

Innovation Strategies and Challenges in Emerging Economies: The Case of Research and Technology Organizations in Turkey

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Abstract—Innovation is highly critical for every company, especially for technology-based organizations looking to sustain their competitive advantage. However, this is not an easy task. Regardless of the size of the enterprise, market and location, all organizations face numerous challenges. Even though huge barriers to innovation exist in different countries, firm- and industry-specific challenges can be distinguished. This paper examines innovation strategies and obstacles to innovation in research and technology organizations (RTO) of Turkey. From the most important to the least, nine different challenges are ranked according to the results of this survey. The findings reveal that to take the lead in innovation, financial constraint is the biggest challenge, which is consistent with the related literature. It ranked number one in this study. Beyond that, based on a sample of 40 RTOs, regional challenges such as underdeveloped regional innovation ecosystem plays a significant role in hampering innovation. Most of the organizations (55%) embrace an incremental approach to innovation, while only few pursue radical shifts. About 40% of the RTOs focus on product innovation, and 27.5% of them concentrate on technological innovation, while a very limited number aim for operational excellence and customer engagement as the focus of their strategic innovation efforts.

Keywords—Innovation strategies, innovation challenges, emerging economies, research and technology organizations.

I. INTRODUCTION

THE subject of innovation management has been notably discussed in business literature for decades. Many studies have explored firm-specific differences since each organization faces unique challenges due to its operating circumstances. As an example, the size of the organization and market orientation affect innovation; therefore, innovation strategies should be tailored to the internal and external conditions of the organization such as the structure, life cycle of the marketplace, size of the ecosystem, competition and even the geographic location [1]. Innovation strategies should therefore be tailored to the internal and external conditions of the organization such as the structure, life cycle of the marketplace, size of the ecosystem, competition and even the geographic location.

This paper examines the innovation challenges that technology-based institutions experience in Turkey. Also, their innovation strategies and strategic orientations are analyzed. We propose that external factors in a particular industry and region may shape the firm's strategic orientation

and innovation decisions because location-related factors (poor technology ecosystem) are among the most critical obstacles according to the results of this study. The purpose of the research is to give an overview about the innovation activities in RTOs of Turkey. The main contribution of this paper is to highlight innovation strategies and challenges in an emerging economy and in certain types of organizations. Obviously, further researches are needed for more detailed results and comprehensive discussions.

A. Innovation Strategies

In general, there are two types of innovation: incremental and radical. Drucker adds two more basic types of innovation: additive and complementary [2]. As innovation literature and practice have been developed, new types of innovations are introduced [3]. The Oslo Manual proposes innovation types as: product, process, marketing method, and new organizational method [4]. Eschenbächer introduces business model innovation additionally [5]. Moore considers innovation in the context of the category life cycle, with category being the product or service term used by customers to distinguish what it is they are buying [6]. Moore proposes four categories related to the life cycle of market place (product leadership, operational excellence, customer intimacy, and category renewal) and he presents 15 types of innovation strategies under those categories as follows:

- Disruptive
- Application
- Product
- Platform
- Values Engineering
- Integration
- Process
- Value Migration
- Line Extensions
- Enhancements
- Marketing
- Experimental
- Organic
- Structural
- Exit

Jaruzelski and Dehoff in The Booz Allen Hamilton (BAH) report divide innovative companies into three categories: need seekers, market readers and technology drivers [7]. Moore's product leaders fit BAH's need seekers. Market readers are relatively similar to customer leaders in Moore's framework

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and basically the technology drivers' competitive edge is operational excellence.

This paper is structured in the following way. First, a critical literature review is presented. Then, the research methodology is explained. Subsequently, the results are demonstrated. Finally, the conclusions are disclosed.

II. EMPIRICAL AND THEORETICAL BACKGROUND

Innovation studies have been mostly focused on the manufacturing industry. The available empirical literature of innovation studies in technology-intensive industries, especially in emerging economies, is scarce. Also, factors that influence innovation in SMEs have been widely studied in developed countries, while SMEs in emerging economies, especially barriers to innovation, have been neglected [8]-[10]. On the other hand, in recent decades, there has been an increasing interest on a special kind of sector [11]-[12]. Especially, barriers to innovation in SMEs have been gradually examined in recent years [13], [14].

A. Innovation Challenges

Piatrier categorized innovation barriers as external and internal in general [15]. Larsen and Lewis proposed three categorizations: financial barriers, marketing barriers, and management barriers [16]. Segarra-Blasco et al. categorized innovation barriers as: cost barriers, knowledge barriers and market barriers [17]. Arvid had slightly different classification: financial barriers, risk barriers, competence barriers, organizational barriers and legal barriers [18].

Recently, more geography-specific studies regarding barriers to innovation in SMEs have been conducted. Cordeiro and Vieira made an international comparison by country. Janeriro [19] revealed six barriers to innovation in Portuguese: (1) the organizational structure; (2) the culture and resistance to change; (3) tradition and rules; (4) market leadership and the absence of rethinking of it; (5) additional work brought by change, and lastly, (6) weak return on investment given risk assumed [14].

Madrid-Guijarro et al. examined barriers to innovation about Spanish manufacturing in SMEs. The results show that the managers' perceptions of issues related to cost are greater barriers [20]. Additionally, Segarra-Blasco et al. identified barriers to innovation in Catalonia are: (1) cost barriers; (2) knowledge barriers and (3) market barriers [17].

Firms in the UK deal with three main barriers: (1) the time required to develop innovation; (2) risk aversion and (3) poor market knowledge [21].

Buse et al. presented the more frequent barriers in Germany as: (1) low budgets; (2) difficulty in recruiting adequate human resources; (3) bureaucracy and (4) poor cooperation [22].

The results of Demirbas' research showed as barriers to innovation in Turkey: (1) lack of state policies to support technology and R&D activities; (2) negative impact of the economy in the level of investment; (3) the high cost of innovation; (4) the lack of appropriate means of financing and (5) the lack of qualified personnel [23].

In Czech Republic, barriers to innovation are (1) high cost; (2) the lack of specialists; (3) long payback periods for recouping investments; (4) equipment technology; (5) standards and legislation; (6) lack of capital; (7) lack of consumer response; (8) resistance to change; (9) the fear of risk; (10) ignorance of the market, and finally, (11) infrastructure of the business [24].

The Community Innovation Survey in France showed nine barriers to innovation: (1) high cost on innovation; (2) the nonexistence of appropriate sources of funding; (3) internal resistance to change in firms; (4) lack of qualified personnel; (6) low information about the markets; (8) level of legislation, regulations and standards, and lastly, (9) lack of commitment of the customer to new products [25].

In Italy, Iammarino et al. found barriers to innovation as: (1) the lack of funding sources; (2) the excessive financial risk; (3) the innovation costs dimension; (4) the inexistence of qualified human resources; (5) the low information about the markets; (6) the scarce information on technology, and (7) the rigid regulatory [26].

Mussi and Spuldar list barriers to innovation in Brazil as follows: (1) risk associated with excessive specialization of human resources; (2) super enhancement of production processes; (3) limitations on the allocation of financial and human resources; and, (4) limitation of market access [27].

Kamalian et al. described barriers to innovation in Iran as: (1) excessive economic risk; (2) insufficient economic resources; (3) insufficient funds, and, (4) the high cost associated with innovation [28].

According to the study conducted by Cordeiro and Vieira more barriers to innovation in SMEs in Spain were: (1) the current economic climate; (2) the limitation of monetary resources; (3) the reduced risk-taking culture; (4) the mechanical performance; (5) routine and cemented processes; (6) resistance to change among leaders and employees; (7) the lack of incentives and compensation for innovation; (8) the high cost of new tools and processes; (9) the small size of the company; and, (10) the owner's profile of leadership and risk taking [14].

Finally, Zhu et al. identified the five key institution-based barriers to innovation in China: (1) unfair competition; (2) access to financing; (3) laws and regulation; (4) tax burdens; and, (5) support systems [13].

Most studies show that factors influencing innovation in SMEs are similar regardless of geography. According to the findings, most common barriers to innovation are high costs, and lack of funding and lack of skilled human resources. Although globally it can be concluded that there are huge similarities in the barriers in different countries, we see that geography-based obstacles such as lack of government support and weak legislation are more emphasized in emerging economies.

More importantly, most of the innovation studies in the literature and referred above are not industry-specific. For example, the software and related IT service sectors are the most innovative in developed economies and in some catching-up economies as well, however, literature regarding

barriers to innovation in such sectors in emerging markets is very limited [29].

A number of studies have examined the influence of company size in innovation. Ettlie and Rubenstein argue that large companies can access to key resources and are able to take on more radical innovations [30]. Laforet finds size is associated with innovation [1]. Dunk highlights the relationship between higher innovation rates and budget constraints, regardless of the size [31].

Also, flexibility is one the terms highly emphasized with regard to innovation in business literature. Strategic flexibility (size, structure, culture of organization) can influence innovation performance by providing more flexible process and structure [32]. Coordination flexibility positively moderates the relationship between product innovation and firm performance [33]. Lastly, optimization of innovation process affects success of innovation efforts. The management of innovation process as an influential factor is widely studied. As an example, Eschenbaecher and Graser demonstrate the potential impact of collaborative networks on innovation [34].

Based on previous research and the findings of this paper, we can basically classify challenges to innovation into four categories:

- 1) **Financial Challenges:** Lack of sources of capital, high amount of investments, and the cost of innovation.
- 2) **Legal Challenges:** Lack of rules and regulations, weak protection of property rights, low barriers to intellectual property theft, and lack of governmental support.
- 3) **Managerial Challenges:** Lack of skilled human resources, size of the company, and structure of the organization and organizational culture.
- 4) **Regional (Market) Challenges:** Lack of opportunities in the market, lack of cooperation with other firms, weak ecosystem, and weak R&D network.

III. RESEARCH METHODOLOGY

The data were collected as part of a larger study designed to explore the strategic planning and innovation activities of IISRC's (Informatics and Information Security Research Center) stakeholders in Turkey. The IISRC annually holds its stakeholders workshop to brainstorm certain subjects, especially trending technologies. In 2014, 100 organizations from different sectors such as telecommunications, defense, finance, security, government, energy, etc., were invited, and 74 organizations participated in the event. The sample group was designed to represent the characteristics of RTOs. Since technologically advanced organizations, particularly in knowledge intensive sectors are more innovative, only technology-based organizations were selected no matter the size of the enterprise. Specifically, the biggest portion (40%) of the sample group was chosen from the information and communication technology (ICT) sector. As the objective for the study was to diagnose rather than to explain, the sample approached was limited to 40 RTOs out of 74 participants. Middle and top managers were surveyed from different organizations that are known or expected to be active in research and technology development.

TABLE I
CHARACTERISTICS OF THE RESPONDING COMPANIES (N=40)

Industry sector	R&D Department	Number of employees involved in R&D	R&D Budget (Million USD)
ICT 40%	Exist 65%	10-50 38%	< 1 13%
Defense 35%	Non-existent 35%	50-100 10%	1-50 33%
Aerospace 4%		100-250 13%	50-250 8%
Transport 3%		>250 5%	>250 5%
Other 13%		Unanswered 38%	Unanswered 38%

IV. RESULTS AND ANALYSIS

A. Innovation Management

Before examining the challenges to innovation that RTOs face in Turkey and introducing their innovation strategies, Table II partially presents a big-picture look at innovation activities in technology-intensive industries of Turkey. About half of the organizations (57.5%) have a department or staff in charge of innovation management. That might signal progress. It may be assumed that the organizations are aware of the importance of innovation, but there is still long way to go. Obviously, 57.5% is not a great figure, but at least institutions are start thinking of innovation management, and are slowly establishing an organizational unit or assigning an employee which is a positive sign. On the other hand, only 27.5% of the organizations use a tool or software for idea generation or selection. It can be interpreted that even the organizations which have employees or a full department in charge of innovation management handle their innovation activities in traditional ways. Lastly and interestingly, 25% of the companies have at least one KPI in their strategic plan to measure the performance of their innovation activities, while 40% of the institutions do not link their innovation efforts (if there are any) to their strategic plan. This figure is very critical for seeing how strategic the organizations consider their innovation activities are. Unfortunately, we had a relatively high number of unanswered participants; especially, in regard to the last question which was referring to a KPI relating to innovation.

TABLE II
INNOVATION MANAGEMENT (N=40)

	Exist	Nonexistent	Unanswered
Innovation Management Department or Staff	n=26 57.5%	n=12 30%	n=5 12.5%
Tool/Software for Innovation/Idea Management	n=11 27.5%	n=11 62.5%	n=4 10%
Key performance indicators regarding innovation in strategic plan	n=10 25%	n=16 40%	n=14 35%

B. Innovation Strategies

The results show that slightly more than half of the institutions (55%) embrace an incremental innovation approach. Only one organization in the sample group responded that it pursues a radical innovation strategy, while 25% of the companies do not have any strategy at all. Even though it is an alarming sign, the result is not surprising. In the previous section, 25% of the firms do not have any items

about innovation in their strategic plan, so it might be expected that 25% of the organizations lack an innovation strategy.

Inspired by Moore's technology adoption life cycle (TALC), the organizations were questioned on what specific areas their innovation efforts focused [6]. Our findings show that technology-based institutions focus on mostly production and technology innovation. Not surprisingly, 40% of companies focus on product innovation, while 27.5% of organizations aim at innovation in new technologies. Technology innovation refers the disruptive innovations in Moore's TALC. New technologies cause disruptive innovation. Therefore, organizations that aim to develop new technologies are trying to create a new market. The same number of the companies (n=4, 10%) claimed that their innovation efforts focus on customer intimacy and operational excellence. Innovation activities regarding operational excellence and customer intimacy may be expected to be done more in the manufacturing sector and other conventional industries compared to knowledge-intensive business services sectors. It would make sense that technology- and R&D-intensive organizations focus more on technology and product innovation.

TABLE III
INNOVATION STRATEGIES (N=40)

Innovation Strategy	
Incremental	n=22 55%
Radical	n=1 2,5%
No Strategy	n=10 25%
Unanswered	n=7 %17.5
Innovation Focus	
New Technology	n=11 27,5%
Product	n=16 40%
Customer Intimacy	n=4 10%
Operational Excellence	n=4 10%
None	n=1 2,5%
Unanswered	n=4 10%

C. Innovation Challenges

In this question, nine challenges were presented to the participants, and they were asked to rank from the most important challenge to the least important one. Whereas the most critical obstacle gets 1 point, the least important is scored as 9. After calculating the total score of every challenge, the average is figured.

According to the findings of this study, heavy investment requirement for innovation is a top challenge. In other words, the most challenging barrier that RTOs face in Turkey is that innovative projects need big budgets. The high speed of technological advancements is ranked number two. The ranking from top to bottom is listed as follows:

1. Heavy investments
2. High speed of technological advancements
3. Length of projects
4. Poor ecosystem
5. Scoping of customer needs
6. Forecasting of emerging technologies

7. Competition
 8. Strategic planning and measuring of R&D performance
 9. Conflict of interest between academy and industry
- *Heavy investments*: Financial constraints seem to be the most important obstacle to innovation. Since R&D projects require heavy investments, this challenge is ranked as number one.
 - *High speed of technologic advancements*: It is very difficult to concentrate on one specific area of technology for tech-based organizations. New technologies emerge continuously, and technology management gets more and more complicated every day. Many products die even before maturity. These make it more complicated to find out the right fields of technologies for R&D organizations. Companies invest millions of dollars, but one wrong decision might be fatal. Apparently, the consequences of the digital age might be also an enemy for innovation if it cannot be managed well.
 - *Length of the projects*: The participants also say that R&D projects take years. Normally, a standard research project lasts from five to 10 years. In that timeframe, there might not be enough room for innovation. Resources are already allocated and employees are loaded with projects that must be delivered on time.
 - *Poor ecosystem*: The managers of the companies in this study believe that the size of the ecosystem is key for fruitful cooperation and that cooperation between the industry players is a must to develop new technologies in a timely way. According to the findings of the survey, it seems that the size of the technology ecosystem is not big enough.
 - *Scoping of customer needs*: Another challenge that technology-based organizations experience is the accurate identification of customer requests and scoping of the projects.
 - *Forecasting of emerging technologies*: Technology firms and R&D organizations should closely follow trends to be able to project future technologies and products. However, sometimes they may not see the future clearly and make wrong choices and investments. The consequences may paralyze future innovation studies.
 - *Competition*: Intense competition is another challenge. Due to this competition, most of the organizations have to survive, and therefore, innovation sometimes is the last item on the agenda.
 - *Measuring of R&D performance*: Another challenge that RTOs face is setting performance indicators and measuring the performance of R&D activities. It may make sense, since generally, strategic plans are made for three to five years and R&D projects take longer. Additionally, it is not easy to measure of the outcomes of the projects.
 - *Conflict of interest between academy and industry*: Universities are supposed to do basic research. On the other hand, industries and consumers are more interested in practical research. Obviously, universities and certain

research centers should conduct visionary projects; however, if the outcomes of their studies do not turn into technologies and those technologies are not transferred to the industry, we may see a huge gap. The roots of this

challenge may be linked to the poor ecosystem mentioned before. Universities, R&D institutions, and corporations should work together. Also, effective organizations that will manage the entire ecosystem should be created.

TABLE IV
INDUSTRY SPECIFIC CHALLENGES TO INNOVATION (N=40)

Organization No	High speed of technological advancements	Competition	Heavy Investments	Length of projects	Forecasting of emerging technologies	Identification of customer need	Measuring of R&D performance	Conflict between academy and industry	Poor ecosystem
1	7	4	3	1		2	8	5	6
2	1		2	3	4	6	5	7	8
3	6	6	6	5	4	7	5	7	7
4			1	4	2	3	5	7	8
5	3		1	8	2	7	4	5	6
6	5		2	1	3	8	4	6	7
7	4	2	1	3	6	8	5	9	7
8	3		1	2					
9	3	4	1	5		7	8	6	2
10	1		2	3	4	5			
11	3		4	7	5	8	6	1	2
12	3		4	8	1	2	5	6	7
13	3	5	5	3	1	8	8	8	8
14	5	6	1	2	8	9	7	4	3
15	1	2	2	4	5	1	2	5	4
16	4	3	6	2	5	2	7	8	1
17	2	8	2	3	3	6	8	7	4
18	8	2	7	6	5		3	4	1
19	5	2	1	3	6	9	8	7	4
20	8	2	4	3	4	7	6	7	7
21	3		2	7	8	1	6	5	4
22	2	8	4	3	6		1	7	5
23	4	8	1	6	5	2	7	3	1
24	7	9	6	5	2	8	3	4	1
25	5		3	2	4	1	8	7	6
26				4	5	3		2	1
27	2	8	1	3	7		5	6	4
28	6	4	1	5	9	2	7	8	3
29	1	8	6	4	5	2	9	3	7
30	2	6	4	3	7	1	5	8	9
31	4	3	7	6	2	5	8	9	1
32	4	6	2	5	8	3	7	9	1
33	4	6	2	5	8	3	7	9	1
34			4	5	6	3	2		1
35		6	1	3	7	8	5	4	2
36	5	3	4	3	4	2	2	5	1
37	2			1				3	
38	3	6	2	7		4	8	1	5
39	8		7	5	4	6	1	3	2
40			1			2	3	4	
Total	137	127	114	158	165	161	198	209	147
Average	3.91	5.08	3.00	4.05	4.85	4.60	5.50	5.65	4.08

To sum up the results, it is proposed that nine challenges mentioned above can be grouped as follows:

- 1) **Financial Challenges:** barriers regarding the funding of the innovation, all related projects and activities (heavy investments).
- 2) **Managerial Challenges:** obstacles related to managing innovation process and projects, also tracking results
- 3) **Regional (Market) Challenges:** obstacles related to specific industries, the market, and the location (high speed of technological advancements, poor ecosystem, forecasting of emerging technologies, competition, conflict of interest between academy and industry).

Table V shows the total score and average scores of these three categorizations, which can be ranked from the most important to least important as follows:

1. Financial Challenges
2. Regional (Market) Challenges
3. Managerial Challenges

TABLE V
CATEGORIZATIONS OF INNOVATION CHALLENGES

	Total Score	Average Score
Financial Challenges	3	3
Managerial Challenges	10.1	5.05
Regional Challenges	27.62	4.6

V. DISCUSSION AND CONCLUSIONS

This study, which was conducted on RTOs of Turkey, highlighted the challenges to innovation. Our findings are consistent with previous research. Financial constraint is one of the most critical barriers to innovation and ranks number one in the results of this survey.

Beyond that, this paper provides a novel contribution to the literature from various respects. First, it shows that regional (market) challenges follow financial challenges and that they are more important than the managerial challenges to innovation. The managerial challenge is the least critical.

Second, the paper presents some industry- and organization-specific obstacles as well: 1) high speed of technological advancements; 2) length of the projects; 3) forecasting of emerging technologies, and 4) measuring R&D performance. Two of four industry-specific challenges are ranked in the top three.

Third, the paper proposes that some challenges would be more important in certain countries, especially in emerging economies. One of the most striking results emerging from the study is that quantitative and qualitative characteristics of technology ecosystems would be highly critical for innovation. Poor ecosystem is ranked as the fourth important challenge to innovation. Additionally, effective management of the ecosystem will be associated with innovation. Even if it ranks as the least important challenge (conflict of interest between academy and industry), the impact of managing an ecosystem on innovation should be explored more in future studies.

Lastly, more than half of the organizations (55%) have an incremental innovation approach while only one organization in the sample groups claims that its strategy is radical innovation. Additionally, the majority of the RTOs focus on product innovation. Technology innovation (27.5%) follows and some portion of the organizations (10%) concentrate on customer intimacy innovation and operational excellence.

A. Managerial Implications

The location-based challenges seem very critical for emerging economies. The policy makers who intend to foster national innovation should catalyze cooperation among players. Research centers, universities, private companies, and government agencies should collaborate to develop more

competitive products and technologies. To do so, extending the ecosystem is necessary. Secondly, some government incentives can be launched to encourage small and medium sized businesses that are suffering from lack of capital. Also, venture capital firms should be more active in emerging economies. Governments should also encourage local and international capital firms to boost innovative projects and ideas. Managers of research and technology institutions should create an organizational culture for fruitful innovation. Even if their most skilled employees are loaded with their daily duties and critical projects, always there should be room for innovation. While delivering current projects, talented workers also must actively follow the trends and forecast emerging technologies. Highly skilled human resources and capital are needed to be prepared for the future.

B. Limitations and Further Research Directions

Like any other study, this one leaves unanswered questions for further analysis as well. Survey data, as with any other research sample, has limitations, posing the need for additional research. The results of this research are restricted with a sample of just 40 organizations. Further research should use a larger sample size to validate our findings. This survey is conducted on RTOs of Turkey; findings might not be transferable to all types of organizations. Thus, it is recommended that further research also can be conducted in different sectors and in different countries. Another limitation of this survey is that some respondents did not answer some questions or they missed some choices. Also, this survey did not include legal challenges such as copyright and lack of government support. Further surveys can be designed more comprehensively and data collection can be done in face to face meetings by different respondents who are knowledgeable about the entire organization.

The current study is the first step to investigate challenges to innovations in knowledge-based sectors, especially in the tech industry in emerging economies. Due to the limited time to collect data and the limited sample size, the conclusions of our survey are only tentative. Further studies may provide more detailed questionnaires by in-depth interviews. Examinations of all innovation types and strategies in different sectors and countries are worth further consideration and analyses. Overall, the study has provided valuable material for both practitioners and academics.

While this paper is limited by the relatively small sample size, it has clearly pointed out the necessity for future research that probes deeper into the underlying sector- and location-based challenges that pull down innovation potential in RTOs. Lastly, not only a few but all types innovation strategies in RTOs located in different countries should be explored in further studies.

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