Trends in the Turkish IT Industry

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***Abstract* — According to a recent Gartner report, Turkey is among the emerging economies and in the list of top 30 countries for Information Technology (IT), and offshore services. In the last decade, the country has done excellent progress in the software sector which is reflected in the rise of exports to many countries. In this article, we present an overview of the Turkey's software sector scenario including current trends in software process, testing, quality, agile method's adoption along with techno parks and incentives provided by the government.**

***Index Terms* — software sector, agile method, techno parks**

I. Introduction

In recent years Turkey is increasingly positioning itself as an all-round provider of IT services, both in terms of application and infrastructure management as well as that of end user management [1]. The Turkish software sector has accelerated its efforts in various service areas, particularly in banking, insurance, defense, telecom, tourism, transport, logistics and contracting in almost all industrial sectors especially in textiles, machinery, metal, automotive and auto parts [2]. This could be possible due to the rise of corporate social responsibility, increasing importance in quality standards, and mandatory governmental implementations for applications, adoption of electronic services in both public and SMEs in all sectors, governmental incentives for IT start-ups, increasing use of effective and efficient e-solutions in every aspect of life [2]. Moreover, Gartner recently identified Turkey among the top 30 countries for IT offshore services between Europe, the Middle East and Africa group (http://www.gartner.com/it/page.jsp?id=1500514).

This paper presents an overview of software sector scenario in Turkey in terms of current trends in software process, testing, quality, agile methods adoption along with techno parks and incentives provided by the government. Turkey's software market has reached approximately US$ 1.6 billion in 2009, up from $ 1.4 billion for 2008, which was nearly 20% of IT in 2008. The growth rate of the Turkish software market was estimated at 7% at the end of 2009, and is expected to be 10% in 2010. It is worth mentioning that the Turkish software market has experienced double-digit growth recently [2].

II. Software Development Organizations

IT companies in Turkey have been constructed and organized around Technology Development Zones (TGZs).

Fourty-five such zones have been established by law and as of December 2011, thirty-two of them are active. These TGZs host the Techno Parks/Cities and around 1,800 technology establishments. IT and Software Development companies have 57% shares in the total. In addition to TGZs, Technology Development Centers (TEKMER) under KOSGEB (Republic of Turkey Small and Medium Enterprises Development Organization), and Technology Free Zones (TEKSEBs) host IT companies. All together, in all these organizations established by law or decree, there are about 1,600 software-development companies [3]. 77% of these software companies are located in the mostly populated cities (Istanbul, Ankara and Izmir).

There are approximately 35 large companies operating in the software market in Turkey. The product lines of these companies range from packaged programs to tailor-made software development for specific needs. Public sector in Turkey almost always requires custom-built software for their specific purposes while the private sector effectively employs a mix of customized products and software products. In Turkey, Milsoft Yazılım Teknolojileri A.Ş. is the first company to obtain SEI CMMI Level 5 rating. There are also various software companies (Havelsan, Ayesas, Meteksan, Koc System, Cybersoft) which have CMMI Level 3 ratings [2]. It is also known that many Turkish software companies are on the way to obtain CMMI, SPICE:ISO 15504 standards, and getting ready to employ best practices of ITIL, and COBIT frameworks[2].

Figure 1 below shows the sector-wise software development in Turkey.

III. Information about Government Incentives to Software Developers and R&D Staff

In an attempt to encourage and support software developers various tools were developed by the state institutions and offered to companies. Table 1 below provides some of the major incentives offered to software developing companies.

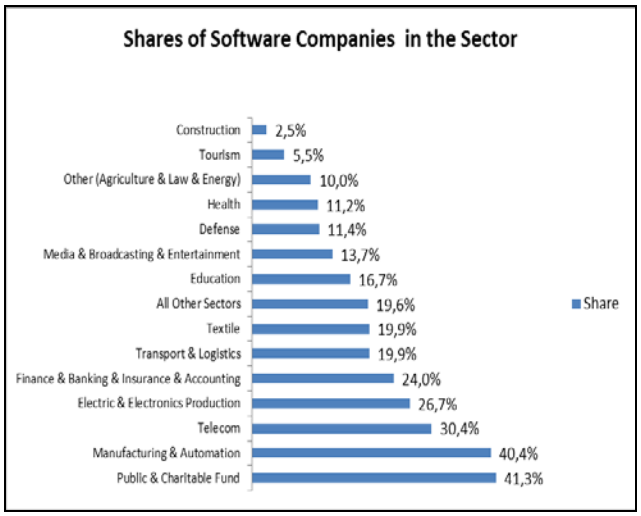

Fig 1. Sector-wise Software Development in Turkey (Adopted from [4])

IV. Turkish Software Testing & Quality

Turkish Testing Board (TTB) has recently introduced the 2012-2013 edition of the Turkey Software Quality Report (TSQR). TSQR 2011-2012 edition was distributed in Turkey and also in more than 70 countries through International Software Testing Qualifications Board (ISTQB) member boards. This report aims to show the significance given to software quality in Turkey and contribute positively to the image of Turkish IT industry throughout the world. When compared to 2010-2011 TSQR results, the maturity level of software testing has improved in 2012 [6].

TABLE I. Software incentives
(http://www.gib.gov.tr/fileadmin/beyannamerehberi/taxincentives.pdf and [5])

Government Incentives	Type of incentive
Tax advantages for TDZs	Income and Corporate Tax Exemption (valid until 31 December 2013)
	Income Tax Withholding Exemption Exemption (valid until 31 December 2013)
	Exemption from Tax, Duties and Fees
	Value Added Tax (VAT) Exemption Exemption (valid until 31 December 2013)
Direct support through projects	Support for R&D project activities by the Turkish Scientific and Technical Research Council – TÜBİTAK, and Technology Monitoring and Evaluation Board - TİDEB)
	Capital support by the Turkish Technology Development Foundation - TTGV
Indirect incentives	Support for expenditures of patents, useful model certificates - The Turkish Patent Institute

The main challenge ahead of software testers is the lack of domain knowledge. In order to overcome this issue, more companies are planning to assign system analyst teams for software testing in their organizations. Within five years, end users and developers will disappear in this test responsibility graph even in mid-sized companies. End users will be involved only in UATs (User Acceptance Testing) and developers will be only responsible for Unit Tests. Almost 65% of survey respondents indicated that the time allocated for software testing is less than 30% of their total project timeline [6].

V. Agile Software Development

The Agile Software Development paradigm has become increasingly popular in the last few years, since it claims lower costs, better productivity, quality and business satisfaction [8]. Recently small to medium IT organizations, especially those involved in custom-built software are anticipating agile software development techniques such as Extreme Programming (XP) and Scrum. Furthermore, with the adoption of agile software development methodologies like Test-Driven Development, time allocated for testing activities has been increased. According to recent survey results, the top three challenges with test automation are test data preparation, lack of test design techniques, and integration with current systems [6]. In test automation frameworks, the most challenging criteria to meet are maintainability and reusability. Test scripts prepared for one build cannot be utilized in testing of next builds [6]. Specifically in agile projects where regression cycles are frequent, this makes test automation useless. However, the major problem is more strategic: it is the perception of test automation as a magician in testing of software [6].

VI. Software Project Processes, Success Rate and Criteria

In a recent survey, 400 people working in IT departments at 50 companies were surveyed [7]. 94% of the respondents have more than 3 years experience in software development and 49% of them were managers involved in software development. It has been realized that 50% of the respondents are currently using waterfall and derivatives but only 33% of the respondents are planning to continue to use this while 64% of the respondents are planning to use agile processes in the near future. 53% of the respondents are currently using traditional development practices. However, only 37% of the respondents are planning to continue to use traditional development practices. According to 45% of the respondents, project success rate is over 70% [7]. Project success rate is expected to improve by the increasing use of agile processes as 64% of the respondents who claimed that their project success rate was over 70% employ agile processes and prefer agility [7].

In terms of strategies for success, most of the respondents found that by increasing significance of time to market, detailed upfront analysis as well as detailed upfront planning

of time and budget are expected to lose their tenancy and suggested that by adopting agility like high customer involvement, incremental delivery of sofware, adapting the plans immediately according to change and high quality are going to be employed more (www.agileturkey.com).

VII. Techno Parks

All techno parks/cities in Turkey are located in the 32 active TGZs hosting about 1,800 technology establishements and providing job opportunities to more than 15,000 employees. Total amount of exports is about 544 million USDs as of December 2011. About 1,000 (%57) of these companies are in the IT and Software Research and Development sector.

TABLE II. Techno Park Summary Data [9]

Number of companies	1,800
Number of employees	15,822 (12,808 R&D, 8,052 Support)
Number of completed Projects	8,052
Number of ongoing projects	4,979
Number of foreign investors	66
Exports	544 Million US Dollars
Number of patents	301

All of these techno parks are usually affiliated with universities and physically located within the university campuses with the advantage of hiring highly qualified R&D technical (faculty members) and research support staff (research assistants) from the related academic departments.

Science and technology parks in Turkey are mostly IT focused. The oldest technopark named METUTECH, established as a TGZ in 2001, is located at the Middle East Technical University, hosting over 262 companies, 75% of which are SMEs. The existing company profile of METUTECH is based on software development and IT (55%), defense (21%), and electronics (10%) industry. This profile is almost the same in other techno parks of the country. The incubation center of METU-Technopolis serves 38 micro-sized companies; most of which are spin-offs from Middle East Technical University. About Ten Million Euros have been spent in last four years for completing the infrastructure and facilities of the science park. Today, METUTECH operates in 60,000 square meters dedicated area. METUTECH provides several free of charge services to its clients on different subjects like Intellectual Property Rights (IPR), licensing, patent consulting and legal issues (such as contract management), international marketing, and financing. As of today, METUTECH manages 30 national and international projects (4 of which are EU projects). The company has a wide level of knowledge and practice in project management, from scheduling to book keeping, coordination and control. Most of these projects have multi partners, from universities to industry and non-profit organizations. Futhermore, these projects are focused around ICT (software development), Electronics (defense), Telecommunications, Energy, Automotive, Biotechnology, Health Care & Medicine, Advanced Engineering (aerospace, defense, advanced materials), and Environment.

VIII. Software Development Export Market

Recently, Turkish software companies have directed their expertise to exports to almost 70 countries. In 2009, the total value of registered software export exceeded US $12.9 million. While it was similar in 2008 but in 2007 it was USD 14.3 million [2]. The main export markets for Turkish made software are Germany, the USA, United Arab Emirates, Libya, the UK, Azerbaijan, Switzerland, Romania, Turkmenistan and Greece [2]. The Turkish ICT market grew exponentially by 14 percent CAGR between 2002 and 2010, reaching USD 28,5 billion in 2010, and is expected to exceed USD 30 billion in 2011 according to interpromedya. Further 28 out of out 500 ICT companies in the Europe, the Middle East and Africa (EMEA) region were Turkish companies in 2010 (Deloitte Technology Fast 500 EMEA) (http://www.invest.gov.tr/en-US/sectors/Pages/ICT.aspx)

IX. Turkey's Software Export Market

The software growth and export of Turkey can be visualized in the following Figure 2 and Table 3 respectively.

X. Turkey as an IT outsourcing country

Based on the results provided in previous sections, it is perceived that the Turkish software sector seems to be competitive on a global scale with successful applications in different business domains. However, it is still a reality that Turkey does not fulfill an important role in spite of its current proven potential. In order to compare the software-development capability of different countries, the so-called Global Services Location Index (GSLI) analyzes and ranks the top 50 countries worldwide as the best destinations for outsourcing activities [10]. Based on this study, it appears that Turkey is the 44th in the top 50 considering the overall score.

A close analysis of these three categories is important to provide a better insight into the situation of Turkey on the global scale and to identify the points for improvement. It appears that the top three outsourcing countries China, India and Malaysia have a very high financial attractiveness and high People Skills Index score. Turkey seems to be somewhere in the middle having an average Financial Attractiveness Index value and still a competent People Skills Index value.

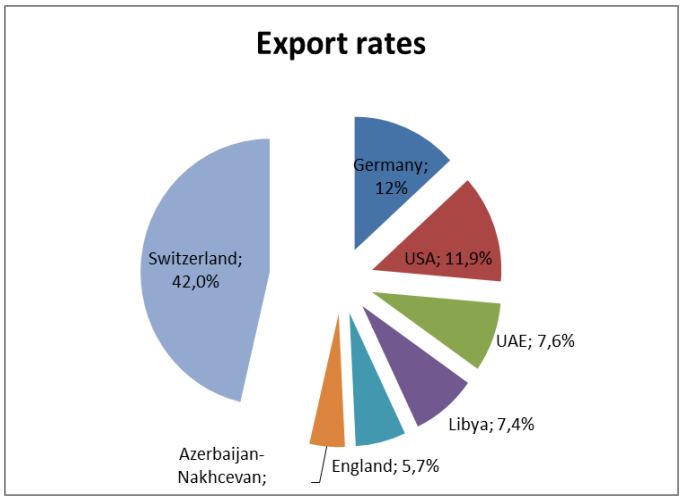

Fig 2. Distribution of Turkish Software Exports Among Countries (Adopted from [4])

TABLE III. TURKEY'S SOFTWARE EXPORT BY COUNTRY (US $) (ADOPTED FROM [2])

Country	2007	2008	2009
Germany	3,735,689	2,431,523	1,549,775
The USA	1,317,092	277,638	1,541,124
UAE	225,489	59,190	1,098,833
Libya	37,562	646,468	981,631
The UK	760,873	1,046,493	966,618
Azerbaijan	157,914	594,064	744,252
Switzerland	9,875	374,527	524,284
Tubitak Free Zone	98,476	153,848	520,032
İstanbul Leather Free Zone	275,717	207,051	503,599
Romania	190,386	521,150	501,440
Turkmenistan	14,490	99,174	480,114
İstanbul AHL Free Zone	400,055	372,148	410,034
Greece	1,238,351	904,060	355,058
Israel	39,306	117,254	343,888
Turkish Republic of North Cyprus	317,171	210,815	315,658
Bulgaria	37,168	2,006	313,909
Albania	70,313	222,317	268,425
The Netherlands	596,128	482,660	256,446
Kazakhstan	917,285	1,036,474	154,784
Ege Free Zone	128,899	137,545	141,187
Others	3,753,973	2,993,579	930,290
TOTAL	**14,322,212**	**12,889,984**	**12,901,381**

A closer look at the global software engineering capability of Turkey ends up with the following conclusion. On one hand, Turkey's software sector is growing internally, and a similar trend has been experienced in the software exports over the recent years. On the other hand, the values from a global perspective indicates that Turkey is not playing an important role yet as a software-development country. Here, the role of Turkey can be distinguished as either an outsourcing nation, the active initiator of outsourcing, or as a host nation for developing software that was outsourced by foreign countries. In fact, based on existing literature, we can state that both roles have their own advantages, including relieving resource shortages, cost savings, staffing flexibility, reducing unemployment, and leveraging expertise. In contrast to the current potential workforce and economic growth of Turkey in the recent years, the minor role of the Turkish software sector in the global arena indicates a clear missed chance, both for Turkey itself and for supplier countries.

With a population of more than 75 million, Turkey has a wide range of business expertise in diverse sectors such as automotive, textile, finance, tourism, defense, healthcare, agriculture, telecommunications, and machinery. Several of these sectors are quite successful and are currently visible on the global market. Pioneer organizations in these sectors also created an IT demand for their products. Despite the positive developments in these sectors and its impact on the IT and software sector, more systematic approaches and strategies are required to boost the software industry in Turkey at a global level [11].

XI. HUMAN CAPITAL AND SOFTWARE ENGINEERING EDUCATION IN TURKEY:

Turkey is a country with around 75 million inhabitants. Of these, approximately 65% are younger than 34 years. With an average age of 29, it has a very young population, and it is therefore not surprising that nearly 1 million new students register at a University, and 400,000 graduates enter the Turkish labor market annually. Turkey provides a very wide range of highly skilled workers to industry. A clear trend is that an increasing number of graduates and students have a good knowledge of English and that technical education and computer science are becoming increasingly popular. Many Turkish youngsters spend a number of years abroad to pursue master and PhD courses before returning back and get good international orientation. Turkish government also supports by providing a number of scholarships for Master, doctoral and postdoctoral studies [1].

Finally, it must be noted that universities contribute a significant role in innovative software development, IT and related research and development. Recently, entrepreneurship and innovation courses are introduced by many universities. Prospectous graduates from undergraduate and graduate programs are highly motivitated by the government incentives for starting a business in technoparks. This is realized by the so called "Capital for Technological Enterpreneurship" complimentary support upto 50,000 US Dollars by the Turkish Ministry of Science, Industry and Technology.

Universities in Turkey have initiated Software Engineering (SE) undergraduate programmes only in the last decade. Before this, the software industry relied heavily on the graduates of the Computer Engineering and other related programmes. So far, in Turkey, 11 (10 foundation/private and one government) universities out of 168 offer SE undergraduate programmes with a total number of 921 intakes

in the 2011-12 Academic Year where the acceptance (by exam) rate was only about 50%. The intake in the 2013-14 Academic Year was 881, and the acceptance rate became about 79%. On the one hand, the software industry in Turkey is in great need of qualified software engineers, on the other hand; the inclination of the candidates in the field is surprisingly low. This may be attributed to the low popularity of the field in the eyes of public compared to Computer Engineering and the high tuition fees at the foundation universities[12].

XII. CONCLUSIONS

The potential socioeconomic benefits of software in an emergent economy country like Turkey are enormous. E-government, e-business, e-health and military software are major areas of software sector domain. Establishment of Techno parks around major universities, number of government incentives along with improved Internet services has facilitated in this process. The collaboration between the software industry and higher education departments can lead to synergies for both in accomplishing their objectives. If issues and challenges are identified in a timely manner, then Turkish software sector is poised to achieve an important position at the global stage and also contribution towards country's social and economic development.

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