internet and telephone and given detailed information about the topic. Questionnaire link was sent to firms through administrations of the 13 technoparks that accepted to take part in the study. In total, 136 questionnaires were returned.

Because the aim of study is to present the current situation of firms located in technoparks about the application of TI processes, following research questions (RQ) are created.

RQ.1.1 (Initiation Phase): Which needs (or reasons) get the firms to make TI?

RQ.1.2 (Initiation Phase): Does the firms have the organizational capabilities (or elements) (budget, staffing, infrastructure etc.) to make TI?

RQ.2 (Acquisition Phase): Which sources firms use to get data in TI process?

RQ.3 (Analyzing/Evaluating Phase): How do the firms evaluate the technological information and which tools do they prefer to use?

RQ.4 (Incorporating to Decision Making Processes/Integration Phase): How is the derived technology intelligence actions included into the decision system of the organization?

#### 4. RESEARCH RESULTS

As a result of the responses given by the 136 firms, some descriptive analysis is taken. It is seen that 53.5% of the firms participated in the study have less than 10 employees and just 16.7% have more than 50. So, almost all of the firms are micro level. With relation to being located in technoparks; just %20,8 of them has been stationed in technoparks less than 1 year period and %47 of them has been stationed in technoparks more than 3 years period. The number of employees and the durations which they have been in technoparks are summarized as follows:

Table-1: Firm Properties

Variables	Percentages%
Number of workers	

Less than 10	53.5
11–25	15.5
26–49	14.1
50 and above	16.9
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Duration of being in technopark	
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Less than 1 year	20.8
1-3 years	31.9
3-7 years	33.3
More than 7 years	13.9
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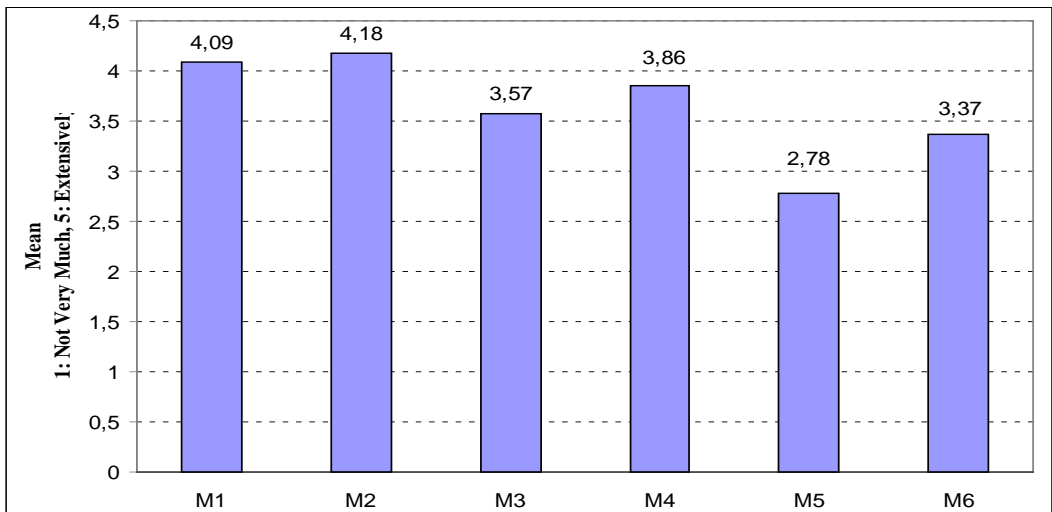
For the RQ 1.1, the main motivation items of the Turkish technopark firms to carry on TI process are listed in Table-2:

Table-2: The Main Motivation Items of TI (RQ 1.1)

Item No.	Items
M1	To satisfy the customer's new requirements and expectations.
M2	To increase the quality and performance of the existing products.
M3	To find out new ways in order to decrease the design and production costs.
M4	To be aware of new commercial and technological opportunities.

- M5 To take advantage of the capabilities and resources of other institutions/companies and to establish partnerships (such as R&D partnerships).
- M6 To watch potential and existing rivals/products.
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Figure-3: Motivation of Technology Intelligence



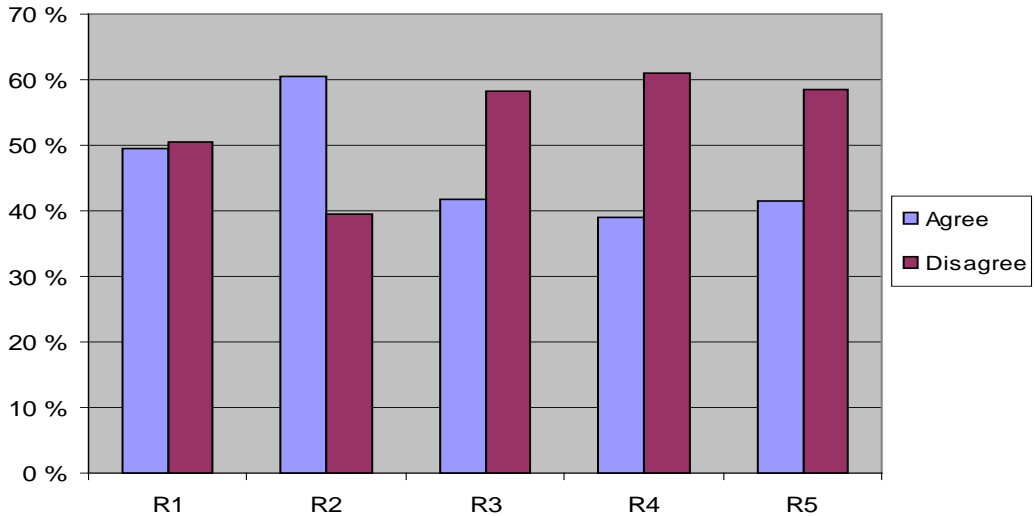
According to the results, as shown in Figure 3, technopark firms have a motivation to perform TI except the collaboration with other institutions. Despite the fact that the networks and collaborations inside and outside the technoparks are the major mechanisms to perform technological knowledge acquisition and technology transfers (Erün, 2012), technopark firms have not evident intent and desire for such collaborations. The most declared motivation of the technopark firms to perform TI is to increase the quality and performance of the existing products and to satisfy the customer's new requirements and expectations.

The questions about the measures and regulations of the firms in their organizational structure to integrate TI process are given in Table 3 and the results that are gained by the analysis of the responds are given in Figure 4.

Table-3: Regulations and Resource Allocation of the Firms to Conduct the Technology Intelligence Process (RQ. 1.2)

Item No.	Items
R1	Technology intelligence process is defined in work procedures
R2	Responsible employees are in charge of technology intelligence
R3	Specialized internal technology intelligence unit/department exists
R4	Information technology and networks for technology intelligence are provided
R5	Dedicated budget for technology intelligence is allocated

Figure-4: Regulations and Resource Allocation of the Firms to Conduct the Technology Intelligence Process



49.5% of the firms declared that they define TI activities in their work processes, 60.4% have appointed employees for TI processes, 41.7% have a specialized internal technology intelligence unit/department for TI processes, 38.9% have created a TI infrastructure in their firms and 41.5% of firms have a dedicated budget for TI processes. Turkish technopark firms prefer to embed the TI activities to their operational routines. The formal and informal TI methods in the organizations are discussed in the TI literature. Several researches argue that TI cannot be delegated fully to dedicated units (Gerybadze, 1994). On the other hand, the empirical studies on the most technology-intensive companies in the world have internal TI steering groups or personnel (Edler et al., 2002).

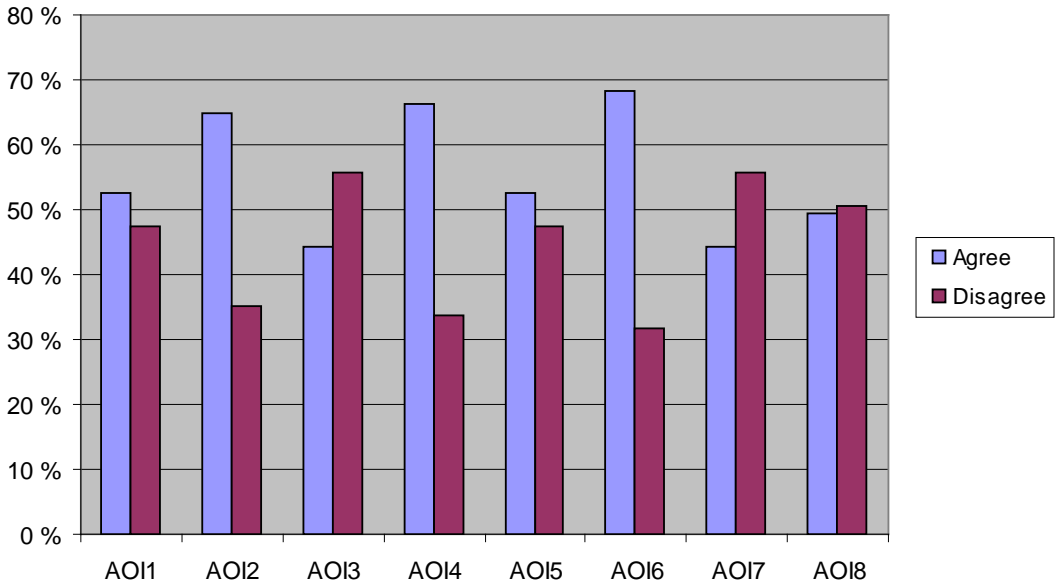
The scaling questions and the findings gathered from the analysis of the answers of the firms for RQ.2 which asks the sources used in the acquisition phase of the introduced TI model are given below.



Table-4: Technological Information Sources of the Firms (RQ. 2)

Item No.	Items
AOI1	Participating in technical societies, industrial platforms
AOI 2	Participating in technical seminars, conferences, fairs etc.
AOI 3	Networking with young firms, spin offs and start-ups
AOI 4	Monitoring industrial and related standards
AOI 5	Monitoring academic articles, thesis, books etc.
AOI 6	Monitoring industrial and technology websites
AOI 7	Participation in supplier workshops
AOI 8	Monitoring national and international patent databases

Figure-5: Technological Information Sources of the Firms



The technological data sources of the firms are mostly open sources such as web sites, fairs and symposiums. Actually fairs, symposiums and customer oriented

platforms combine the technological data and marketing activities. The new startups and suppliers seem not to be of such importance as a source of technological data. This finding is consistent with the result of RQ1.1 which founded the lowest level TI aim “to take advantage of the capabilities and resources of other institutions/companies and to establish partnerships (such as R&D partnerships)”. Also, technopark firms do not have an important reliance to watch the patent databases. It could be the result of tendency to spend their limited sources (financial, personnel and time) efficiently whereas patent databases require technical knowledge and infrastructure and the open sources are relatively cheap and accessible.

RQ.3 examines by which methods the firms analyzes the data and which are gathered by different methods for achieving organizational aims. The findings as a result of the analysis for the RQ 3 are given in Table 5 and Figure 4.

Table-5: Evaluation Methods of the Data Gathered for TI Items (RQ. 3)

Item No.	Items
E 1	Patent analysis is held concerning technology intelligence process
E 2	Bibliometric analysis is held concerning technology intelligence process
E 3	Technology trend analysis is held based on technology intelligence process
E 4	Roadmap analyses are held based on technology intelligence process.
E 5	Benchmarking processes are held based on technology intelligence process.
E 6	Technology development analysis, S-curves are held concerning technology intelligence process
E 7	Quality Function Deployment analysis is held concerning technology intelligence process
E 8	Some heuristics and creative problem solving methods are utilized depending on employee experience.

The instruments and tools that are used to analyze and evaluate the technological data are mostly heuristic methods. Top management prefers to make inferences based upon their experiments. This result could be related with the limited sources and size of the SMEs and owner-manager factor of the technopark firms. Bibliometric analyses, patent analyses, benchmarking process, roadmap analyses,, S-curves and Quality Function Deployment analysis are the least preferred tools. As a result of the gathered data, it is found that firms mostly use heuristic method

to give meaning to the data they collected and they use other analytical methods in low or very low levels. Although heuristic methods are appropriate for the analysis of the small data, it becomes a must to use analytical methods to give meaning to intensive data (Brin and Page, 1998).

For the last phase of TI, the phase of integration to decision making procedures, the questions (Table 6) and the information gained by the analysis of the responds is given as follows.

Figure-6: Evaluation of the Data Gathered for Technology Intelligence

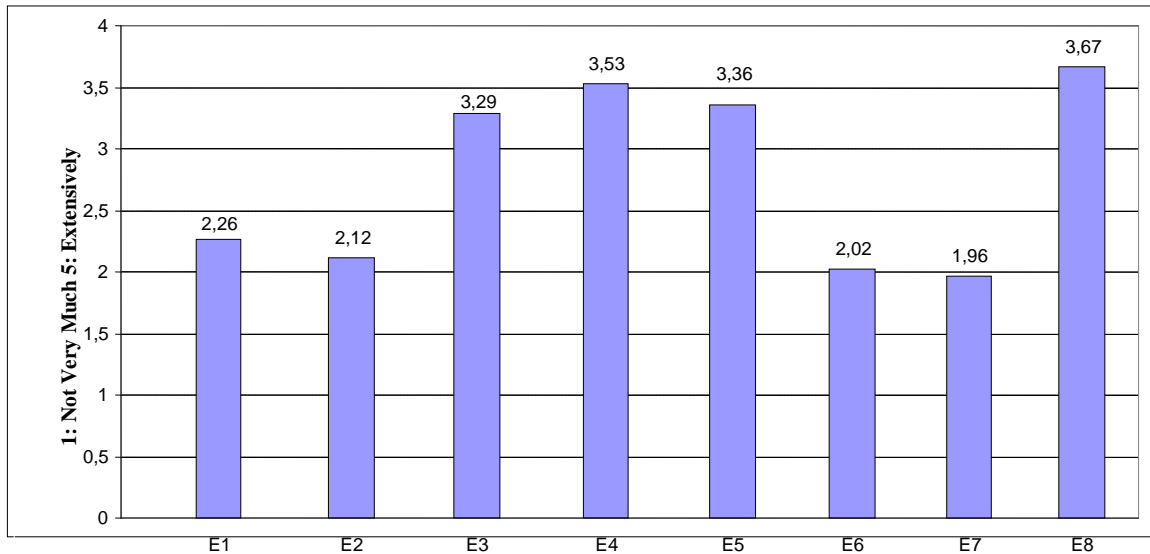
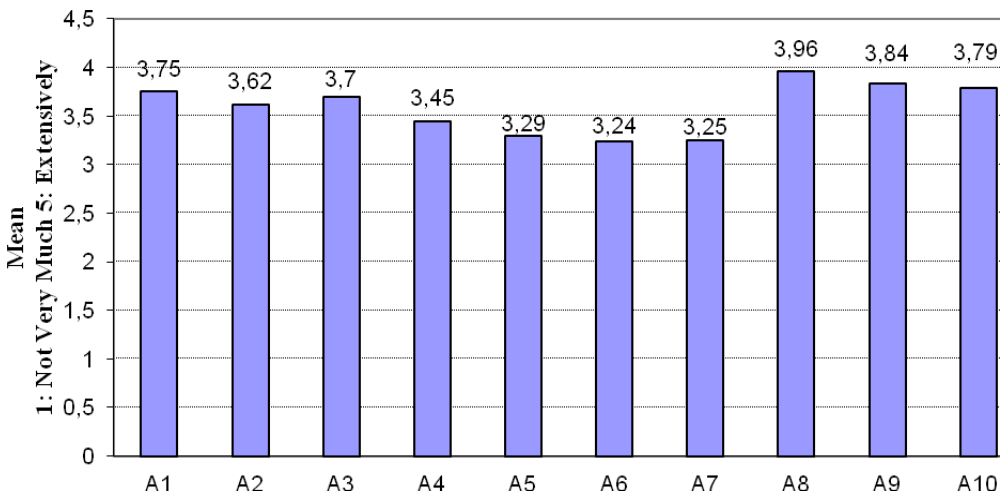


Table-6: Application of the Data Gathered for Technology Intelligence Items (RQ. 4)

Ite No.	Items
A 1	Technology intelligence results are regularly reported to top management

- A 2 Technology intelligence results are kept in database that is accessible for whole organization
- A 3 Technology intelligence results are discussed in daily meetings
- A 4 Technology intelligence results are shared within whole organization via e-mail, minutes of meeting etc.
- A 5 Technology intelligence results are input for selecting new business partners
- A 6 Technology intelligence results are shared with the project or business partners
- A 7 Technology intelligence results are input for technology transfer decisions
- A 8 Technology intelligence results are integrated to R&D and new product development process.
- A 9 Technology intelligence results are the input for project selection
- A 10 Technology intelligence results are input for strategic goals development process

Figure-7.:Application of the Data Gathered for Technology Intelligence



The results show that the firms most frequently integrate this data to R&D or new product development and project selection processes. Their inclination to use the information for all of the decision making procedures and organizational actions is determined as partly high.

## 5. CONCLUSION AND DISCUSSION

This study discusses the TI processes of Turkish technopark firms, in context of synthesized TI model, by the empirical data that was obtained from 136 technopark firms. Data collected by survey show that the technopark firms are mostly SMEs and they conduct technology intelligence process mostly informal methods. Most of them do not allocate resources such as budget and personnel for TI process. When monitoring the technologies, the great reliance on using relatively not technical and informally structured sources and instruments shows us that TI mechanisms of the technopark firms are some more different than reviewed big companies in literature. The tech-based and R&D oriented companies in the world put more emphasis on TI and have more formal and systematic TI process (Edler et al., 2002; Lichtenthaler, 2003; Lichtenthaler, 2005). This diversification could be related to characteristics of the technopark firms such as size, owner-manager factor, personnel and financial sources etc. But, traditional monitoring processes in most companies are largely arbitrary, and are dependent on what individuals in the company read think and share informally with each other. (Fleisher, 2006). In today's world, such an arbitrary process is insufficient (Patton, 2005).

Veugelers et al. (2010) found that the Internet is growing so large that quick keyword searches at low search depth are likely to miss a number of technologies of interest to the organization. Data sources for technology intelligence contain millions of documents and to automate the collecting, processing and analysis of millions of textual data sources, one needs appropriate IT tools. To select the right tools, an organization needs to understand the role and possibilities of IT in the technology intelligence process, as this will allow the identification, selection and installation of the appropriate, cost-effective software (Veugelers et al., 2010).

In prior works, many reasons have been brought forward to explain why some companies master radical technological change and others do not. The most often cited are managerial incompetence, organizational inertia, insufficient financial resources, a rigid organizational culture, and insufficient technology intelligence

(Christensen, 1997; Schilling, 1998; Iansiti, 2000; Cohen and Levinthal, 1990). The reviewed firms in TI literature are mostly international, big-sized and resource-rich organizations, and the generic model of TI is based upon those companies' TI implementations. Arman and Foden (2010) made a case study in an aerospace organization employing 38.000 people in 50 countries and found that the implementation of TI methodologies are intended to enable proactive searches for information on potential technology-related developments. SMEs have more limited sources than big firms. Also, owner-managers have a psychological ownership effect in SME's strategic behaviors (Ikavalko et al., 2010). And this could affect the TI process of the SMEs.

The technopark firms are supposed to be more technology oriented and technology driven firms but most of them are SMEs. Therefore, further research should focus on how SMEs can perform TI more effectively and efficiently. More comprehensive research can be made on this topic in the future.

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