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Fehim Bakırcı
Thomas Heupel
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Üstün Özen *Editors*

German-Turkish Perspectives on IT and Innovation Management

Challenges and Approaches

FOM Hochschule

Springer Gabler

FOM-Edition

International Series

Series editors

FOM Hochschule für Oekonomie & Management, Essen, Germany

This work appears in the FOM-Edition, published by the FOM Hochschule für Oekonomie & Management.

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FOM-Edition
International Series
ISBN 978-3-658-16961-9
ISBN 978-3-658-16962-6 (eBook)
https://doi.org/10.1007/978-3-658-16962-6

Library of Congress Control Number: 2017957563

Springer Gabler

Printed on acid-free paper

This Springer Gabler imprint is published by Springer Nature
The registered company is Springer Fachmedien Wiesbaden GmbH
The registered company address is: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

Message of Greeting

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Steffen Kugler

"2nd Economic Forum: German-Turkish Perspectives on IT and Innovation Management"

Information and communication technologies (ICT) are drivers of innovation. They are also an inherent component of an excellent education system and ensure the quality of scientific work. At the same time, they make our everyday life easier and are becoming an increasingly important key to social participation. This is why ICT has also been chosen as a field of scientific cooperation between Germany and Turkey.

By launching the German-Turkish Year of Research, Education and Innovation 2014, the German Federal Ministry of Education and Research and the Turkish Ministry of Science, Industry and Technology forged closer ties between Germany and Turkey. Furthermore, we also agreed to continue to develop the potential of our close cooperation in education, research and innovation beyond the Science Year.

I am delighted that the "2nd Economic Forum: German-Turkish perspectives on IT and Innovation Management" is also a step in this direction. The Forum offers the opportunity to reflect upon the success factors for German-Turkish cooperation in ICT and is at the same time a platform that can inspire forward-looking collaborative projects.

I would like to thank all those players who have committed to continuing German-Turkish cooperation beyond the joint Science Year both within the framework of this 2nd Economic Forum and other collaborative projects. I wish the participants at this conference a lively exchange of new ideas and inspiration for future cooperation.

Prof. Dr. Johanna Wanka
Federal Minister of Education and Research

Preface by the Editors

In 2014 the German-Turkish year of science, education and innovation, entitled as "Science Bridging Nations", was initiated by the German Federal Ministry of Education and Research and the Turkish Ministry of Science, Industry and Research. In the course of the scientific year, around 100 projects were submitted for an idea contest. The FOM University of Applied Sciences was able to assert successfully in this contest with the project "E2E – Building a Bridge on Sciences", an initiative to strengthen the innovative potential of the cooperation between the FOM University of Applied Sciences and the Ataturk University Erzurum.

The starting point of the project was the already existing teaching cooperation between the FOM and the Ataturk University. The aim of "E2E" was to extend the cooperation to the research sector of both universities and to establish a fundament for common researching projects. In addition to a delegation trip of German scientists to Erzurum in April 2015, the common conference of the Ataturk University Erzurum and the FOM "2. Economic forum: German-Turkish perspectives on IT and Innovation Management" took place from 4th to 6th November 2015 at the FOM Munich. For this purpose, the following topics were scientifically discussed:

- IT in the education system and as a macroeconomic factor
- IT in the health care sector
- IT in Human Resource Management
- Management of technical innovations
- Innovation management in SME
- Success factors (measurement) of innovations

The results of the conference contributions are now available in this essay collection. In addition to the exchange of research results, German and Turkish perspectives for the economic discourse were discussed in order to develop theoretical insights and practical success potentials. Although the E2E project is officially completed with this essay collection, the cooperation between the FOM and the Ataturk University is not finished but will be continued at various levels. Both this book and the cooperation make a valuable contribution to the maintenance of the cooperation between Germany and Turkey, which is not limited to politics, economics and culture but has to be further deepened, especially in education and research.

First of all we would like to thank the Federal Ministry of Education and Research for the financial support of the entire project what makes the success of this project possible. Also the FOM and the Ataturk University have provided additional financial resources to complete this project. We would also like to take this opportunity to express our gratitude to all the people who have supported the project. We would like to start by thanking the Rector of the FOM, Prof. Dr. Burghard Hermeier, and the previous Rector of the Ataturk University, Prof. Dr. Hikmet Koçak, for the cooperation between the two universities. We would also like to thank Christoph Hohoff and Gerrit Landherr from the FOM's support research department who have planned the project. Additionally we would like to take the chance to thank the directors of the FOM Munich, Prof. Dr. Gerald Mann and Oliver Dorn, who have contributed to the organization of the aforementioned conference in Munich. For the publishing of this book, Kai Stumpp from the FOM's publishing department has rendered valuable services that we would like to acknowledge. Furthermore, we would like to thank the Springer Publishing house for the excellent cooperation.

May this book not only be interesting and profitable for students and scientists, but also be noticed by the public by keeping in mind the German-Turkish cooperation.

The editors
Prof. Dr. Fehim Bakırcı
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Part I

Introduction

R&D in Germany and Turkey – a Comparison

1

Andreas Kladroba

Contents

1.1 Introduction

> Innovative solutions are the factors that drive our prosperity and support our quality of life. They strengthen Germany's position as a leading industrial and exporting nation. And they make it possible to find creative answers to the urgent challenges of our time (Bundesministerium für Bildung und Forschung 2014a, p. 3).

These are the words the federal government used in 2014 to substantiate its continued commitment to research and development in accordance with the "High-tech Strategy". This insight, however, is far from new. In 2000, at the European Council meeting in Lisbon the Heads of State and Government had set the objective to make the European Union "the most competitive and dynamic knowledge-based economy in the world", the main in-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_1

strument for this endeavor being a Europe-wide increase of intramural R&D expenditures to 3% of the gross domestic product by 2010. Like Germany, R&D activities are here considered "a driving force for a competitive and dynamic knowledge-based economy" (Commission of the European Communities 2002, p. 3).

Consequently, the promotion of R&D is not only an integral part of various government programs, but also of importance for supranational organizations like the United Nations or the OECD.

In consequence, given the economical and societal magnitude of the topic, it would be appropriate to dedicate attention to comparative observations of R&D activities in the focus countries Germany and Turkey within the framework of the *Second Wirtschaftswissenschaftliches Forum*. This could involve assessing the current state and carrying out an international comparison. Recommendations for political and economic actions should be discussed only as an afterthought.

The international R&D survey (briefly described in the following chapter) serves as empirical basis of the analysis.

The rest of the paper is structured as follows:

- Sect. 1.2: The R&D survey on the basis of international agreements set forth in the Frascati manual
- Sect. 1.3: General economic reflections on Germany and Turkey
- Sect. 1.4: R&D systems in Germany and Turkey
- Conclusion

1.2 The International R&D Survey

The member states of the European Union (pursuant to Regulation (EU) 995/2012), OECD countries, and other countries gather data on research and development (R&D). The common framework of the Frascati manual, prepared and published by the OECD (2015), allows for an international comparison of the R&D structures in the individual countries.

The R&D survey distinguishes between four R&D sectors: business enterprises, higher education, government and PNP.[1] Data on the different sectors is gathered and published separately. There are, however, cross-sectorial analyses providing an overall societal or economical view on R&D structures (cf. also Bundesministerium für Bildung und Forschung 2014b; European Commission 2013; Wissenschaftsstatistik 2015a, 2015b).

The core indicators of the R&D survey are intramural R&D expenditures and R&D personnel. Intramural R&D expenditures are defined as expenditures for research and developmental activity performed in-house. Research contracts awarded to external institutions are consequently considered extramural R&D. In addition to scientific staff, R&D

[1] Private Non Profit.

personnel also comprises technicians and so-called "other supporting R&D staff" (these being mostly administration employees, however, attributable to R&D activities).

Key structural aspects to be examined in the R&D survey include

- R&D-performance (Where is R&D carried out?) versus R&D-funding (Who is financing R&D?). Industrial R&D (R&D in the business enterprise sector), for instance, can be state-funded.
- Regional R&D distribution at the Federate State level (NUTS[2] 1) is of particular interest in a federal country like Germany. However, also underlying regional structures (NUTS 2 or NUTS 3) as well as special aggregations (chamber's districts, metropolitan regions etc.) can be covered.
- When assessing R&D personnel, gender issues are crucial.

  The findings are published by Eurostat (including Turkey), OECD, BMBF and Stifterverband/Wissenschaftsstatistik.

1.3 Germany and Turkey – a Brief Economic Overview

Some particular economic and societal issues, such as research and development, must be examined in a broader context in order to allow practical interpretations. For that reason, this chapter offers a brief comparison of important facts on Germany and Turkey.

1. **National territory**

   Turkey is twice the size of Germany (783,562 km^2 compared to 357,340 km^2).[3]
2. **Population**

   In 2014 the number of inhabitants where roughly the same for Turkey and Germany (Turkey: 78.6 million, Germany: 80.8 million).[4] This means that Germany's population density is on average twice as high as Turkeys (226 and 98 inhabitants per square kilometer, respectively). This number is somewhat misleading, however, as the regional distribution in Turkey is considerably more heterogeneous than in Germany. For example, more than 15 million people (almost one fifth of the population) live in the greater Istanbul area (as defined in NUTS 2). Germany's largest agglomeration, the Ruhr district (as defined by the Regionalverband Ruhr[5]) has a population of only 5 million – slightly over 6%.

   With reference to the urban/rural distribution, however, the two countries are fairly similar. 57% of the German population and 52.5% of the Turkish population live in an urban environment.

[2] NUTS = Nomenclature des unités territoriales statistiques is the official regional classification of the EU. For Germany NUTS 1 corresponds to the federal states, NUTS 2 to the administrative districts and comparable aggregations, and NUTS 3 to the counties and county boroughs.

[3] Source: www.wikipedia.de (08.01.2016).

[4] Source: Eurostat.

[5] The Ruhr district is no administrative unit. Therefore there is no official delimitation.

3. **Gross domestic product (GDP)**
   With 3757.1 billion US dollars, the German GDP was two and a half times the amount of the Turkish GDP (1502.5 billion US dollars) in 2014[6], a per capita GDP of 45,619 USD and 19,610 USD for Germany and Turkey, respectively. A breakdown by industries of the economic output reveals that in Germany a quarter of all value is created in the industry (approximately 22% in Turkey). Agriculture contributes 8% to the total value created in Turkey, but only 0.8% in Germany. This results in a number of similarities in the economic performances of both countries which are, as we are going to see, only partially reflected in the R&D sector structure.
4. **Intramural R&D expenditures**
   German intramural R&D expenditures amounted to €79,729.51 million for all sectors in 2013, €53,566.2 million of which was accounted for by the business enterprise sector. In Turkey these numbers are €5844.61 million for overall R&D expenditures and €2775.4 million for R&D in the business enterprise sector.

1.4 R&D Systems in Germany and Turkey

1.4.1 Intramural R&D Expenditures – Absolute and in Relation to the GDP

As already mentioned, with almost €80 billion, intramural R&D expenditures across all sectors in Germany (GERD = Gross Domestic Expenditures on R&D) are more than thirteen times as high as in Turkey. Fig. 1.1[7] shows both countries in an international ranking. In order to better assess this relation one needs to consider the following comparative figures:

1. The most research-oriented federal state in Germany is Baden-Württemberg with €20.2 billion worth of intramural R&D expenditures. In a ranking of German federal states, Turkey would rank 6th Turkish R&D expenditures are comparable to the ones of the administrative district of Darmstadt (with Frankfurt/Main as the largest city).
2. Volkswagen is the most research-oriented enterprise in the world. In 2014 VW spent approximately €13.1 billion on research and development (European Commission 2015). If Turkey was an enterprise, it would rank around 13th in an international business ranking (equivalent to the Daimler AG).

A comparison of absolute R&D data in this form is certainly impractical. Therefore, both in the field of innovation research and in the political debate the relation between intramural R&D expenditures and the gross domestic product has established itself as a comparative figure.

[6] Source: OECD.
[7] All R&D data refers to 2013, with the exception of the US and Switzerland, where only data on 2012 was available.

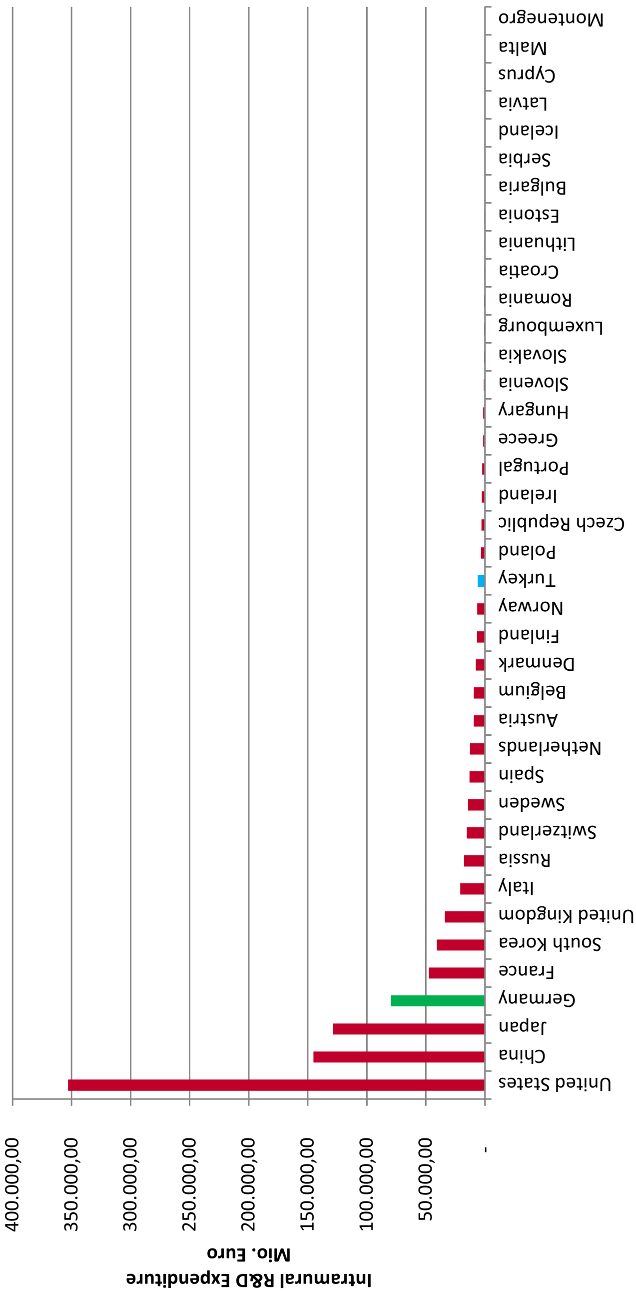

Fig. 1.1 Intramural R&D expenditures 2013

Fig. 1.2 shows the corresponding international ranking.

Measured by this indicator, the most research-oriented countries are South Korea (4.15%) and Japan (3.47%), followed by the Scandinavian countries Finland (3.3%), Sweden (3.3%) and Denmark (3.08%). With 2.83% Germany ranks eighth, just above the US (2.81%). Turkey (0.95%) ends up in the bottom third, however, still higher than several other EU countries. With 2.03% the EU itself (EU 28) falls considerably short of its own 3% aim. Even the EU 15 states achieve only 2.12%.

A look at the development of R&D expenditures in Germany and Turkey over the last 20 years provides further interesting insight. Fig. 1.3 shows the annual rate of change between 1993 and 2013.

Two points appear to be particularly striking:

1. The total increase during the period considered was considerably higher in Turkey than it was in Germany. Whereas the amount of German intramural R&D expenditures merely doubled, the Turkish growth rate was at over 750%, however, with different increases in different sectors. The business enterprise sector saw the most drastic increase, with an almost unbelievable increase of research activities by the factor 16 within 20 years. Well below that are the higher education sector (+800%) and the government sector (+400%). In addition to that, R&D activities appear to vary with the years. In the first decade (1993–2003) R&D expenditures were not even doubled (+90%). The following decade (2003–2013) saw a 350% increase, evidently due to an increased political support of R&D (cf. also European Commission 2013, p. 329).
2. Whereas the changes in Germany remain relatively constant (annual rate of change below 10%) and consistently positive, Turkish R&D expenditures are far more volatile, with a more-than-40% decrease between 1993 and 1994 on the one hand, and a 40% increase between 2005 and 2007 on the other hand. This kind of high volatility is displayed throughout all sectors. The sectors are, however, not positively correlated as one might assume. In 2004, for instance, the government sector experienced a slight decrease, whereas the other sectors saw an increase of about 30% each. In 2008 R&D expenditures in the higher education sector declined significantly, while expenditures in the other two sectors rose substantially.

All in all it can be said that, as also noticed by the EU, with the turn of the millennium R&D increasingly became the focus of Turkish policy. So far, however, R&D could not be put onto a stable, sustainable growth path.

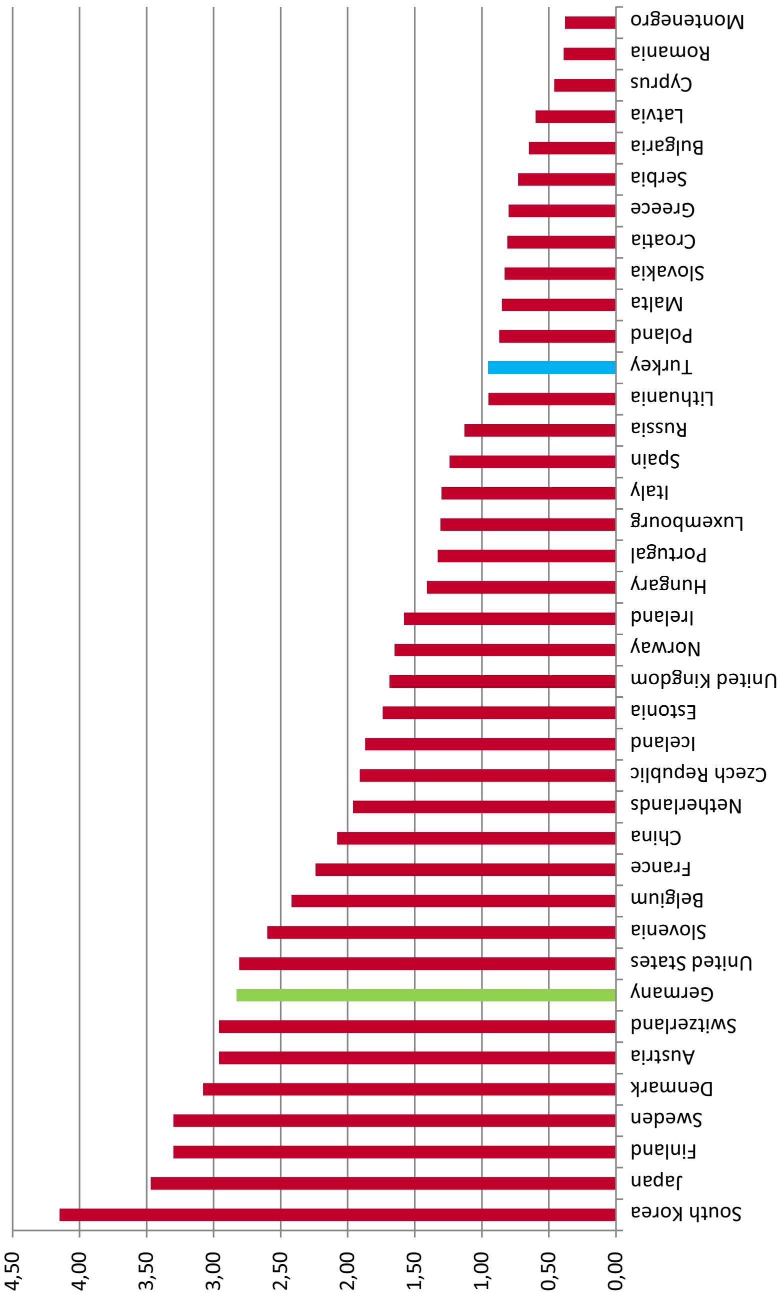

Fig. 1.2 Intramural R&D expenditures in relation to the GDP 2013

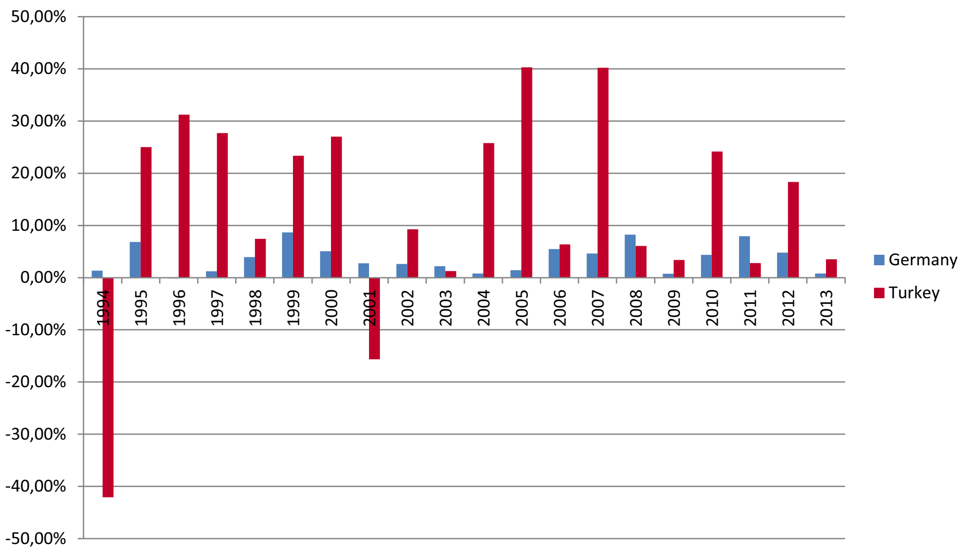

Fig. 1.3 Rates of change of intramural R&D expenditures

1.4.2 The Sectoral Breakdown

When the EU set its 3% target, it did so with the stipulation that two thirds of national R&D expenditures should be spend within the business enterprise sector. This, however, was more of a means to an end than an economic objective. It had been supposed that the business enterprise sector did not invest enough in R&D compared to, for example, the US, which allegedly accounted for the 80% gap between US and European R&D expenditures. Fig. 1.4 shows that in addition to Germany other countries, too, meet the requirements. Turkey was at 47% in 2013, with an apparent investment gap in private R&D efforts. It should be specified, however, that

1. since 1993 the rate of R&D in the business enterprise sector in Turkey has increased from 23 to 47%, meaning that this sector is making a considerably bigger effort today than it was 20 years ago.
2. a simple calculation shows that increased efforts of the private sector alone do not suffice to bring the Turkish R&D expenditures to a level comparable to that of leading research nations. If one was to take the expenditures in the higher education sector and the government sector in the year 2013 as given, private expenditures would have to rise to €9.2 billion (currently €6.136 billion) to meet the 2 : 1 requirements. Based on the assumption of a constant GDP, however, this would account for merely 1.5% of the GDP (currently 0.95%) – only half of the intended 3%. Increased effort is required, therefore, not only in the business enterprise sector.

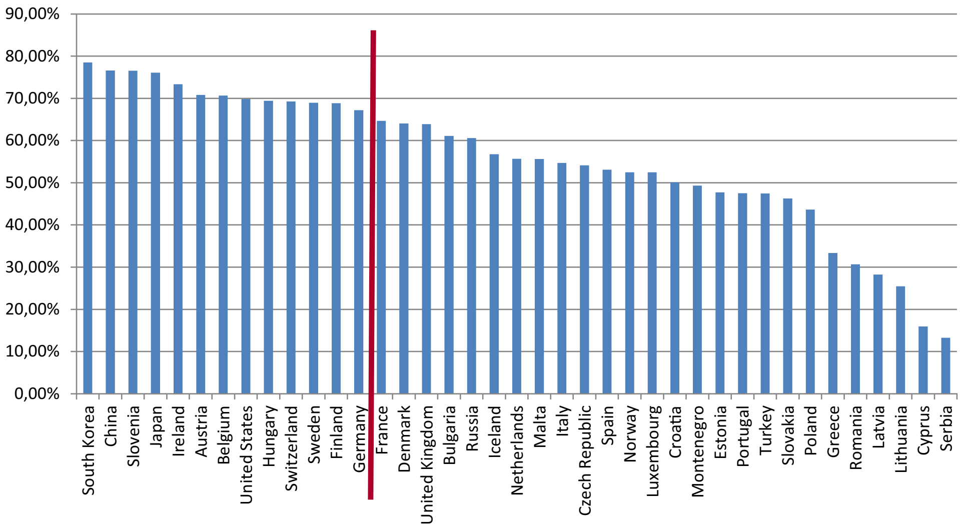

Fig. 1.4 Share of the business enterprise sector in intramural R&D expenditures 2013

1.4.3 Funding

The other question besides R&D performance ("Who is doing it?") is the one of funding ("Who is paying for it?"). It is easy to see that the institution paying for R&D is not necessarily the one conducting it. The State, for instance, may fund R&D projects in enterprises and at universities, and universities may acquire external funding for projects from enterprises.

Unfortunately international R&D surveys do not always cover R&D funding with the appropriate amount of detail. Eurostat, for instance, reports R&D funding just "by the business enterprise sector". Whether this means that an enterprise is funding its own R&D or that it is carrying out research for another enterprise remains unclear. Such information can often only – if anywhere – be found in national publications.[8]

All the same, even the Eurostat publications allow for interesting insight into R&D financing structures. In the following, the focus will be on three issues:

1. To what degree are enterprises involved in the funding?
2. How far is the State involved?
3. What role do other countries play?

In Germany approximately 65% of all domestic R&D expenditures are funded by the business enterprise sector, earning Germany a place among the leading countries Japan, South Korea, and, interestingly, China. Hence, the German business enterprise sector is

[8] For Germany cf. Wissenschaftsstatistik (2015).

more strongly involved in R&D than for example the American one (with share of financing of slightly under 60%). The share of business-based R&D funding in Turkey amounts to approximately 49%, making Turkey rank more or less in the middle, ahead of Norway (43%) and the UK (46%), tied with Austria (49%), and slightly behind the Netherlands (52%).

The degrees of State involvement in Germany and Turkey are, relative to the total sum, more or less similar (27–29% of intramural R&D expenditures), situating both countries in the lower part of the middle range. This category is headed by Russia (67%), followed by several lesser developed countries such as Cyprus, Serbia, Greece, and Romania. But even in countries such as Norway, Spain, and Italy does the state share in funding amount to more than 40%.

Foreign R&D funding in the business enterprise sector is not very common.[9] With slightly above 5% in Germany and a mere 0.8% in Turkey, the overall share of foreign funding is rather low in both countries. However, a look at other countries reveals that this is quite common: Foreign shares in Japan and Korea amount to significantly less than 1%, and 3.8% in the US, which raises the question as to why.

Countries with a low degree of foreign funding can be roughly divided into two groups.

1. Countries focusing more on the export of R&D: Globally operating enterprises tend to conduct their own research globally as well. If these enterprises are, for example, relatively centrally organized, R&D is more likely to be exported from these countries than imported.[10] The US and Germany are typical representatives of this category.
2. Countries with enterprises lacking foreign partners. This appears to be the problem Turkey is facing. Czernich (2014) found that German enterprises tend not to name Turkey as an attractive target country for their R&D activities.

1.4.4 Personnel

588,615 people were involved in R&D in Germany in 2013[11] – approximately 1.5% of the overall workforce. In Turkey 112,969 FTEs were involved in R&D, 0.5% of the overall workforce. Broken down by sectors, 61% of the German R&D personnel were employed in the business enterprise sector and 22% in the higher education sector. In Turkey the numbers were at 52 and 38%, respectively.

9 On the international interdependence of R&D cf. also Czernich and Kladroba (2013) and Belitz (2015).
10 On the different forms of organization of foreign R&D cf. Czernich (2014).
11 R&D personnel is generally measured in form of Full Time Equivalents (FTEs). The data on the proportion of women, however, is presented as headcount, as this value was available for a higher number of countries.

The R&D survey distinguishes three personnel groups: researchers, technicians, and other supporting R&D staff. The proportion of researchers among R&D personnel was around 60% in Germany, with a relatively large range of 55% in the business enterprise sector and 76% in the higher education sector. The Turkish R&D survey presents a detailed listing of personnel groups only for the business enterprise sector. Here, the proportion of researchers amounted to 69% – significantly higher than in Germany.

An evaluation of the data according to gender revealed a proportion of women among the entire R&D personnel of 27% in Germany and 36.2% in Turkey. Considering only scientific personnel, i.e. highly qualified staff with a university degree, the proportion of women would be 28% in Germany, ranking Germany 29th in a ranking of 34 countries for which Eurostat provides R&D personnel data. Turkey ranks 17th and therefore in the middle. Just for comparison – at the top of the ranking are Latvia and Lithuania with a proportion of women of more than 50%. At least 10 of the 34 countries ranked have a percentage of women of over 40%.

It should be noted, however, that neither Germany nor Turkey are homogeneous in themselves. First of all there are considerable differences between individual sectors. In Germany the female share in scientific personnel in the higher education sector is 38%. In the business enterprise sector, it is a mere 14%. In Turkey a similar trend is noticeable, albeit at a higher level, with a 42% proportion of women in the higher education sector and 24% in the business enterprise sector. The phenomenon of a higher percentage of women in the higher education sector than in the business enterprise sector can be observed throughout all industrial nations without exception, however, with varying differences between individual sectors.

Still, both in Germany and Turkey there are also differences within individual sectors, however, with similar results. Within the business enterprise sector, for instance, the proportion of women is comparatively high in the food sector, the textile industry, agriculture and the manufacture of pharmaceuticals. The percentage of women in the manufacture of pharmaceuticals, for instance, is over 40% in Germany and even over 65% in Turkey. Traditional industries such as the manufacture of electrical and optical equipment, the manufacture of machinery, and the manufacture of motor vehicles on the other hand have a low female share in the overall workforce, with less than 10% in Germany and approximately 15% in Turkey.[12]

There is, however, a noticeable difference between Germany and Turkey in regard to the proportion of women in the higher education sector broken down by fields of science. In Germany medicine, agricultural sciences, the humanities and the social sciences have a high percentage of women (over 40%, partly also over 50%). At the bottom end of the ranking are the STEM subjects, with a proportion of women of only 20–30%. A more homogeneous emerges in Turkey. With a good third, the lowest proportion of women can

[12] For a comprehensive representation of R&D personnel within the German business enterprise sector cf. Schneider and Stenke (2016).

be found in agricultural sciences and engineering sciences. The other fields of science feature a percentage of women of more than 40%, again with medicine at the top (48%).[13]

It is also interesting to compare the development over time of the proportion of women among scientific personnel in Germany and Turkey. During the last ten years since 2003 the percentage of women in Turkey has remained largely unchanged. Germany, on the other hand, has seen an increase from below 20 to 27% which, however, is attributable only to the public sector. The public employers' attempt to integrate more women into academic life has been successful to a certain extent. With an 8% increase Germany has played one of the leading roles in an international comparison. In the private sector, however, there has only been a mere 3% increase to 14%.

1.4.5 R&D in the Business Enterprise Sector

In 2013 €53,566.2 million were spent on intramural R&D in the German business enterprise sector – approximately two thirds of all R&D expenditures. After many years of continuous growth, expenditures stagnated for the first time and were at roughly the same level as the previous year, with a slight 0.4% minus.[14] German R&D is dominated by the manufacturing industries, accounting for more than 85% of the entire intramural R&D expenditures in the German business enterprise sector. This makes Germany the undisputed leader among the industrial nations, followed within the EU by Italy, Finland, and Sweden with 70–72%. The end section consists of, inter alia, Norway, with less than a third. Bulgaria brought up the rear with 14%. The other side of the coin is, of course, a correspondingly small proportion of the service sector to the overall German R&D activities.

A breakdown by industries reveals that German R&D is largely dominated by the automotive industry (Fig. 1.5). Nearly a third of all intramural R&D expenditures in 2013 can be attributed to car manufacturers and their suppliers. This value has remained largely unchanged for many years.

As expected, a comparison between Germany and Turkey yields various differences, but also some unanticipated parallels. Similarities include the facts that

- the Turkish business enterprise sector, too, has been steadily growing for many years, albeit in total at a considerably higher rate than the German one.
- with slightly under 9% the growth between 2012 and 2013 was, compared over many years, below-average (as mentioned before, this period saw a stagnation for Germany).

[13] For a detailed structural analysis of women at higher education institutions (including an international comparison) cf. Ihsen (2014).

[14] The Wissenschaftsstatistik (2015a) provides a comprehensive set of figures on R&D within the German business enterprise sector. Analyses into that matter can be found in Wissenschaftsstatistik (2015b).

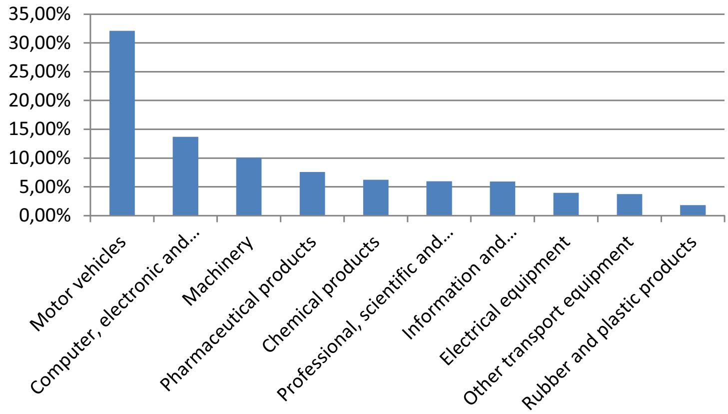

Fig. 1.5 Intramural R&D expenditures in Germany by industries

- both, the German and the Turkish business enterprise sector, were affected by the financial crisis in 2009, however,
  - effectively only in 2009 (both countries had recuperated by 2010),
  - with only a minor slump in both countries.

These parallels are all the more surprising considering the remarkable structural differences between both countries.

The Turkish business enterprise sector is much more characterized by the service industry than its German counterpart. A good 47% of intramural R&D expenditures are attributable to business services.[15] Accordingly, the industry's share amounts to nearly 51%.[16] On the sectoral level Turkish R&D is characterized by information and communication activities, as well as technical service providers[17], more so than by traditional industries such as the manufacture of motor vehicles, the manufacture of chemicals, the manufacture of electrical and optical equipment, and the manufacture of machinery (Fig. 1.6).

Another noteworthy aspect of the inter-country comparison are the relative research costs, i.e. the amount of intramural R&D expenditures per researcher. In Germany these are almost four times as high as in Turkey (€270,000 and €70,000, respectively), with a wide span in both countries due to differences in the capital intensity of research within individual sectors. With €572,000 per researcher in Germany and slightly over €100,000 in Turkey, pharmaceutical research constitutes the most expensive field in both countries. It is also interesting to note that information and communication activities is one of the

[15] Sections G–N in NACE 2.0.
[16] The agricultural and mining sectors are entirely missing.
[17] NACE 2.0 section M.

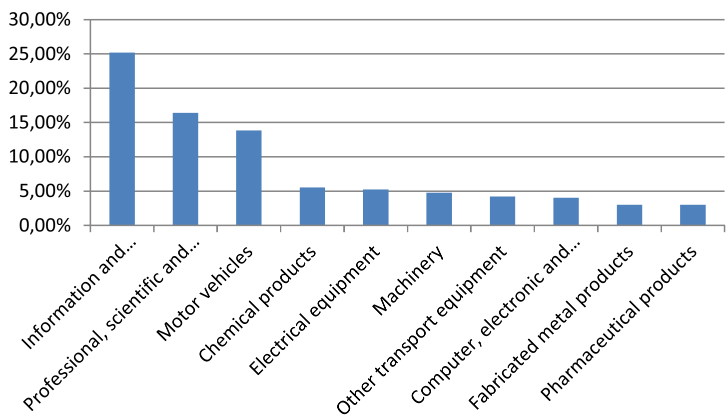

Fig. 1.6 Intramural R&D expenditures in Turkey by industries

most expensive research fields in Germany (with more than €300,000 per researcher), whereas in Turkey it represents the least expensive area (€45,000 per researcher).

1.4.6 R&D in the Higher Education Sector

The German Higher Education Sector

There are 428 higher education institutions in Germany, including 108 universities.[18] In 2013 99,123 FTEs were employed in the higher education sector. €14,301 million were spent on research and development.[19] The German research landscape is mostly medical-, science- and technology-oriented (Fig. 1.7). The MINT subjects and medicine account for a good three quarters of all intramural R&D. It should, however, be noted that research in these subjects is usually considerably more cost-intensive than, for example, in the humanities or social sciences. Accordingly, R&D personnel is a factor to be taken into account. However, even this indicator yields the result that the medical-, science- and technology-based subjects are dominating the higher education sector, accounting for two thirds of all R&D personnel.[20]

The Turkish Higher Education Sector

The Turkish universities are quite young. Just 10 out of 173 universities are older than 59 years.[21]

[18] https://de.wikipedia.org/wiki/Liste_der_Hochschulen_in_Deutschland.
[19] On the methodology of R&D surveys within the higher education sector cf. Statistisches Bundesamt (2013).
[20] However, only 44 % of all students are attributable to these subjects.
[21] https://de.wikipedia.org/wiki/Liste_der_Universit%C3%A4ten_in_der_T%C3%BCrkei.

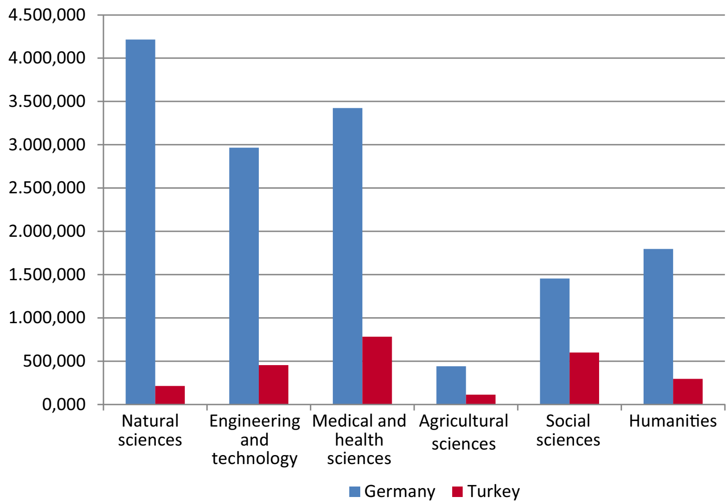

Fig. 1.7 Intramural R&D expenditures in the higher education sector by field of science

Intramural R&D in Turkish higher education institutions amounted to slightly under €2.5 billion in 2013, with a particularly high level of self-financing (48%; not counting third-party funds as done in the business enterprise sector, but self-generated funding, e.g. tuition fees). This is attributable to the large number of private universities (66 out of 173, plus 4 institutions of the Turkish armed forces). For comparison only, in most industrial nations far less than 10% of all R&D expenditures are self-financed. Only Japan compares to Turkey in that aspect (43%).

Research in the Turkish higher education sector rests on two pillars: medicine, accounting for almost a third of all research funds and 25% of all R&D personnel, and – rather unusually – the social sciences, making up almost 25% of all intramural R&D. Hardly any other industrial nation exceeds 20% in this category, thus highlighting the significance of the social sciences for the Turkish higher education sector.

Conclusion

In 2002, Germany, along with the other EU countries, made a commitment to demonstrating intramural R&D expenditure numbers in the amount of 3% of the gross domestic product by 2010. Despite a good starting position (in 2002 the expenditure-to-GDP relation was 2.42%[22]) progress was lagging, and the ratio reached a mere 2.71% by 2010, and, despite a growing trend, only 2.83% by 2013. It should, however, be mentioned that German policy makers have always taken this target rather seriously without ever losing sight of it, and that there has been at least an approximation in Ger-

[22] All GDP relations take into consideration the national accounts revision under the SNA 2008.

many, whereas in several other EU countries there has been no progress whatsoever or even a deterioration, meaning that ultimately the EU has still a long way to go.

The medium-term objective for Turkey must be an increase in the amount of research and development to a level comparable to that of leading industrial nations. This, however, calls for an immense effort in all sectors. It is mostly the business enterprise sector that requires adjustment, but also the other sectors' R&D is still considerably short of what can usually be expected of a modern industrial nation.

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2 Knowledge and Innovation Economy: an Evaluation of Turkey

Fehim Bakırcı

Contents

2.1 Introduction

Mankind has reached the current level of civilization of our era and economic order through three different transformations and economic experiences. Production, work and life styles have been differentiated with every transformation and experience in society. The first of these transformations was agricultural transformation and this period is known as agricultural economy. The second transformation was the change to an industrial economy which established automized production. The third one is the transformation based on knowledge, technology and innovation.

Intensive cognitive effort has been made in order to name this last transformation through which civilization has changed totally. The changes of the 21st century become more evident day by day. This last circumstance which we are currently experiencing has been known by various names such as the third wave, the post-industrial period, and post capitalism by different philosophers, among them Brzezinski's technocratic era definition

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_2

which exhibits a different angle. Naming this period knowledge based economy or knowledge economy has become a scientific approach.

The industrial civilization paradigm which was also named revolution and lasted for 300 years has ended and a new global paradigm which is based on knowledge, technology and innovation has appeared with this last transformation. Now, knowledge has replaced capital which was the main input and evolution dynamic of the old paradigm. Countries which were able to use this as a production factor have become pioneers of a new global paradigm. These developments enabled knowledge to become a main factor of global competition power, economic development and social welfare. The economic structure began to be called "new economy" with this new structuring. The qualitative and all quantitative developments that change the rules and functions of economy are defined as new economy (Atkinson et al. 1999). It is also possible to define new economy as a high level and long term development that has emerged due to the dissemination and adoption of developments and efficiency in ongoing information and intercommunication technology (De Masi et al. 2001). And the concept of new economy also expresses an economic structure in which there are high technologic developments, globalization of the world market, changing economic needs, and an obligation to think and act in this environment (Nakamura 2000).

Consequently, when today's economies are defined, concepts such as "the knowledge economy", "digital economy", "virtual capitalism", "knowledge based economy", "economy of net" are used as synonyms for the concept of new economy or new economy's sub branches.

A more scientific approach is to use the concept of knowledge because it is a driving force of economy and it provides economic and social benefits by passing through scientific processes.

These knowledge-based social and economic changes correlate with other changes and different approaches. For example, a knowledge-based urban transformation is a creation of this change. When cities transform into places where knowledge networks are being woven, some problems such as global democratization, and an identity problem, global migration, and settlement problems have occurred. In connection with these, interactive social movements have also begun to arise in a bipolar social structure, such as knowledge of the poor and knowledge of the rich. These developments have forced local governments and states which are trying to ensure social peace and social balance to establish a structure of civil organization which works for global economy and lives with local culture. Nations, which were unsuccessful in their attempts to develop their civilisation, have to keep up with globalization (Castells 2000).

Today, because global competition has gained a momentum based on knowledge, and knowledge economy has become a key to social development, it is required for countries to transform their economic structures into knowledge economies. How successfully transformation is realized or the success which is achieved is of critical importance to classify countries as developed or developing. In this context; after the theory of knowledge and innovation economics has been explained, the performance of Turkey's knowledge economy has been analysed and the situation has been evaluated in order to understand how successful Turkey is in becoming a knowledge society and whether its economy is knowledge based or not. For this purpose, knowledge economy and innovation indexes which are economic indicators have been drawn upon in addition to analyses that have been conducted. The knowledge economy based projections will also be illustrated with an approach that has become a catchword known as goal 2023 in Turkey.

2.2 Knowledge and Innovation Economy: A Techno-Economic Paradigm

The new social structure of our century is called the knowledge society. In the knowledge society, the fundamental resources are knowledge, products of knowledge and innovation. The knowledge society involves interconnected organization, standard protocols for transfers and communication and at the same time knowledge transfer. This new understanding has a unique character which differentiates it from agricultural and industrial societies. The new society is characterized by more knowledge incorporated in the new products and services, by more importance given to learning and innovation, globalization and sustainable development. Information is one of the main phenomena that directs the social and economic life of the new century.

In this context, Drucker (2001) defines the knowledge society as follows:

> "The next society will be a knowledge society. Knowledge will be its key resource, and knowledge workers will be the dominant group in its workforce. Its three main characteristics will be:

- Borderlessness, because knowledge travels even more effortlessly than money.
- Upward mobility, available to everyone through easily acquired formal education.
- The potential for failure as well as success. Anyone can acquire the "means of production", i.e., the knowledge required for the job, but not everyone can win."

The new society proposes innovation and producing knowledge. Today, evolution is based on the production of knowledge and therefore the knowledge economy concept is now used more.

The target in this society is to have a workforce which can use information efficiently, effectively. Because information has a central position in knowledge society, unlike industrial society, the need for white collar employees namely a qualified workforce has increased instead of the section which is called blue collar employees. The industrial worker who works in the industrial society also lost his value as industrialization reached its highest level, a technical class which consists of professionals who produce science instead of bare products. According to Drucker, this class is "knowledge workers." Briefly, "knowledge society is a structure in which the most strategic production factor is information." This trend that has led to fast changes in society is leading to revisions in economic theories and models. Traditional “production functions” focus on labour, capital, materials and energy; knowledge and technology are external influences on production. Now, analytical approaches are being developed so that knowledge can be included more directly in production functions. Investments in knowledge can increase the productive capacity of the other factors of production as well as transform them into new products and processes (OECD 1996).

OECD defines the knowledge economy as “economy which is directly based on the production, distribution and use of knowledge and information”. In knowledge economy, it is very important to innovate and to invest in knowledge because these are the elements which make productivity grow.

Organizations of all sizes and industrial sectors are faced with the task of implementing these technologies into their everyday services in order to compete and survive in this new knowledge economy.

In fact, in this economy, knowledge has become the key driver of economic competitiveness and success: it has added massive value to economic production through increases in productivity, and the application of new technologies and new ideas, both in the form of new inventions and also new applications of existing knowledge, has brought revolutionary change to virtually all markets and sectors.

When this new techno-economic paradigm is founded on innovations and entrepreneurship in an institutional structure it emerges and becomes a process which spreads by itself.

This is why this newly developing techno-economic paradigm is very different from the standard (classical) innovation mentality. Three conditions should be pointed out for this newly developing paradigm (Kudyba and Romesh 2002):

- Constant price decline of innovation linked products (microelectronic devices, biotechnologies, wireless communication etc.).
- Unlimited increase in the supply of these products.
- Increase of innovation to a higher level and constant incentives to innovate in other areas which are linked to the basic ones.

When this process begins, production cost declines with an expansion in the market of innovative products. This process continues until it affects the production process of all products. This kind of process narrows the area of old fashioned production and increases the usage of new products and processes. The adaptation of economic, national, international, political, and social institutions provides constant technological development. This kind of development which creates a quantum leap in productivity has the economic potential for a new paradigm.

Some thinkers have argued that the emergence of a knowledge based economy or new paradigm is a major departure, a new paradigm offering endless productivity gains, faster non-inflationary growth and ever increasing stock markets and low unemployment (Brinkley 2008). And also; the formation of “.com”’s especially for technology based companies, the rise of the consumer confidence index, the increase of the foreign trade deficit, the increase of inequality in income distribution, and wage rigidity (stickiness) are among the basic features of this new situation (Kudyba and Romesh 2002).

Many situations which did not exist in the old economy such as:

- Existence of wage rigidity (stickiness) along with low unemployment,
- Existence of low unemployment along with low inflation,
- a situation in which sustainable growth doesn't increase income inequality and
- a situation in which share certificate evaluation doesn't comply with traditional norms can be found in the new economy.

Although the attention of economists to technology dates back to old times, they have recently positioned technology in the centre of economic thought. The emergence of an effect on macro and micro economic variables, technological developments in general, and the advancement of information communication technologies in particular has led to economists becoming more interested in this subject (Yumuşak et al. 2010).

Elements such as production, sharing, usage, and enrichment of information have gradually become more strategic. Countries that want to enhance their global competitive power need a qualified workforce, namely human capital, R&D, information and communication technologies and an institutional structure which prepares a platform to provide all these, and economic development has gradually become more dependent on information (Yeo 2010). This is why developing countries need to transform into knowledge economies with a programmed effort in order to create development by strengthening the economic infrastructure. The character and the quantity of knowledge in countries' economic development also play an important part. Each knowledge based economy is positioned on four main pillars related to production, usage, dissemination, and development of information.

The World Bank has developed the following framework to help countries articulate strategies for their transition to a knowledge economy (World Bank Institute 2007):

- An economic and institutional regime to provide incentives for the enhancement of welfare, growth; usage, dissemination, and creation of information.
- An educated and skilled population to create, share, and use knowledge well.
- An efficient innovation system of firms, research centres, universities, consultants, and other organizations to tap into the growing stock of global knowledge, to assimilate and to adapt it.
- A dynamic information infrastructure to facilitate the effective communication, dissemination, and processing of information.

It is a more scientific approach to use the concept of knowledge because it is a driving force of economy and it provides economic and social benefits by passing through scientific processes.

2.3 Basic Features of the Knowledge and Innovation Economy

Improvements in information and technology affect all economic components. The economic structure becomes dynamic, complicated and difficult to foresee with this interaction. Production, consumption, distribution relations and market structure which are defined as the three main elements of economy are being configured based on knowledge. This structuring could be in the form of constant improvement of standard production processes, of obtaining new and different production processes, products and services by using available knowledge, or using completely new knowledge based on improvement. While production factors are consumed when they are used, knowledge cannot be consumed. A production function that includes information transforms into $TP = f(K, L, I)$ (TP = Total Products, K = Capital, L = Labour, I = Information) (coefficient of technological development/information). And when information becomes a production factor, traditional production also becomes more efficient due to the law of increasing returns.

When it comes to considering consumers' point of view, consumers buy products and services faster without restrictions of time and place. Economy is on the consumer's agenda. Barriers to enter and exit the market are becoming lower and information is becoming an element of competition. Companies which are innovative and enterprising, information cantered and able to adapt to market conditions, manage change and not only exist in the local but also in the global market can be successful. It is becoming mandatory to develop innovative products and services that can compete with global companies due to lifted borders.

In addition, the economic effect of physical distances and the cost of access to information have been reduced thanks to information and communication technologies. In this way, the cost of founding a new company is lower and the opportunities to compete in new markets increase. While the success criterion of companies was measured in terms of material profit in industry based economies and is now measured by "market value", qualified human resources which have replaced financial capital which was a scarce resource of old times has become a scarce resource. It seems that there is an increasing demand for manpower that can be defined as a sort of knowledge worker. In addition, information and communication technologies create collaboration opportunities in order to produce high quality, low cost products and services (European Commission 2012).

One of the changes which seems to be happening in the knowledge economy that the service sector is coming to the forefront. It seems that humanitarian services, information technologies and scientific improvement based R&D activities are gradually gaining in importance. It is possible to say that the economic model in which knowledge comes to the forefront forces current work processes and jobs to be more qualified (Meçik 2013).

Knowledge based processes, such as production, consumption, distribution etc. and economic developments as far as technological innovation are rapidly changing, because in our society:

- Computer technologies lead the development dynamic and there is an institutional infrastructure that consists of computer networks.
- Intellectual sectors lead the markets.
- Socio-economic system also consists of a voluntary non-governmental organization.
- There is a multi centred and participatory democratic political system.
- There is a strength to produce a high level information.
- Basic values are based on satisfaction that originates from reaching goals.

A knowledge economy which is formed by a society in that way, focuses on information as a production factor. Therefore it is necessary to learn and to use information for organizational development and innovation. In this context there are some factors that make the occurrence of this new knowledge based economy important and distinguish this economy from an industrial economy (Kim et al. 2006; Kevük 2006). Information revolution, flexible organizations, knowledge, skill, learning, innovation, information networks, learning organizations and innovation systems, global competition, clustering with production are some of these features.

Trends which are based on coding the information have intensified and the coded information sharing has increased the information stock of developed economies. Along with information Technologies, the advantage of coded information is to have a feature that can be transferred at minimum cost and maximum velocity. ICT has increased the capacity of producing and processing the information and decreased the cost of carrying out these processes (Hougton and Sheehan 2000). The knowledge economy can be defined as an economy that is spread to other areas and used by organizations and people for more economic and social development. A gradual increase in the importance of information presents a substantial potential to develop more efficient production methods for products and services and enables countries to transfer these techniques to people in an efficient and low cost way to reinforce their economic and social development. Increasing the level of welfare by extracting and processing natural resources is replaced by human knowledge and practices of creativity. Knowledge has become a production factor and a commodity which is of vital importance for people and companies in the 21st century that is defined as a century of knowledge based economies (Kefala 2010).

Interactive connections among companies in the knowledge economy help achieve new research results and gain basic technology components and reduce the cost of innovation and risks. Local clustering of networks and firms is important for the future of the knowledge economy. Firms use the clustering factor to work with other firms and technology based units for reasons such as rising costs and the expansion of technology's scope (Houghton and Sheean 2000).

Basic components of the knowledge based economy could be classified as consumer demand, technology, globalization. There is a higher demand for services that are produced by knowledge based industries. Technology serves as a provider of both demand and supply. Computers and the internet contribute to the development of the knowledge economy and help reduce the costs of investment and transportation by being used efficiently in production processes. New technologies at the same time enable new markets to be used as well.

Opening new markets and international trade will enable competition to increase in knowledge intensive sectors (Brinkley 2008).

The new knowledge based economy requires a broader mind-set and the understanding of changes in macro and micro units. Furthermore it requires facilities of technological infrastructure but this is not enough. The game of yield maximization which can be obtained from information and communication industries will be possible by behaving according to the new rules of the game. This is necessary for companies and industries as well as for the economy of a country and global economy.

And finally it should be mentioned that there is a need for a new economic theory in the knowledge economy. There should be an economic theory which positions information in the centre of the process of economic value formation. Because this kind of theory can explain innovation and processes of countries' growth only (Drucker 1994). This conclusion

Subjects	Old Economy	New Economy
Economy-wide Characteristics:		
Markets	Stable	Dynamic
Scope of Competition	National	Global
Organizational Form	Hierarchical, Bureaucratic	Networked, Entrepreneurial
Potential Geographic Mobility of Business	Low	High
Competition Between Regions	Low	High
Industry:		
Organization of Production	Mass Production	Flexible Production
Key Factor of Production	Capital/Labour	Innovation/Knowledge
Key Technology Driver	Mechanisation	Digitisation
Source of Competitive Advantage	Lowering Cost Through Economies of Scale	Innovation, Quality, Time to Market and Cost
Importance of Research/Innovation	Moderate	High
Relations with other Firms	Go it Alone	Alliances and Collaboration
Workforce:		
Principle Policy Goal	Full Employment	Higher Wages and Incomes
Skills	Job-Specific Skills	Broad Skills, Cross-Training
Requisite Education	A Skill	Lifelong Learning
Labour - Management	Adversarial	Collaborative
Nature of Employment	Stable	Market by Risk and Opportunity
Government:		
Business - Government Relations	Impose Requirements	Assist Firms' Innovation and Growth
Regulation	Command and Control	Market Tools, Flexibility

Fig. 2.1 Differences between Old and New Economy. (Source: Bonnett 2000)

can be inferred from these expressions; the economic theory that focuses on the dynamics of the industrial community is not enough to explain today's economy.

In this sense, the basic differences between the old and the new economy are shown in Fig. 2.1.

2.4 Components, Parameters and Indicators of the Knowledge and Innovation Economy

Features that differentiate the knowledge economy can be stated as follows:

- *It is an economy in which the service industry is gaining in importance.* The service sector has also continuously grown more diverse with the development of the knowledge economy.
- *It is an economy that is based on credit*. The evolution of electronic money and credit cards is an information sourced development.
- *It is a digital and virtual economy.* All sorts of information, such as voice-recordings, writings, images etc. are transmitted by computer networks in the form of bits. A large amount of information reaches its receivers in a very fast, cheap and safe way.
- *The knowledge based economy is a network economy*. Information technologies and communication networks present a chance for small scale companies to have advantages like bigger companies. For example, they present a chance to compete in the global arena.
- *The knowledge economy eliminates middlemen.* Intermediary firms that producer firms use in order to reach end users vanish because of communication networks in the knowledge economy.
- *The dominant sector of the knowledge economy is a triple formation.* The dominant economic sector in the knowledge economy that is formed by the integration of computers, communication and entertainment as the new media sector. People change methods of doing business, producing, working, having a good time, living and thinking.
- *The knowledge economy includes innovation.* Constant regeneration of processes, market, people is an innovative foresight of today's economy. The secret of being successful is innovation and creativity.
- *The knowledge economy reduces the difference between producer and consumer.* Consumers in the knowledge economy can contribute to production and have the opportunity to direct production through increasing communication technologies.
- *The knowledge economy is a rapid economy.* Success of companies and decision units depends on capacity of ability to adapt to innovation and speed of information. "An adage of big fish eats small fish is replaced by an adage of fast fish eats slow fish" (Jennings and Haughton 2001).

- *The knowledge economy also includes some social problems in its structure.* It also seems that a new political economy is beginning that brings some problems such as power, security, equality, quality, quality of work life and the future of the democratic process with it. The possibility of information and fast growing technologies being misused by dictatorial powers and governments is a serious social problem.
- *The knowledge economy is a harmonious economy.* Usage of computers and the internet is effective to reduce the cost of friction that is a problem which causes conflicts between sellers and buyers in the industrial economy.

Because the knowledge economy is a concept which is about humans, it is defined as "a shape of activity subject to human owned scientific, systematic, organized information to be applied to production, consumption, sharing". Knowledge economy can be defined with twelve main elements (Tapscott 1996):

- Knowledge
- Digitalisation
- Virtualisation
- Molecularization
- Integration/Internetworking
- Disintermediation
- Convergence
- Innovation
- Prosumption
- Immediacy
- Globalisation
- Discordance

There are different classifications for basic components of the knowledge economy in academic literature. There are four components of the knowledge economy (Fig. 2.2).

Economic and Institutional Regime	A country's economic and institutional regime provides stimulation to use information efficiently and develop entrepreneurship.
Education and Talent	A country's citizens need education to produce, share and use information effectively.
Infrastructure of Information and Communication	Infrastructure of dynamic information facilitates effective communication, spread of information, the functioning of the information,
Innovation System	A country's innovation system - firms, research centres, universities, think tanks, consultants and other organisations - is able to attract, adopt increasing global information stock and form new technologies by adapting to local needs.

Fig. 2.2 Four Basic Components of the Knowledge Economy

The knowledge assessment methodology developed by the World Bank K4D is a method which helps to identify problems and opportunities that can be encountered in the route of transition to a knowledge economy by using these components. These components can be summarized as follows:

- R&D and innovation: National innovation system in which innovation policies can be found that aim to develop and commercialise local and global innovations, institutions and support mechanisms which include R&D systems. Here, some important indicators are the number of patents, copyright payments, number of scientific publications.
- Education: An innovative and dynamic education system that includes public and private institutions which educate knowledge experts, technology literates, the workforce, qualified human resources that are the most important components of the knowledge economy (David and Foray 2002).

Here, some important indicators are rate of adult literacy, participation in secondary and higher education.

- Information and communication technologies: Here, some important indicators are the number of telephone subscribers, the number of computers and usage of internet.
- Proper work environment in which the knowledge economy can develop: Here, some important indicators are restrictions with and without tariffs, quality and feasibility of regulations, local credits for private sectors, number of days required to initiate work, the intensity of local competition, political stability (World Bank Institute 2007).

Kevük (2006) states that components of the knowledge economy are ICT, innovation, knowledge workers. Alexander and Butcher (2011) also state that production, usage, acquisition of information are the main components of the knowledge economy. Oort et al. (2009) remark that R&D is also a component of the knowledge economy besides these components. In conclusion, it can be remarked that in literature, components of the knowledge economy develop in the factors' orbit of ICT, innovation, R&D, knowledge workers and human capital (Godin 2008).

When decision makers set a target for the knowledge economy and knowledge society, they must be able to evaluate countries' conditions in terms of information and communication technologies.

Several indexes can be used for this particular subject. Some institutions that have developed these indexes are: McConnell A Global Technology Policy and Management Consulting Firm, The Centre for International Development at Harvard University, The Economist Intelligent Unit, The United Nations Conference on Trade and Development (UNCTAD), The United Nations Development Program (with its Technology Achievement Index), World Economic Forum, The Mosaic Group and The World Bank (Beig et al. 2007).

The KAM Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge (Fig. 2.3). This is an indication of the overall potential of knowledge

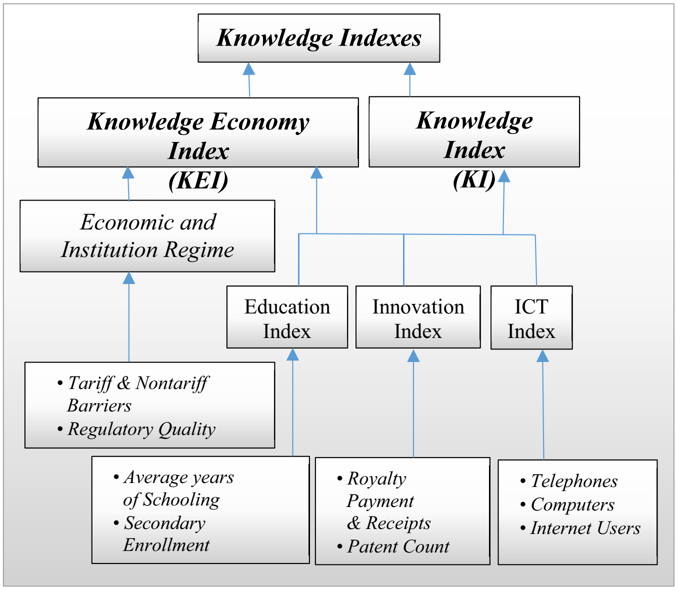

Fig. 2.3 Knowledge Indexes. (Source: http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,contentMDK:20584278%23menuPK:1433216%23pagePK:64168445%23piPK:64168309%23theSItePK:1414721,00.html)

development in a given country. Methodologically, the KI is the simple average of the normalised performance scores of a country or region with the key variables in the three knowledge economy pillars education and human resources, the innovation system and information and communication technology (ICT).

The Knowledge Economy Index (KEI) takes into account whether the environment is conducive for knowledge to be used effectively for economic development. It is an aggregate index that represents the overall level of development of a country or region towards the Knowledge Economy. The KEI is calculated based on the average of the normalized performance scores of a country or region with all 4 pillars related to the knowledge economy – economic incentive and institutional regime, education and human resources, the innovation system and ICT.

For the purposes of calculating KI and KEI, each pillar is represented by three key variables (more on these variables):

The Economic Incentive and Institutional Regime

- Tariff & Nontariff Barriers
- Regulatory Quality
- Rule of Law

Education and Human Resources

- Average years of schooling
- Secondary Enrolment
- Tertiary Enrolment

The Innovation System

- Royalty and License Fees Payments and Receipts
- Patent Applications Granted by the US Patent and Trademark Office
- Scientific and Technical Journal Articles

These three variables are available in 2 forms: scaled by population and in absolute values. Thus, both KE and KIE are also available in "weighted" and "unweighted" forms. In innovation, the absolute size of resources matters, as there are strong economies of scale in the production of knowledge and because knowledge is not consumed in its use.

Information and Communication Technology (ICT)

- Telephones per 1000 people
- Computers per 1000 people
- Internet users per 10,000 people

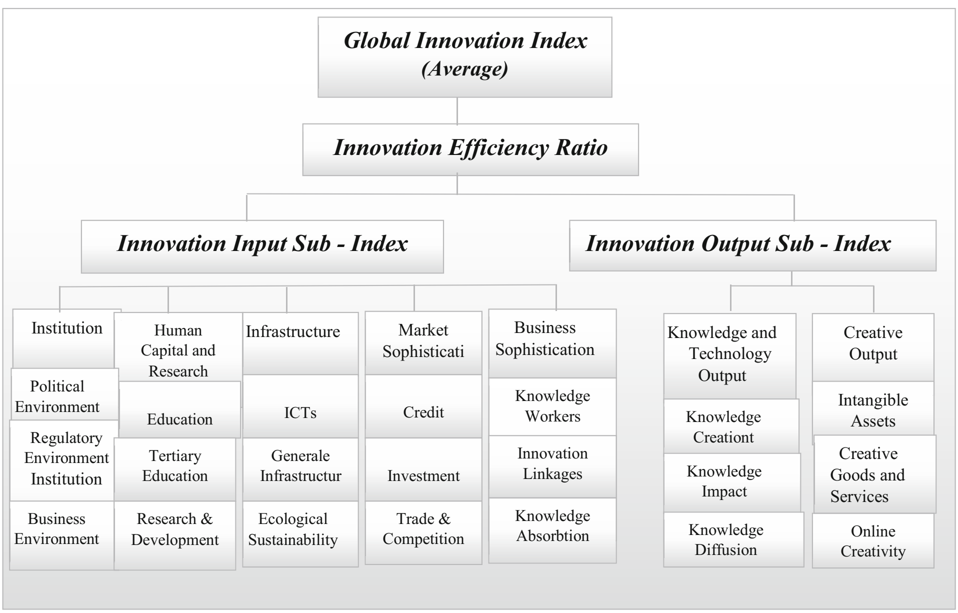

Fig. 2.4 Innovation Index. (Source: https://www.globalinnovationindex.org/content/page/data-analysis/)

The other performance analysis related to the usage of information communication technologies with an effect on development dynamics is conducted by the Networked Readiness Index which was developed by The World Economic Forum. The index aims to measure the readiness level of countries to use communication information technologies. It is one of the studies to measure how well countries adopt these technologies in terms of individual, business world and public administration (World Economic Forum 2014). This index has four main elements such as environmental conditions, readiness, usage, creation of an effect.

Similarly, indexes have also been developed to measure innovation structures of countries. The European Union (EU) and INSEAD use innovation indexes as indicators when they measure innovation performance and put countries in order according to this measurement in studies which are performed by The Economist Intelligence Unit (Fig. 2.4). And also the World Bank analyses countries' performances and creates rankings according to index scores under the frame of the knowledge economy that accepts innovation as an input as well.

2.5 Knowledge and Innovation Economy in Terms of Turkey

Because transition to a knowledge economy has become a key to an increase in social development and welfare, it requires implementations of economy policies that are in this direction and a structural transformation. But it is really important how successfully this structural transformation is implemented or how much progress is made in the transformation process.

R&D and innovation studies which were neglected for years have increased significantly in the economic transformation process that was experienced in 2000s. And progress has been made in financial and human resources. At this point it is observed that these resources are still growing but it is not enough yet according to levels which were set by Turkey for 2023 and beyond.

First, the second and third waves defined by Toffer were implemented. Turkey was able to become a young industrial country through protectionism and incentive policies. But the transition to knowledge equipped understanding is necessary to increase productivity in production and to professionalise by producing high value added products.

Turkey is aware of the fact that the role of the information and communication technology sector will be more important in the future compared to today. In this respect, Turkey has become more interested in the sector of information and communication technologies in recent years, and accelerated necessary studies to have a higher involvement in this sector in future. At this point it should be mentioned that information might have been bought from outside without having been produced in the country. What is important to ensure the production of information and its sustainability. Due to the given situation it is important for the knowledge economy profile of Turkey compared with high, moderate and low countries to reach ICT's about the average level of welfare of each country's citizens and by socio-economic indexes (Table 2.1). And also although information can be obtained about the average wealth level of countries by looking at GDP figures from the table, it is not enough to indicate the development level of countries. The Human Development Index is therefore also included in the table. Political rights and freedom that affect creativity of people's happiness and wealth are added as further indexes. Political rights and freedom are indexes that are effective in terms of the work climate. The existence of knowledge workers shouldn't be ignored. For this reason, the number of working researchers is considered in R&D activities. One of basic activities related to the production of information and innovation is R&D activity. The share of R&D expenditures are also included in GDP. The other important index is the number of patents, which can represent the process of innovation creation. Low figures of this variable mean there are problems in terms of creating innovation.

Table 2.1 Country Group and Turkey's Socio-Economic Indicators (2012)

	World	High-Income Countries	Middle Income Countries	Low Income Countries	Turkey
Growth Rate	2.88	1.84	6.28	5.61	8.77
GDP Per Capita ($)	10,196	38,165	4366	1899	10,605
Gross domestic expenditure on R&D (%)	2.20	2.48	1.25	–	0.92
ICT Goods Exports/Export (%)	10.01	8.72	14.31	4.39	1.66
ICT Goods Imports /Import (%)	11.06	10.76	12.24	6.36	3.83
Internet Usage (100 Kişi başına)	32.55	72.74	26.44	15.78	43.07
Patent Applications (Residents)	1,277,816	820,994	448,655	14,052	4543
Patent Applications (Non-Resident)	705,504	482,209	222,760	52,363	7056
Secure Internet servers (per million people)	184.17	938.22	11.12	3.45	143.64
Human Development Index[a]	0.89	0.66	0.66	0.50	0.76
Index Economic Freedom[b]					62.1
Freedom Index[c]					7.10
Personal Freedom[c]					7.16
Economic Freedom[c]					7.03
Computer Usage[d]					93.5
Internet Access[d]					92.5
Having Website[d]					58.0

[a] Source: http://hdr.undp.org/en/composite/HDI.
[b] Source: https://freedomhouse.org/report-types/freedom-world#.U48oVPl_usd, http://www.sithi.org/admin/upload/media/%5b2013-02-12%5dHighlights%20of%20the%202013%20Index%20of%20Economic%20Freedom/2013_02_12_Index2013_Highlights.pdf.
[c] Source: https://www.cato.org/human-freedom-index (04.08.2017).
[d] Source: www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1615.

As can be seen in Table 2.1, most of Turkey's socio economic indexes are low compared to the average of the world and country group. But it can be said that Turkey has a tendency towards rapid increase since the beginning of the 2000s. The World Bank developed a "methodology of information evaluation" to highlight the importance of the knowledge economy in global competition and formed knowledge based economy indexes to measure knowledge based economic structures of countries by using this method (World Economic Forum (2014). Education, innovation, information and communication technologies form the knowledge index (KI) by clustering. The knowledge economy index (KEI) is formed by adding indexes related to economy and institution. The knowledge economy index (KEI) examines the ability of a country to spread, to customize, to create information. As a country approaches 10 it shows that there is progress in the field of the knowledge economy variable. We tried to make a situation analysis by using indexes related to the knowledge economy and indexes related to elements of the knowledge economy. There are KI and KEI indexes and sub components related to the knowledge economy in Table 2.2 which allow it to compare present conditions of countries. The KEI and KI figures of Turkey are close to the World average but lower than the average of high income countries. It can be said that Turkey is situated within the group of middle income countries.

According to measurements of innovation performance that are carried out by the EU, INSEAD, the Economist Intelligence Unit and the World Bank, the index value of Turkey's innovation increased from 0.18 s in 2007 to 0.24 s in 2011. This value increased from 0.52 to 0.54 in the same period of time in the EU. It can be said that Turkey is defined as an innovative state and a member of moderate non-assertive European countries. But it also seems that Turkey shows a below-average performance. There are areas such as open, perfect, and convenient research systems, finance and support, innovation foundations, and their economic effects where Turkey is relatively strong. Areas where Turkey's performance is low are human resources, company investments and intellectual assets (Karaata 2012). If growth rates are taken into consideration, areas such as R&D

Table 2.2 Country Group and Turkey's KEI and KI Indicators (2014). (Source: World Economic Forum 2014)

	World	High-Income Countries	Middle Income Countries	Low Income Countries	Turkey
Knowledge Index (KI)	5.01	8.67	5.07	1.58	4.81
Knowledge Economy Index (KEI)	5.12	8.60	5.01	1.58	5.16
Economic Incentive and Institution Regime	5.45	8.39	5.18	1.61	6.19
Innovation	7.72	9.16	6.21	2.13	5.83
Education	3.72	8.46	4.72	1.54	4.11
Information and Communication Technology	3.58	8.37	4.28	1.05	4.50

expenditures ensure that the performance of Turkey's growth is high. It seems that Turkey shows above average growth performance in fields such as human resources, open, perfect, and convenient research systems, finance and support, investments of firms.

Turkey's position can be seen in Table 2.3 according to global innovation index value and order. Turkey is 58th with a score of 37.81 among all other countries.

In other studies Turkey also ranks 71st with a score of 41.68 according to Innovation Input Sub-Index rankings. Singapore is the 1st with a score of 72.12 in this field. Within another study Turkey is 52nd with a score of 5.42 among 82 countries according to the most innovative countries ranking of World Bank. The expected innovation performance index of Turkey is higher than index that occurred with 5.81. The World average of innovation performance index is 6.28 (EIU 2009).

Political and economic decision mechanisms comprehended better that R&D and innovation have a critical importance and strengthen Turkish economy while reducing external dependence. In this context, some assertive goals have been set by the supreme council for science and technology for the year 2023 when celebrations will take place for the 100th year of the Republic of Turkey. In the direction of this goal Turkey is:

- to allocate at least 3% of its GDP (60 billion dollars), two thirds of it will come from firms, to R&D
- to become one of the world's top 10 economies and to have 300,000 full-time employees of whom 180,000 work in private sector.
- to increase the number of broad band subscribers to 30 million.
- to provide 14 million households with internet connections of 1000 Mbps.
- to increase the sector share to 8% in GDP.
- to become one of the top 10 countries in the field of e-transformation
- to enable 80% of the population to use a computer.
- to increase growth of the information and communication technology sector to reach 160 billion US dollars with an annual rate of nearly 15%.
- to increase the share of R&D spending in GDP from 0.85 to 3%.

These are the predictions (www.invest.gov.tr, n. d.).

Table 2.3 Global Innovation Index Rankings. (Source: Dutta et al. 2015)

	Score	Rank	Efficiency
Switzerland	68.30	1	1.01
United Kingdom	62.42	2	0.86
Germany	57.05	12	0.87
Russian Federation	39.32	48	0.74
Turkey	37.81	58	0.81
Brazil	34.95	70	0.65

Turkey launched “The National Science, Technology and Innovation Strategy 2011–2016” to reach these goals. The national STI Strategy conducted by the Scientific and Technological Research Council of Turkey focusses six different horizontal policies and it has the goal to provide support to competitive sectors (such as automotive, machine production, information and communication technologies) in which the R&D and innovation capacity of Turkey is strong compared to other sectors which are already developing (defence, energy, space, water, food) (TÜBİTAK 2013).

Conclusion

Knowledge and innovation that is an important reflection of knowledge have become the most important components of global competition and economic development in our age in which social and economic structures are transforming in a knowledge based way. Now economy administrations comprehend that it is necessary to benefit more from global scaled knowledge resources in order to strengthen elements of competition and development, because, it is not possible to be excluded from this gripping global transformation trend. It can be said that although this process is relatively in favour of developed countries with effect of neoliberal policies, developing countries are also benefiting from this on a large scale. In this study, Turkey’s situation, which could be said to be on one of the highest levels in the ranking of developing countries, but with much further potential in terms of knowledge economy and innovation. We tried to benefit from indexes that try to measure knowledge economy and innovation performance to realize this goal. Turkey, which saw the need for a paradigm change to reach a new economy based scientific technologic development that is targeted in the medium and long term, has implemented some reforms since the beginning of the 2000s.

Thanks to these reforms which were applied successfully, Turkey has shown significant improvement in many macro-economic indexes and experienced a development adventure that set an example by showing extraordinary economic performance. It is observed that Turkey has made evident progress to use both human and financial resources in recent years and has increased investment into R&D and innovation and outputs. Turkey, which believes that transformation is inevitable and necessary, has been making efforts to implement result oriented mechanisms especially in terms education, economy and social state policies.

It has become an inevitable strategic dimension necessity for Turkey to make bigger moves in the field of R&D and innovation for the purposes of making a history in economy by attaining the figures of exports and GDP set out in the vision of 2023 and keep going in its track without being caught by the middle income trap. Consequently, Turkey attaches importance to increasing R&D target driven projects, stimulus policies, effectiveness in allocating resources, and, for this purpose, obtaining coordination between institutions and organizations. It seems that the active policies of especially TUBİTAK and other institutions affiliated to the ministry of science, industry and technology in the fields of patent, scientific publication and copyright have increased innovation index values although it is late. And Turkey is rising towards an upper ranking in the knowledge economy index.

Although Turkey's goals "of increasing allocated resources for RD to 3% (60 billion dollars) and increasing GDP to 2 trillion dollars" seem ambitious. It doesn't look impossible when potential values such as exhibiting this performance in a steady economic, social, politic environment, its active population, its SME performance, its openness to innovation, its geographical and strategic position, its willingness to use new technologies and having a population that is prone to interaction, are taken into consideration. But it must also be mentioned with realistic approaches such as the "Report of Inventiveness Union Progress" (2013) of the European Commission that Turkey ranks 27th of 33 European countries in terms of growth rates. Regarding the increase in science and technology (it is a composite index which includes the share of a country in the most cited publications, the number of good university per one million inhabitants, patent applications, the number of prestigious European Research Counsel grants), Turkey has made very limited progress in knowledge intensiveness of its economy in the last ten years. And this shows that Turkey needs to go a long way in terms of transformation into the knowledge economy. In general, one can say in Turkey:

- fixed capital, investment into the information and communication sector are not adequate
- spending of R&D lag behind those of fast growing economies.
- human capital is not successful in increasing the level of its education.
- the inclination to high tech products in the structure of production remains limited and it seems that the low tech based production structure will continue.

While Turkey shows relatively good performance according to criterions such as given incentives to R&D and innovation and the existence of institutions that are needed in national innovation system and scientific publications, Turkey needs to make progress to have qualified human resources in order to make innovation in the fields of general education and intellectual property rights as a more comprehensive criterion. Education reforms should be implemented, the infrastructure of information and communication technologies should be extended for the purposes of producing, using and sharing information and implementing institutional-legal regulations in order to create knowledge workers and human capital.

Opportunities such as the gradual increase in the number of universities in recent years, the programme for alignment with the acquis in the EU membership process, the development of the financial system, the rapid acquisition of information and communication technologies, the existence of new job opportunities in the long term, the existence of science based prominent sectors in the economic field increase hopes to become a knowledge society, to transform knowledge into an economic value and to achieve a position among developed countries.

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Research and Development and High Technology Exports in Selected Countries at Different Development Stages: a Panel Co-integration and Causality Analysis

3

Yusuf Bayraktutan, Hanife Bıdırdı, and Aziz Kutlar

Contents

3.1 Introduction[1]

National economic performance is closely connected more than anything else to the ability to develop and use technology in the global economy where competition and the speed

[1] This study is derived from the PhD thesis titled "Dynamics of technological progress and the structure of exports: A panel data analysis" prepared by the second author under the supervision of the first author.

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*,
FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_3

of technological change are continuously increasing. Technological capacity as a way of production, utilization and dissemination of information has become the most critical determinant of international trade performance and prosperity of a country. In countries with advanced technology, a process of change in which a considerable part of economic activities consists of information, intensive elements has been experienced. As production of goods and services becomes increasingly technology inclusive, technological capability, taken as a reference to determine the development level of a country, has reshaped long-run development perspectives.

An overview of the composition of international trade indicates that the proportion of technology content of goods or production processes in total world trade has a tendency to rise. Technology, rather than factor stock, is the focus of global competition, and value-added and monopolistic advantages created by high tech goods and production processes make this tendency even more important.

Technological differences among countries also determine which countries specialize in which areas of world production and trade, affect technological capacity and the ability to improve technology as well as the composition of foreign trade. When competitiveness in foreign trade is studied, it is important to examine the relationship between foreign trade and technological level. In this study, after examining the relevant empirical literature, the impact of R&D expenditures and the number of researchers on the exports of high and medium high technology manufacturing industries is investigated with a panel data method by using the data of 26 countries with different levels of development, 16 of which are developed and the remaining 10 developing, for the period 1996–2012. Domestic physical capital stock and foreign direct investment inflows are also used to explain high-tech exports. The panel unit root tests are applied to determine the level of the stationarity of the variables and the long-run relationship between the variables tested by using panel co-integration tests.

Studies in literature, which analyze the relationship between R&D, innovation and exports usually focus on developed countries (DC). Including developing countries (LDC) in the analysis, this study gains further importance in terms of shedding light on the contribution of development level to the discussion. Moreover, unlike most of the empirical analyses, which either base on cross-section data and do not take the effect of time into account or take the effect of time into account but only for a single country, a comparative analysis using 17 years of data from countries at different levels of development is done for this study. Panel data methods (panel unit root tests, panel co-integration tests, panel error correction model) used for the estimation of the models enable a differentiation between the short and long-run impacts of technological development indicators on export performance.

This study is designed in three parts. In the first part devoted to the literature, empirical studies on the subject are summarized; econometric methods, data sets, models and variables are introduced in the second part; empirical findings and economic interpretation of them are presented in the third and final part. The study is completed with a general overview and policy recommendations.

3.2 Theoretical Basis and Literature Review

Effects of differentiation in technology on exports and competitiveness have been the subject of different theories. In contrast to the Heckscher-Ohlin model which assumes that technology is homogeneous (the same everywhere), the technological gap hypothesis (Posner 1961) and the product cycle theory (Vernon 1966) were the first steps towards differentiation in terms of technology that entered into foreign trade theories; Krugman (1979), Grossman and Helpman (1991) see technological differences between countries as a major source of international trade. While DC specialize in manufacturing and trade of technology products thanks to their high-tech capabilities, LDC rather specialize in areas based on resources and/or labor due to their weakness in R&D and innovative factors, and relatively abundant (therefore cheap) labor. Unlike labor-intensive products, the price elasticity of demand is low and the income elasticity is high for the products produced using high technology. Thus, the countries manufacturing and exporting technology products enjoy both a higher level of prosperity and high return.

The countries and companies, which design technology with long-run strategies and place importance on R&D and innovation, have the advantage of being more competitive in international markets. There are three distinct connections between technological innovation and international competitiveness. Firstly, process innovation increases competitiveness by reducing production/output costs. Secondly, secondary product innovation makes the products more attractive both in domestic and foreign markets by improving quality. Thirdly, product innovation will allow a monopoly profit by creating a monopolistic position for a certain period of time that will help these products to gain a market share (Archibugi and Michie 1998, p. 10–11). Benefits of technological improvements for innovative countries are positive effects on the foreign trade balance in the short-run by reducing the need for imports and foreign exchange spending, as well as the improvements in terms of trade, and the ability to specialize in sectors providing high returns in the long-run.

As the value-added created in high-tech goods is high, the transformation of exports from low-tech goods to mainly high-tech ones leads a country to become more prosperous and competitive. Medium-tech products are the complex products whose technological content does not change rapidly. R&D expenditures are important for them; they require advanced engineering capabilities and their production scale is large. Entry barriers to the market are quite high for these types of products due to the need for large amounts of capital and there are “learning effects”. For high-tech products, high barriers to entry prevail due to their need for advanced and rapidly changing technology and complex skills (Lall 2000a, p. 341–343, 2000b, p. 8–9). Innovative technologies, a large amount of R&D expenditure, high-tech infrastructure, and a strong collaboration and relations between firms and research institutions are among the main features of these products. Additionally, as the social benefits of the resources in the industry where these products are produced outreach private benefits, positive externalities arise (Krugman 1992, p. 14).

The impact of R&D, innovation, technological development level and factors affecting these variables on exports is discussed in various empirical studies. The level of technology is analyzed with different indicators in these studies conducted on a country, industry or company basis. Competitiveness, which is measured by the share of exports at transnational and sector level, is usually described by variables related to labor costs, fixed investments and the level of technology; the impact of technological development resources on export performance is typically determined in line with theoretical expectations. Empirical literature including featured studies is summarized in Table 3.1.

Magnier and Toujas-Bernate (1994) studied price (export price) and non-price (R&D expenditures and fixed capital investments) determinants of export market share at the sectoral level using the 1975–1987 period data of 20 manufacturing industry sectors in the USA, Japan, Germany, Britain and France. Although there are important differences in some countries and sectors, estimation results of the model including price and non-price effects indicate the importance of non-price effects like R&D for the export market share.

In order to explain export performances of countries, Fagerberg (1997) uses independent variables such as direct and indirect R&D activities (capital and intermediate goods purchases from domestic and foreign companies), the share of foreign companies in indirect R&D, unit labor costs, gross fixed capital formation and domestic demand (domestic market size) for the year of 1985 in 10 OECD countries and 22 industries. A positive relationship is found between direct and indirect R&D and competitiveness. Domestic indirect R&D provides a greater contribution to competitiveness than indirect R&D from foreign resources. R&D investments affect competitiveness twice as much as physical capital investments. While the impact of domestic market size on competitiveness is negative, there is no significant effect of low wages.

Wakelin (1998) has investigated the determinants of bilateral trade for 9 OECD members and 22 manufacturing sectors, taking relative innovation, labor costs and investment rates as determinants of export performance, and questioning how these determinants differ across the countries and industries. In addition, the sensitivity of results to the selection of an innovation variable is investigated by using relative R&D intensity and relative patents; and a new industrial classification is developed taking the impact of innovation on trade performance into account in net innovation user or developer sectors. Despite the heterogeneity between sectors and countries, with the analysis of pooled data it is concluded that innovation and investment variables affect trade performance positively and labor costs affect it negatively. It is found that differences in innovation have more impact on the trade performance of sectors developing technology than those using technology.

Montobbio (2003) has associated export market share in a given sector with the three explanatory variables R&D expenditures, unit labor costs and gross fixed capital formation in 14 countries for the periods 1980–1983, 1984–1987 and 1988–1990 by evaluating the impact of sectoral differences on the dynamic relationship between technological level and export performance, Sectors are divided into three sub-categories, namely high-tech, medium-tech and low-tech; and it is recognizable that differences in the technological content of sectors affect the relationship between technological variables and export market shares.

Table 3.1 Summary of Empirical Literature

Studies	Country and Sector	Period or Year	Dependent Variable	Independent Variable
Magnier and Toujas-Bernate (1994)	5 DC, 20 Manufacturing Sectors	1975–1987	Export Market Share	Relative Export Prices, R&D Expenditures, Investment Rate (Gross Fixed Capital Formation/Value-Added)
Fagerberg (1997)	10 OECD Countries, 22 Sectors	1985	Export	Direct and Indirect R&D, Foreign Share in Indirect R&D, Gross Fixed Capital Formation, Unit Labour Costs, Domestic Demand
Verspagen and Wakelin (1997)	9 OECD Countries, 22 Manufacturing Sectors	1970–1978; 1980–1988	Bilateral Export	Real Wage Rate, R&D intensity (R&D Expenditure/Value Added), Capital Intensity (Investment/Value Added), Mutual Exchange Rate
Wakelin (1998)	9 OECD Countries, 22 Manufacturing Sectors	1988	Bilateral Export	Relative Investment Intensity (Gross Fixed Capital Formation/Production), Relative Wage Rate, Relative R&D Intensity and Relative Patents
Montobbio (2003)	14 Countries, 12 Sectors	1980–1991	Export Market Share	R&D Expenditures, Gross Capital Formation, Unit Labour Costs
Sanyall (2004)	G-5 Countries, 18 Industries	1980–1998	Bilateral Export	R&D Intensity (R&D Expenditures/Output) and Technology Facilities, Arable Land per Worker, and Relative Capital/Labour Ratio

Table 3.1 (Continued)

Studies	Country and Sector	Period or Year	Dependent Variable	Independent Variable
Vogiatzoglou (2009)	28 Countries, 3 ICT Product Groups	2000–2005	Information and Communications Technology (ICT) Goods Exports	R&D Expenditures/GDP, The Number of Researchers, Real Effective Exchange Rate Index, Total ICT Expenditure, Manufacturing Value-Added, Openness Index, The Number of Telephone Mainlines, Inward FDI Stock/GDP
Seyoum (2005)	55 Countries	2000	High-tech Exports	R&D Expenditures, The Number of Engineers and Scientists Working in R&D, FDI Inflows, Development Level of Importer Country
Braunerhjelm and Thulin (2008)	19 OECD Countries	1981–1999 (Every Second Year)	Share of High-tech Exports in Total Exports	R&D Expenditures, Market Size (Country GDP/OECD GDP), Public Education Expenditures/GDP, FDI Outflows/GDP, Medium Technology Manufacturing/GDP, GDP per capita, Balance of Technology Payments
Tebaldi (2011)	Various Countries	1980–2008, (Averages of Five Years)	High-tech Exports per Labour, Share of High-Tech Exports in Manufacturing Industry Exports	Enrolment Ratio, FDI Inflows per Labour, Domestic Savings/GDP, Exchange Rate Index, Gross Fixed Capital Formation/GDP, Inflation Rate, Openness Ratio
Alemu (2013)	11 East Asian Countries	1994–2010	High-tech Exports	R&D Expenditures/GDP, The Number of R&D Personnel, GDP per capita, The Number of Telephone Mainlines, Secondary School Enrolment Rate, Gross Fixed Capital Formation/GDP, FDI Inflows

Sanyal (2004) has investigated the impact of technological factors (R&D intensity and technological facilities), factor endowment (arable land per employee and relative capital/labor ratio) and variables on bilateral trade flows (export performance) by taking 18 industries of the USA, UK, France, Germany and Japan as a sample for the 1980–1998 period. The whole period is sub-grouped into 1980–1989 and 1990–1998, and it is concluded that at an aggregate level innovation there is an important factor influencing bilateral trade performance.

Vogiatzoglou (2009) examines the impact of R&D expenditures (as percentage of GDP), the number of R&D personnel per million people (human capital), the real effective exchange rate index, total expenditures on information and communication technologies (ICT), the size of manufacturing industry (value-added), the openness index, the number of phone lines per one hundred people and the FDI inflows/GDP export specialization by using a multiple regression method for the period 2000–2005 of 28 countries; and statistically significant effects of R&D and human capital are found.

Seyoum (2005) studies the determinants of high-tech exports using the data of 55 countries for the year 2000. Factor analysis and multivariate regression analysis are used to investigate the relationship between high-tech exports and R&D expenditures, the number of engineers and scientists working in R&D, FDI inflows and the development level of the importer country (demand conditions of host country). It is concluded that all the variables have an impact on high-tech exports; and the highest impact arises from FDI inflows.

Braunerhjelm and Thulin (2008) examine the impact of R&D expenditures and market size on high-tech exports using every second year data for the 1981–1999 period of 19 OECD countries. A panel regression model is used in the analysis and it is found that while R&D expenditure is an important determinant of high-tech exports, market size has no effects.

Tebaldi (2011) investigates the determinants of high-tech exports using averages of five year data of the 1980–2008 period. As a result of the panel data analysis using the fixed effects method, human capital, FDI inflows and openness are determined to be important determinants of high-tech exports. In addition, it has been shown that although the institutions do not have a direct impact on high-tech exports, they somehow have an indirect impact on human capital and FDI inflows; no significant impact of fixed capital investments, savings, exchange rate and macroeconomic volatility (inflation) on high-tech exports is found.

Alemu (2013) examines the impact of R&D investments and the number of researchers on high-tech exports for the 1994–2010 period of 11 East Asian countries. The analysis using the panel GMM estimation method concludes that the R&D expenditures/GDP ratio and the rise in the number of R&D personnel increase high-tech exports.

The related literature regarding technology and exports or high-tech export performance usually focuses on DC. Although different results are obtained from these multi-country, single country or industry level studies; the impact of variables used as a representative of technological development on exports stands out in accordance with the theoretical expectations.

3.3 Model and Data

As value-added is higher in technology intensive goods, the transformation of exports composition from low-tech goods to mainly high-tech goods allows a country to be more prosperous and competitive. Technological capacity and capability and human capital stock play a critical role in the development of competitiveness. Based on this fact, by using the panel data method, the relationship between the technological development indicators and high-tech exports in DC and LDC is analyzed with annual data of the 1996–2012 period. Export structure is formed on the base of the export proportions of low, medium and high-tech goods; in order to determine the technological nature of exports, absolute value, per labor value of medium and/or high-tech exports, their share of total exports, etc. can be utilized. High and medium high technology export per labor is preferred as the dependent variable in this study. The technology development capability is measured by two different variables, namely R&D expenditures and the number of researchers. Domestic physical capital stock and foreign direct investment flows are used to explain the export performance of high-tech products.

Two different models to examine the impact of R&D expenditures, the number of researchers, the fixed capital investments and foreign direct investments on high-tech exports are analyzed using panel co-integration methods. The two econometric models presented below are used with the annual data of 16 DC and 10 LDC for the 1996–2012 period; these models are tested separately for DC and LDC.

$$\mathrm{LnHTEX}_{it} = \beta_{0i} + \beta_{1i}\mathrm{LnR\&D} + \beta_{2i}\mathrm{LnGFC} + \beta_{3i}\mathrm{LnFDI} + u_{it} \tag{3.1}$$

$$\mathrm{LnHTEX}_{it} = \beta_{0i} + \beta_{1i}\mathrm{LnRP} + \beta_{2i}\mathrm{LnGFC} + \beta_{3i}\mathrm{LnFDI} + u_{it} \tag{3.2}$$

The variables used in the analysis, their definitions and the data source, and the countries in the sample are presented in Tables 3.2 and 3.3. Country classification is based on the IMF World Economic Outlook Database 2014.

The exports of high and medium high-tech manufacturing industries are used as a dependent variable in the models defined in Eqs. 3.1 and 3.2; the R&D expenditure is used as an independent variable in the first model while the number of researchers is used in

Table 3.2 Variable Descriptions and Data Sources

Variable	Definition	Data Source
HTEX	High and medium high-tech exports per million labor	OECD (2015) (STAN)
R&D/RP	2 different variables are used as technological development indicators: R&D expenditure per million labor force (R&D) and the number of researchers (RP) per million labor	OECD (2015), UNESCO (2015), and World Bank (2015) (WB)
GFC	Fixed capital investment per million labor	UNCTAD (2015)
FDI	Foreign direct investment inflows per million labor	UNCTAD (2015)

Table 3.3 List of Selected Countries

Developed Countries	Developing Countries
Austria	Bulgaria
Czech Republic	China
Denmark	Hungary
England	India
Finland	Lithuania
France	Mexico
Germany	Poland
Ireland	Romania
Japan	Russia
Latvia	Turkey
Slovakia	
Slovenia	
South Korea	
Spain	
The Netherlands	
USA	

the second one. Fixed capital investment and FDI inflows are also independent variables in both models.

I. **High-tech Exports:** Manufacturing industry data is grouped on the basis of OECD technology-intense industry classification. As seen in Table 3.4, based on the technological intensity, industries are divided into 4 groups: high tech, medium high-tech, medium low-tech, low-tech. High and medium high-tech industries are counted as high tech sectors in this study.
II. **R&D Expenditures, and the Number of Researchers:** R&D expenditures and the number of R&D personnel are the most commonly used variables to define technological capabilities of a country. R&D expenditures and R&D personnel are of great importance in every stage of technological activities such as developing a new product and/or production method, efficient use of current or imported technology and adapting or changing technology. Thus, even the firms and countries that only import technology have to make R&D expenditure and must have sufficient R&D personnel to obtain the highest efficiency from imported technology. In this context, the resources allocated for R&D activities and the number of researchers are significant, not only for the production of new scientific and/or technological information or implementation of current information with the aim of producing goods and services; but also for gaining knowledge and experience in the process of improving technological abilities (Saygılı 2003, p. 70). R&D expenditure is one of the most critical determinants of international competitiveness. A positive relationship between R&D

Table 3.4 Classification of Manufacturing Industries Based on Technology Intensity. (Source: OECD (2015), Structural Analysis (STAN) database)

Technology Intensity[a]	ISIC Rev 4[b]	Industry Content
High-technology	21	Pharmaceuticals, medicinal chemical and botanical products
	26	Computer, electronic and optical products
	303	Air and spacecraft and related machinery
Medium high-technology	20	Chemicals and chemical products
	27	Electrical equipment
	28	Machinery and equipment n.e.c.
	29	Motor vehicles, trailers and semi-trailers
	302	Railway locomotives and rolling stock
	304	Military fighting vehicles
	309	Transport equipment n.e.c.
Medium low-technology	19	Coke and refined petroleum products
	22	Rubber and plastic products
	23	Other non-metallic mineral products
	24	Basic metals
	25	Fabricated metal products, except machinery and equipment
	301	Building of ships and boats
Low-technology	10–12	Food products, beverages and tobacco
	13–15	Textıles, wearıng apparel, leather and related products
	16	Wood and products made of wood and cork, except furniture; articles made of straw and plaiting materials
	17–18	Paper and paper products – Printing and reproduction of recorded media
	31–32	Furniture – other manufacturing

[a] OECD's classification of manufacturing industries based on technology intensity. For more information, see Hatzichronoglou (1997).
[b] This shows ISIC Rev. 4 (4th Revision of International Standard Industrial Classification of all Economic Activities).

expenditures and specialization/competitiveness of high-tech sectors in manufacturing industry exports is expected.

III. **Gross Fixed Capital Formation:** Fixed capital investments are one of the basic elements that accelerate capital accumulation and technological development. Innovative activities carried out for production and productivity increase depend upon investments on buildings, machinery and equipment, various tools of experiments, tests and measurement equipment, etc. On the other hand, investments in physical infrastructure are a prerequisite for the spread of emerging technological innovations among firms and sectors. Investments are necessary to transfer technological innovations to other companies and sectors, because innovations in the form of production methods created by innovative companies are usually embodied in machinery and equipment. Investments are a means of transferring, adapting and changing technology developed in other countries. With this in mind, fixed capital investments are included in the model.

IV. **Foreign Direct Capital Inflows:** From the 19th century until World War I, and since the 1960s, national economies have become even more dependent on each other as a result of the increasing internationalization of goods, services and capital markets, developments in communications technology, the increasing rate of integration in the goods market as a result of growing foreign trade and transforming foreign trade links (Bayraktutan 2013, p. 162). Foreign direct capital investment, which is one of the most important reasons behind this process, contributes to the technological developments both by increasing the physical capital stock, and allowing the transfer of new production methods and organization forms (Saygılı 2003, p. 93). In particular, attracting new technologies to home country or activities of foreign firms towards technological improvement support the technological capabilities of the host countries. With the aim of finding an opportunity to evaluate different interpretations of its effects on technological developments in the literature, FDI inflows are included in our models as an independent variable.

3.4 Econometric Methods and Findings

The models defined for analyzing the impact of R&D expenditure, the number of researchers, fixed capital investments and foreign direct investments on high-tech exports are analyzed by panel co-integration methods. The first stage of the co-integration analysis is to examine the unit root characteristics of the variables. In the second stage, whether variables have a long-run co-integration relationship is determined by panel co-integration tests, and in the third stage, an estimation of the panel co-integration vector is made. Finally, the short and long-run causality relationship between variables is investigated.

3.4.1 Panel Unit Root Analysis

Since unit root characteristics of variables play an important role in performing co-integration analysis, the panel unit root test suggested by Im et al. (2003) was firstly applied to the series[2].

[2] In addition to Im et al. (2003), Levin et al. (2002), Breitung (2000), ADF Fisher and PP Fisher unit root tests suggested by Maddala and Wu (1999) were applied to the series, but the results are not reported here. For details, see Bıdırdı (2015).

Table 3.5 Results of the IPS Panel Unit Root Tests for Developed Countries

	Model-1		Model-2	
Variable	Constant	Constant and trend	Constant	Constant and trend
LnHTEX	0.033 (0.513)	−0.535 (0.296)	−0.1142 (0.454)	−0.738 (0.230)
LnR&D	2.912 (0.998)	−0.955 (0.169)	–	–
LnRP	–	–	1.850 (0.967)	−1.677 (0.046)**
LnGFC	0.343 (0.634)	1.554 (0.940)	0.133 (0.553)	1.723 (0.957)
LnFDI	−0.543 (0.293)	3.026 (0.998)	−0.677 (0.249)	2.682 (0.996)
ΔLnHTEX	−8.594 (0.000)***	−4.666 (0.000)***	8.362 (0.000)***	−4.486 (0.000)***
ΔLnR&D	−7.643 (0.000)***	−7.386 (0.000)***	–	–
ΔLnRP	–	–	9.360 (0.000)***	−7.867 (0.000)***
ΔLnGFC	−4.926 (0.000)***	−2.237 (0.012)**	4.683 (0.000)***	−2.512 (0.006)***
ΔLnFDI	−8.764 (0.000)***	−7.681 (0.000)***	8.530 (0.000)***	−7.471 (0.000)***

Notes: Since the data on the number of researchers in Austria is missing, variables of Model-2 were tested for 15 countries. Δ is the first difference operator. Values in parentheses are p-values. ***, ** and * indicate a rejection of the null hypothesis of non-stationary at 1%, 5% and 10% levels respectively. Optimal lag length was determined by using the *Schwarz Information Criterion*

Prior to the unit root test, logarithms of all variables were taken. For both the level and the first difference of the logarithmic series, unit root tests were applied and the results of the DC and LDC were presented in Tables 3.5 and 3.6 respectively. The optimal lag length eliminating the problem of autocorrelation between errors was determined using the Schwarz information criterion.

When we look at the results of the unit root test applied to the level values of logarithmically transformed variables for DC in Table 3.5, it is obvious that the findings in the model with constant and the model with constant and trend for the series of the number of researchers (LnRP) do not demonstrate a complete consistency in terms of stationarity. Results regarding high-tech exports (LnHTEX), R&D expenditures (LnR&D), gross fixed capital investment (LnGFC) and foreign direct investment inflows (LnFDI) series show that variables are not stationary at level and have a unit root problem. Therefore, by taking the first differences of series, it was reinvestigated if there is a unit root. When we look at the results of the unit root analysis for DC according to the first difference, it is observed that high-tech exports (ΔLnHTEX), R&D expenditures (ΔLnR&D), the number of researchers (ΔLnRP), gross fixed capital investment (ΔLnGFC) and foreign direct investment inflows (ΔLnFDI) are stationary [I (1)] in the first difference of their series.

In Table 3.6, when we examine the results of the unit root tests applied to the level values of logarithmically transformed variables for LDC, the results concerning the series of high-tech exports (LnHTEX), R&D expenditures (LnR&D), the number of researchers (LnRP), gross fixed capital investment (LnGFC) and foreign direct investment inflows (LnFDI) show that all series are not stationary in level and they have a unit root problem. Therefore, by taking the first difference of the series, it was reinvestigated if there is a unit

Table 3.6 Results of the IPS Panel Unit Root Tests for Developing Countries

	Model-1		Model-2	
Variable	Constant	Constant and trend	Constant	Constant and trend
LnHTEX	2.634 (0.995)	−0.466 (0.320)	1.981 (0.976)	−0.212 (0.415)
LnR&D	3.987 (1.000)	−0.301 (0.381)		
LnRP			0.293 (0.615)	−1.239 (0.107)
LnGFC	1.084 (0.860)	0.585 (0.721)	1.187 (0.882)	0.594 (0.723)
LnFDI	0.183 (0.572)	2.029 (0.978)	−0.178 (0.429)	2.230 (0.987)
ΔLnHTEX	−5.863 (0.000)***	−3.865 (0.000)***	5.561 (0.000)***	−3.633 (0.000)***
ΔLnR&D	−5.866 (0.000)***	−5.334 (0.000)***		
ΔLnRP			−6.974 (0.000)***	−6.346 (0.000)***
ΔLnGFC	−3.449 (0.000)***	−1.735 (0.041)**	3.355 (0.000)***	−1.887 (0.029)***
ΔLnFDI	−5.809 (0.000)***	−4.662 (0.000)***	5.749 (0.000)***	−4.788 (0.000)***

Notes: Since the data on the number of researchers in India is missing, variables of Model-2 were tested for 9 countries. Δ is the first difference operator. Values in parentheses are p-values. ***, ** and * indicate a rejection of the null hypothesis of non-stationary at 1%, 5% and 10% levels respectively. Optimal lag length was determined by using the *Schwarz Information Criterion*

root. When the results of the unit root analysis concerning the first difference of variables regarding LDC are examined, it is observed that all series are stationary [I (1)] at their first difference.

Following the unit root tests, co-integration tests are performed.

3.4.2 Panel Co-integration Tests

Since the series of high-tech exports (LnHTEX), R&D expenditures (LnR&D), the number of researchers (LnRP), gross fixed capital investment (LnGFC) and foreign direct investment inflows (LnFDI) are stationary in their first difference, the long-run relationship between these series is examined with Pedroni (1999, 2004), and Kao (1999) co-integration tests for both models. Panel co-integration test results for DC and LDC are presented in Tables 3.7 and 3.8 respectively.

In the Model-1 Pedroni co-integration test for DC, according to the model, constant Panel PP and Panel ADF statistics are significant at 5% and 1% levels, and Group PP and Group ADF statistics are significant at 1% level. In terms of the relevant test results, the H_0 hypothesis concerning the fact that there is no co-integration between the series has been rejected and the alternative hypothesis H_1 claiming that there is a co-integration between the series has been accepted. As for the model with constant and trend, by looking at the test results of Panel PP, Panel ADF, Group PP and Group ADF, the H_0 hypothesis arguing that there is no co-integration between the series is rejected, and the alternative hypothesis H_1 claiming that there is a co-integration between the series is accepted. Panel PP and

Table 3.7 Results of Panel Co-integration Tests for Developed Countries

	Model-1		Model-2	
Pedroni statistic	Constant	Constant and trend	Constant	Constant and trend
Panel v-stat	0.10 (0.45)	−1.48 (0.93)	0.25 (0.40)	−1.17 (0.87)
Panel rho-stat	1.60 (0.94)	2.67 (0.99)	0.69 (0.75)	2.67 (0.99)
Panel pp-stat	−1.85 (0.03)**	−2.46 (0.00)***	−3.75 (0.00)***	−3.95 (0.00)***
Panel adf-stat	−2.53 (0.00)***	−2.84 (0.00)***	−3.92 (0.00)***	−4.04 (0.00)***
Group r-stat	2.55 (0.99)	3.95 (1.00)	1.99 (0.97)	3.56 (0.99)
Group pp-stat	−4.71 (0.00)***	−8.30 (0.00)***	−5.44 (0.00)***	−8.76 (0.00)***
Group adf-stat	−4.92 (0.00)***	−5.58 (0.00)***	−5.51 (0.00)***	−6.61 (0.00)***
Kao ADF statistic	−3.73 (0.00) ***	–	−2.96 (0.00)***	–

Notes: ***, **, * indicate a rejection of the null hypothesis of no co-integration at 1%, 5%, 10% levels respectively. Figures in parentheses indicate the probability value. Newey-West Bandwidth selection using the Bartlett Kernel was used for the Pedroni and Kao co-integration test

Panel ADF statistics as well as Group PP and Group ADF statistics are significant at 1% level, and indicate that there is a co-integration. In general, the results of the Pedroni co-integration test for Model-1 indicate that there is a co-integration between the relevant variables for DC.

In the Model-2 Pedroni co-integration test for DC, the H_0 hypothesis, which states that there is no co-integration between the series in the model with constant, is rejected in Panel PP, Panel ADF, Group PP and Group ADF tests. The alternative hypothesis H_1 indicating that there is a co-integration between the series is accepted. Test results are significant at 1% level. As for the model with constant and trend, the H_0 hypothesis is rejected in Panel PP, Panel ADF, Group PP and Group ADF tests and the alternative hypothesis is accepted instead. Relevant test statistics are also significant at 1% level. When Pedroni co-integration test results are reviewed as a whole for Model-2, it is recognizable that there is a co-integration between the relevant variables of DC.

Following Model-1 and Model-2 Kao co-integration tests for DC, the H_0 hypothesis, which states that there is no co-integration between the series is rejected, the alternative H_1 hypothesis indicating that there is a co-integration between the series is accepted. In other words, high-tech exports, R&D expenditures, the number of researchers, gross fixed capital investments and foreign direct investment inflows in DC move together in the long-run and the analysis shows that there is a co-integration between these variables. Thus, a significant relationship between high-tech exports, R&D expenditures, and the number of researchers, gross fixed capital investments, and foreign direct investment inflows variables is observed in the long-run in both models.

Co-integration test results for LDC are presented in Table 3.8.

In Model-1 Pedroni co-integration test for LDC, Group PP statistics and Group ADF statistics are significant at 1% and 10% levels respectively in the model with constant and

Table 3.8 Results of Panel Co-integration Tests for Developing Countries

	Model-1		Model-2	
Pedroni statistic	Constant	Constant and trend	Constant	Constant and trend
Panel v-stat	0.09 (0.46)	−0.17 (0.56)	0.27 (0.39)	1.98 (0.02)**
Panel rho-stat	1.25 (0.8)	2.66 (0.99)	1.38 (0.91)	2.49 (0.99)
Panel pp-stat	−0.82 (0.20)	−0.49 (0.30)	0.20 (0.58)	−0.85 (0.19)
Panel adf-stat	−0.66 (0.25)	−0.46 (0.32)	−0.59 (0.27)	−1.71 (0.04)**
Group r-stat	2.30 (0.98)	3.33 (0.99)	2.57 (0.99)	3.428 (0.99)
Group pp-stat	−0.60 (0.27)	−2.56 (0.00)***	0.44 (0.67)	−2.29 (0.01)***
Group adf-stat	−0.24 (0.40)	−1.47 (0.07)*	−0.73 (0.23)	−2.56 (0.00)***
Kao ADF statistic	−4.81 (0.00) ***	–	−3.10 (0.00)***	–

Notes: ***, **, * indicate a rejection of the null hypothesis of no co-integration at 1%, 5%, and 10% levels respectively. Figures in parentheses indicate the probability value. Newey-West Bandwidth selection using the Bartlett Kernel was used for the Pedroni and Kao co-integration test

trend. Based on the relevant test results, the H_0 hypothesis is rejected and the alternative hypothesis H_1 indicating that there is a co-integration between the series is accepted. With a general evaluation of Pedroni co-integration test results for Model-1, it can be observed that there is no clear co-integration relationship between variables.

In Model-2 Pedroni co-integration test for LDC, Panel v and Panel ADF statistics are significant at 5% level; Group PP and Group ADF statistics are significant at 1% level in models with constant and trend. Based on relevant test results, the H_0 hypothesis, which states that there is no co-integration between the series is rejected and the alternative hypothesis H_1 indicating that there is a co-integration between the series is accepted. When generally evaluated, Pedroni co-integration test results for Model-2 indicate a co-integration relationship between variables.

According to Model-1 and Model-2 Kao co-integration tests for LDC, the H_0 hypothesis, which states that there is no co-integration between the series, is rejected; the alternative hypothesis H_1 indicating that there is a co-integration between the series is accepted. There is a co-movement of high-tech exports, R&D expenditures, the number of researchers, gross fixed capital investments and foreign direct investment inflows in LDC in the long-run and the analysis shows that there is a co-integration between the variables. From this point forth, it can be stated that there is a significant relationship between high-tech exports, R&D expenditures, and the number of researchers, gross fixed capital investments and foreign direct investment inflows variables in the long-run in both models.

When Pedroni and Kao co-integration tests are reviewed together, a long-term relationship between high-tech exports, R&D expenditures, and the number of researchers, gross fixed capital investments and foreign direct investment inflows was observed in both models for the samples of DC and LDC in general.

3.4.3 Panel Co-integration Parameters Estimation

The FMOLS (Full Modified Ordinary Least Square) method developed by Pedroni (2000; 2001) is used to predict the long-run relationship coefficients after the co-integration tests.

Table 3.9 shows the estimated FMOLS results for DC. According to the FMOLS estimation results, the sign of the coefficient of R&D expenditures (LnR&D) variable is positive as expected and it is statistically significant at 1% level, i.e. in the long-run, an increase in R&D expenditures affects high-tech exports in a positive way across the panel. The signs of gross fixed capital investments (LnGFC) and foreign direct investment inflows (LnFDI) variables are also positive as expected and they are statistically significant at 1% level. The elasticity of R&D expenditures variable is estimated to be 0.46 across the panel. Thus, a 1% increase in R&D expenditures in 16 DC leads to a 0.46% increase in high-tech exports in the long-run. The elasticity of gross fixed capital investments (LnGFC) variable is estimated to be 0.41 across the panel. Thus, a 1% increase in fixed capital investments in 16 DC leads to a 0.41% increase in high-tech exports in the long-run. Similarly, the elasticity of foreign direct investment inflows (LnFDI) variable is calculated as 0.23. Thus, a 1% increase in foreign direct investment inflows in DC leads to a 0.23% increase in high-tech exports in the long-run.

According to the results of the Model-2 FMOLS estimation, the signs of the coefficients of LnRP, LnGFC, and LnFDI variables are positive as expected, and they are statistically significant at 1% level. Elasticity of the number of researchers (LnRP) variable is estimated to be 0.65 across the panel. Thus, a 1% increase in the number of researchers in DC leads to a 0.65% increase in high-tech exports in the long-run. The elasticity of fixed capital investments (LnGFC), and foreign direct investment inflows (LnFDI) variables are estimated to be 0.48 and 0.32 respectively. Thus, across the panel, a 1% increase in fixed capital investments and foreign direct investment inflows leads to a 0.48% and a 0.32% increase in high-tech exports respectively.

When the Panel FMOLS estimation results regarding the impact of R&D expenditures (LnR&D) on high-tech exports (LnHTEX) presented in Table 3.9 within the framework of Model-1 for DC are evaluated on the basis of each country, it is recognizable that the coefficient of the relevant variable is positive in the Czech Republic, Denmark, Ireland, Japan, S. Korea, Latvia, the Netherlands, Slovakia, Slovenia, and the USA and it is statistically significant; i.e. R&D expenditures increase high-tech exports in these countries. The highest increases are in the following countries: Japan (1.40%), Latvia (1.25%), the Netherlands (1.06%), and the USA (1.03%). In the relevant model, the sign of the coefficient showing the impact of fixed capital investments (LnGFC) on high-tech exports (LnHTEX) is also positive and significant in all DC except Latvia, Spain, and the USA. The relevant coefficient is bigger particularly in the Netherlands (1.07), the Czech Republic (0.65), and Germany (0.64). The coefficient of foreign direct investment inflows (LnFDI) is positive and statistically significant in Austria, the Czech Republic, Germany, Ireland, South Korea, Slovakia, Slovenia, and England in the same model; i.e. an increase in foreign direct investment inflows (LnFDI) leads to an increase in high-tech exports in

Table 3.9 Results for Panel FMOLS Estimation of Developed Countries

Countries	Model-1			Model-2		
	$LnHTEX = B_0 + B_1 LnR\&D + B_2 LnGFC + B_3 LnFDI + ut$			$LnHTEX = B_0 + B_1 LnRP + B_2 LnGFC + B_3 LnFDI + ut$		
	LnR&D	LnGFC	LnFDI	LnRP	LnGFC	LnFDI
Austria	0.15 (0.57)	0.53 (0.01)**	0.30 (0.03)**	–	–	–
Czech Rep.	0.62 (0.00)***	0.65 (0.00)***	0.29 (0.00)***	0.59 (0.02)**	0.41 (0.04)**	0.44 (0.00)***
Denmark	0.63 (0.00)***	0.62 (0.00)***	−0.01 (0.72)	0.75 (0.00)***	0.47 (0.00)***	0.05 (0.22)
Finland	−0.49 (0.29)	0.58 (0.04)**	0.29 (0.14)	1.95 (0.08)*	1.50 (0.00)***	−0.53 (0.10)
France	0.16 (0.12)	0.53 (0.00)***	0.09 (0.11)	0.25 (0.15)	0.53 (0.00)***	0.08 (0.16)
Germany	0.02 (0.90)	0.64 (0.00)***	0.52 (0.00)***	−0.15 (0.54)	0.64 (0.00)***	0.57 (0.00)***
Ireland	0.14 (0.02)**	0.19 (0.00)***	0.30 (0.00)***	0.37 (0.00)***	0.19 (0.00)***	0.27 (0.00)***
Japan	1.40 (0.00)***	0.58 (0.00)***	−0.11 (0.05)*	2.70 (0.00)***	0.61 (0.01)**	0.20 (0.00)***
South Korea	0.71 (0.00)***	0.37 (0.06)*	0.16 (0.05)*	0.91 (0.00)***	0.39 (0.08)*	0.16 (0.12)
Latvia	1.25 (0.04)**	−0.48 (0.23)	0.70 (0.10)	−1.33 (0.13)	−0.20 (0.57)	1.55 (0.00)***
The Netherlands	1.06 (0.00)***	1.07 (0.00)***	−0.01 (0.74)	1.42 (0.00)***	1.15 (0.00)***	0.10 (0.02)**
Slovakia	0.39 (0.00)***	0.68 (0.00)***	0.45 (0.00)***	1.24 (0.00)***	0.52 (0.00)***	0.44 (0.00)***
Slovenia	0.34 (0.01)***	0.46 (0.00)***	0.34 (0.00)***	0.32 (0.00)***	0.25 (0.02)**	0.50 (0.00)***
Spain	0.21 (0.37)	0.10 (0.34)	0.21 (0.16)	−0.46 (0.18)	0.18 (0.10)	0.48 (0.00)***
England	−0.32 (0.37)	0.28 (0.00)***	0.22 (0.05)*	−0.37 (0.09)*	0.30 (0.00)***	0.25 (0.00)***
USA	1.03 (0.00)***	−0.16 (0.62)	0.03 (0.85)	1.58 (0.04)**	0.21 (0.62)	0.24 (0.38)
PANEL	**0.46 (0.00)*** **	**0.41 (0.00)*** **	**0.23 (0.00)*** **	**0.65 (0.00)*** **	**0.48 (0.00)*** **	**0.32 (0.00)*** **

Notes: Since the data on the number of researchers in Austria is missing, Model-2 were estimated for 15 countries. Values in parentheses are p-values. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels respectively these countries. The relevant coefficient is bigger especially in Germany (0.52) and Slovakia (0.45).

The evaluation of the Panel FMOLS estimation results regarding the impact of the number of researchers (LnRP) on high-tech exports (LnHTEX) presented in Table 3.9 within the framework of Model-2 for DC on the basis of each country indicates that the coefficient of the relevant variable is positive in the Czech Republic, Denmark, Finland, Ireland, Japan, S. Korea, the Netherlands, Slovakia, Slovenia, and the USA and it is statistically significant. As the number of researchers increases, high-tech exports rise in these countries. The highest increases are in the following countries: Japan (2.70%), Latvia (1.95%), the USA (1.58%) and the Netherlands (1.42%). In the relevant model, the coefficient showing the impact of fixed capital investments (LnGFC) on high-tech exports (LnHTEX) is positive and significant in all DC except Latvia, Spain, and the USA, and particularly bigger in Finland (1.50) and the Netherlands (1.15). The coefficient of foreign direct investment inflows (LnFDI) is also positive and statistically significant in the Czech Republic, Germany, Ireland, Japan, Latvia, the Netherlands, Slovakia, Slovenia, Spain and England in the same model. Countries with the biggest coefficient are Latvia (1.55) and Germany (0.57).

Table 3.10 shows the estimated FMOLS results for LDC. According to the Model-1 FMOLS estimation results, the coefficient sign of the R&D expenditures (LnR&D) variable is positive as expected and it is statistically significant at 1% level. Thus, in the long-run, an increase in R&D expenditures affects high-tech exports in a positive way across the panel. The sign of the coefficient of gross fixed capital investments (LnGFC) is also positive as expected and it is statistically significant at 1% level. The coefficient sign of foreign direct investment inflows (LnFDI) variable is negative and it is statistically insignificant. The elasticity of R&D expenditures (LnR&D) variable is estimated to be 0.94 across the panel. Thus, a 1% increase in R&D expenditures in 10 LDC leads to a 0.94% increase in high-tech exports in the long-run. The elasticity of the gross fixed capital investments (LnGFC) variable is estimated to be 0.46 across the panel. Thus, a 1% increase in fixed capital investments in 10 LDC leads to a 0.46% increase in high-tech exports in the long-run.

According to the results of the Model-2 FMOLS estimation, the sign of the coefficients of LnRP, LnGFC, and LnFDI variables are positive as expected and statistically significant at 1% level. The elasticity of the number of researchers (LnRP) variable is estimated to be 0.65 across the panel, i.e. a 1% increase in the number of researchers in LDC leads to a 0.65% increase in high-tech exports in the long-run. The elasticity of the fixed capital investments (LnGFC), and foreign direct investment inflows (LnFDI) variables are estimated to be 0.51 and 0.23 respectively. Thus, across the panel, a 1% increase in fixed capital investments and foreign direct investment inflows leads to a 0.51% and a 0.23% increase in high-tech exports respectively.

Table 3.10 Results for Panel FMOLS Estimation of Developing Countries

Countries	Model-1			Model-2		
	LnHTEX = B_0+ B_1LnR&D + B_2LnGFC + B_3LnFDI + ut			LnHTEX = B_0 + B_1LnRP + B_2LnGFC + B_3LnFDI+ut		
	LnR&D	LnGFC	LnFDI	LnRP	LnGFC	LnFDI
Bulgaria	1.81 (0.01)***	1.17 (0.10)	–0.70 (0.23)	2.58 (0.00)***	–0.08 (0.81)	0.47 (0.04)**
China	0.99 (0.00)***	1.00 (0.02)**	–1.47 (0.00)***	1.47 (0.00)***	0.76 (0.10)	–0.13 (0.81)
Hungary	0.31 (0.22)	0.11 (0.71)	0.77 (0.02)**	1.22 (0.00)**	0.53 (0.11)	0.39 (0.17)
India	0.78 (0.06)*	0.69 (0.00)***	0.04 (0.77)	–	–	–
Lithuania	2.51 (0.00)***	0.64 (0.00)***	–0.98 (0.00)***	0.80 (0.44)	0.71 (0.12)	0.38 (0.16)
Mexico	0.52 (0.00)***	0.70 (0.00)***	–0.11 (0.25)	0.01 (0.96)	0.98 (0.00)***	0.03 (0.84)
Poland	–0.08 (0.61)	0.47 (0.02)**	0.79 (0.00)***	1.20 (0.32)	0.45 (0.00)***	0.72 (0.00)**
Romania	1.30 (0.00)***	–0.41 (0.31)	0.61 (0.00)***	–0.89 (0.29)	0.89 (0.02)**	0.20 (0.45)
Russia	0.68 (0.14)	0.27 (0.08)*	–0.03 (0.77)	–2.11 (0.09)*	0.43 (0.00)***	–0.03 (0.75)
Turkey	0.58 (0.12)	–0.03 (0.88)	0.46 (0.10)	1.57 (0.10)	–0.05 (0.83)	0.10 (0.73)
PANEL	**0.94 (0.00)*****	**0.46 (0.00)*****	**–0.06 (0.40)**	**0.65 (0.00)****	**0.51 (0.00)*****	**0.23 (0.00)*****

Notes: Since the data on the number of researchers in India is missing, Model-2 were estimated for 9 countries. Values in parentheses are p-values. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels respectively

The evaluation of the Panel FMOLS estimation results regarding the impact of R&D expenditures (LnR&D) on high-tech exports (LnHTEX) presented in Table 3.10 within the framework of Model-1 for LDC on the basis of each country indicates that the coefficient of the relevant variable is positive in Bulgaria, China, Hungary, India, Lithuania, Mexico, Russia, and Turkey as expected. However, the coefficient is not statistically significant in Hungary, Poland, Russia, and Turkey. R&D expenditures increase high-tech exports in Bulgaria, China, India, Lithuania, Mexico, and Romania. Countries with the highest rate of increase are Lithuania (2.51%), Bulgaria (1.81%), Romania (1.30%), and China (0.99%). In the relevant model, the coefficient showing the impact of fixed capital investments (LnGFC) on high-tech exports (LnHTEX) has a positive sign and is statistically significant in China, India, Lithuania, Mexico, Poland, and Russia. An increase in fixed capital investments in these countries contributes to the increase in high-tech exports. Countries with the highest effect are China (1%), Mexico (0.70%), and India (0.69%) respectively. For the same model, the impact of foreign direct investment inflows (LnFDI) on high-tech exports (LnHTEX) is statistically significant in China, Hungary, Lithuania, Poland, and Romania. However, the sign of this coefficient is found to be negative in China and Lithuania. FDI inflows to these countries reduce rather than increase the export of high-tech commodities.

When the Panel FMOLS estimation results regarding the impact of the number of researchers (LnRP) on high-tech exports presented in Table 3.10 within the framework of Model-2 for LDC is evaluated on a country basis, it is seen that the coefficient of the relevant variable is positive and statistically significant in Bulgaria, China, Hungary as expected; i.e. the increase in the number of researchers increases high-tech exports in these countries. The countries with the highest rate of increase are Bulgaria (2.58%), China (1.47%), and Hungary (1.22%). In the relevant model, the sign of the coefficient showing the impact of fixed capital investments (LnGFC) on high-tech exports (LnHTEX) is also positive and significant in Mexico, Poland, Romania, and Russia. An increase in fixed capital investments in these countries contributes to the increase in high-tech exports. Countries with the highest effect are Mexico and Romania with 0.98%, and 0.89% respectively. The impact of foreign direct investment inflows on high-tech exports is not statistically significant in countries other than Bulgaria and Poland in the same model.

3.4.4 Panel VECM Estimation

Co-integration analyses, according to Model-1 and Model-2, show that there is a co-integrated relationship between high-tech exports (LnHTEX), R&D expenditure (LnR&D), the number of researchers (LnRP), gross fixed capital investments (LnGFC), and foreign direct investment inflows (LnFDI). The Panel Vector Error Correction Model (VECM) is used to differentiate long-run balance and short-run dynamics between the co-integrated series and to determine short-run dynamics. Panel VECM for Model-1 and Model-2 is illustrated by Eqs. 3.3 and 3.4.

$$\begin{aligned}\Delta \mathrm{LnHTEX}_{it} &= \alpha_{1i} + \sum_{p=1}^{k} \alpha_{11ip} \Delta \mathrm{LnHTEX}_{it-p} + \sum_{p=1}^{k} \alpha_{12ip} \Delta \mathrm{LnR\&D}_{it-p} \\ &\quad + \sum_{p=1}^{k} \alpha_{13ip} \Delta \mathrm{LnGFC}_{it\_p} + \sum_{p=1}^{k} \alpha_{14ip} \Delta \mathrm{LnFDI}_{it\_p} + \varphi_{1i} \mathrm{e}_{it-1} + \upsilon_{1it}\end{aligned} \tag{3.3}$$

$$\begin{aligned}\Delta \mathrm{LnHTEX}_{it} &= \alpha_{2i} + \sum_{p=1}^{k} \alpha_{21ip} \Delta \mathrm{LnHTEX}_{it-p} + \sum_{p=1}^{k} \alpha_{22ip} \Delta \mathrm{LnRP}_{it-p} \\ &\quad + \sum_{p=1}^{k} \alpha_{23ip} \Delta \mathrm{LnGFC}_{it\_p} + \sum_{p=1}^{k} \alpha_{24ip} \Delta \mathrm{LnFDI}_{it\_p} + \varphi_{2i} \mathrm{e}_{it-1} + \upsilon_{2it}\end{aligned} \tag{3.4}$$

Panel VECM for Model-1 and Model-2 is illustrated by Eqs. 3.3 and 3.4, where k stands for optimal lag length and e_{it-1} stands for one-period lagged residual term obtained from panel FMOLS. Moving forward from this point, it is possible to investigate both short and long-run causality relationships within the framework of the panel VECM. In accordance with this purpose, the VAR model is first estimated by stationary values of variables and then the optimal lag length is determined. Panel VECM is estimated within the framework of pre-determined optimal lag length.

Error correction terms of Model-1 and Model-2, ECT1 (−1) and ECT2 (−1), were estimated to be −0.69 and −0.67 respectively as shown in Table 3.11 in which the Panel VECM results for DC are presented. The fact that these coefficients have negative signs

Table 3.11 Panel VECM Estimation Results for Developed Countries

Model-1		Model-2	
	ΔLNHTEX		ΔLNHTEX
ΔLnHTEX(−1)	0.36 [4.69]***	ΔLnHTEX(−1)	0.37 [4.72]***
ΔLnR&D(−1)	−0.14 [−1.40]*	ΔLnRP(−1)	−0.01 [−0.13]
ΔLnGFC(−1)	−0.19 [−2.83]***	ΔLnGFC(−1)	−0.18 [−2.75]***
ΔLnFDI(−1)	0.20 [4.62]***	ΔLnFDI(−1)	0.19 [4.37]***
C	0.03 [3.25]***	C	0.02 [2.17]**
ECT1(−1)	−0.69 [−7.57]***	ECT2(−1)	−0.67 [−7.55]***
R^2 Adjusted R^2 F Statistic	0.29 0.28 19.96***	R^2 Adjusted R^2 F Statistic	0.30 0.28 19.00***

Notes: Optimal lag length was determined to be 1 by using the *Schwarz Information Criterion* for both models. The values in brackets show the calculated t-statistics. According to the Normal Distribution Table, 1%, 5%, and 10% t table values are 2.32, 1.64, and 1.28 respectively. ***, **, * indicate significance at 1%, 5%, 10% levels respectively

Table 3.12 Wald F statistics from Panel VECM for Developed Countries

Model-1		Model-2	
Dependent Variable: ΔLnHTEX		Dependent Variable: ΔLnHTEX	
Restricted Variable:	Chi-square	Restricted Variable:	Chi-square
ΔLnR&D	1.962 (0.16)	ΔLnRP	0.019 (0.89)
ΔLnGFC	8.030 (0.00)***	ΔLnGFC	7.602 (0.00)***
ΔLnFDI	21.345 (0.00)***	ΔLnFDI	19.141 (0.00)***

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. The values in parentheses are probability values. The optimal lag length was determined by using the *Schwarz Information Criterion* for both models

and are statistically significant show that the vector error correction mechanism works and there is a causality relationship from LnR&D, LnGFC and LnFDI to LnHTEX; from LnRP, LnGFC and LnFDI to LnHTEX in the long-run.

The value of the error correction coefficients refers to how much of the imbalance which occurred in the short-run, is eliminated in the next term (Tarı 2005, p. 417). In this context, the findings of the analysis show that in subsequent terms, 69% of the short-run imbalance is eliminated for Model-1; and 67% of the short-run imbalance is eliminated for Model-2. In other words, for Model-1 and Model-2, deviations occurring between the short-run series in DC will converge to a long-run balance, approximately after 1.5 terms.

With reference to the panel VECM estimation results in Table 3.11, the Wald test is performed by placing restrictions on ΔLnR&D (−1), ΔLnGFC (−1) and ΔLnFDI (−1) for Model-1; and ΔLnRP (−1), ΔLnGFC (−1), and ΔLnFDI (−1) for Model-2. The Wald test results, which are performed to test short-run causality relationships between the variables are presented in Table 3.12 for Model-1 and Model-2.

According to Table 3.12, while no short-run causality relationship from R&D expenditures (LnR&D) to high-tech exports (LnHTEX) in DC for Model-1 is detected, it is found that there is a 1% significance level short-run causality from each of the fixed capital investments (LnGFC) and foreign direct investment inflows (LnFDI) variables to high-tech exports (LnHTEX).

In terms of the results of the short-run causality analysis for Model-2, while no short-run causality relationship from the number of researchers (LnRP) to high-tech exports (LnHTEX) in DC is detected, it is found that there is a 1% significance level short-run causality from each of the fixed capital investments (LnGFC) and foreign direct investment inflows (LnFDI) to high-tech exports (LnHTEX).

The Panel VECM estimation results calculated for LDC are presented in Table 3.13. Error correction coefficients ECT1 (−1) and ECT2 (−1) for Model-1 and Model-2 were estimated as −0.24 and −0.19 respectively. The fact that these coefficients are negative and statistically significant shows that the vector error correction mechanism works and there is a causality relationship from LnR&D, LnGFC, and LnFDI to LnHTEX; from LnRP, LnGFC, and LnFDI to LnHTEX in the long-run. The findings regarding the error

Table 3.13 Panel VECM Estimation Results for Developing Countries

Model-1		Model-2	
	ΔLNHTEX		ΔLNHTEX
ΔLnHTEX(−1)	0.36 [4.00]***	ΔLnHTEX(−1)	0.37 [3.88]***
ΔLnR&D(−1)	0.10 [0.75]	ΔLnRP(−1)	0.12 [0.83]
ΔLnGFC(−1)	−0.23 [−2.86]***	ΔLnGFC(−1)	−0.25 [−3.10]***
ΔLnFDI(−1)	0.25 [4.45]***	ΔLnFDI(−1)	0.25 [4.27]***
C	0.04 [2.10]***	C	0.05 [2.40]***
ECT1(−1)	−0.24 [−2.79]***	ECT2(−1)	−0.19 [−2.07]**
R^2	0.20	R^2	0.20
Adjusted R^2	0.18	Adjusted R^2	0.17
F Statistic	7.63***	F Statistic	6.71***

Notes: The optimal lag length was determined to be 1 by using the *Schwarz Information Criterion* for both models. The values in brackets show the calculated t-statistics. According to the Normal Distribution Table, 1%, 5% and 10% t table values are 2.32, 1.64, and 1.28 respectively. ***, **, * indicate significance at 1%, 5%, 10% level respectively

correction coefficients, which show how much of the imbalance occurring in the current term is eliminated in the subsequent term state that 24% of the imbalance for Model-1 and 19% of the imbalance for Model-2 is eliminated in the subsequent term. In other words, deviations between the short-run series in LDC will converge to a long-run balance after approximately 4 terms for Model-1 and 5 terms for Model-2.

With reference to the panel VECM estimation results in Table 3.13, the Wald test is performed by placing restrictions on ΔLnR&D (−1), ΔLnGFC (−1) and ΔLnFDI (−1) for Model-1; and ΔLnRP (−1), ΔLnGFC (−1) and ΔLnFDI (−1) for Model-2. The Wald test results, which are performed to test short-run causality relationships between the variables are presented in Table 3.14 for Model-1, and Model-2.

According to Table 3.14, while no short-run causality relationship from R&D expenditures (LnR&D) to high-tech exports (LnHTEX) in LDC for Model-1 is detected, it is found that there is a short-run causality from each of the fixed capital investments (LnGFC) and

Table 3.14 Wald F statistics from Panel VECM for Developing Countries

Model-1		Model-2	
Dependent Variable: ΔLnHTEX		Dependent Variable: ΔLnHTEX	
Restricted Variable:	Chi-square	Restricted Variable:	Chi-square
ΔLnR&D	0.567 (0.45)	ΔLnRP	0.699 (0.40)
ΔLnGFC	8.185 (0.00)***	ΔLnGFC	9.636 (0.00)***
ΔLnFDI	19.860 (0.00)***	ΔLnFDI	18.248 (0.00)***

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. The values in parentheses are probability values. The optimal lag length was determined by using the *Schwarz Information Criterion* for both models foreign direct investment inflows (LnFDI) variables to high-tech exports (LnHTEX) at 1% significance level.

According to the findings of the Model-2 short-run causality analysis, while no short-run causality relationship from the number of researchers (LnRP) to high-tech exports (LnHTEX) in LDC is detected, it is found that there is a 1% significance level short-run causality relationship from each of the fixed capital investments (LnGFC) and foreign direct investment inflows (LnFDI) variables to high-tech exports (LnHTEX).

3.4.5 Discussion and Implications

In this part of the study, the panel co-integration and panel VECM estimation results of the models, which were developed to investigate the impact of R&D expenditure, the number of researchers, fixed capital investments, and FDI inflows on high-tech exports will be interpreted in terms of the theoretical background of international economics.

In order to explain the exports of high and medium high-tech manufacturing industries, R&D expenditures and the number of researchers that were used in two models in addition to fixed capital investments and FDI inflows as explanatory variables. It is found that relevant variables influence exports of high and medium high-tech goods in a way, which is compatible with previously conducted empirical analysis (Montobbio 2003; Sanyal 2004; Seyoum 2005; Alemu 2013) and theoretical expectations in countries with different levels of development. In developed countries, R&D expenditures and the number of researchers are the two most important variables affecting high-tech exports; the impacts of fixed capital investments and FDI inflows, however, they are relatively low compared to R&D expenditures and the number of researchers.

In LDC, similarly to DC, the impact of R&D expenditures and the number of researchers on high-tech exports is greater than that of fixed capital investments and FDI inflows. However, it is noteworthy that the impact of R&D expenditures on high-tech exports in LDC is nearly twice as high as in DC. This finding is quite important for LDC, as there is a significant technological gap between them and DC. Since the sensitivity of high-tech exports to R&D expenditures in LDC is greater than other variables and higher compared to DC, it seems possible for LDC to increase exports of high value-added and high-tech goods by allocating more resources from national income to R&D expenditure and investing more to increase highly qualified human capital which is necessary for R&D activities and thus, it is possible to reduce or close the technological gap between LDC and DC.

Evaluating empirical findings on a country basis indicates that there is a positive and significant relationship between both R&D expenditures, the number of researchers, and high-tech exports for more than half of the DC and LDC; also the improvements in these indicators let the high-tech exports increase. The result is consists of our theoretical expectations and it is possible to interpret it in the following way: Technological development dynamics, such as R&D expenditures and the number of researchers are two basic tools, not only to develop new technologies, but also to gain experience and expertise for the utilization, adaptation and modification of imported technology for countries which are in the process of acquiring technological skills. In this sense, it is crucial for both DC which have a leading role in terms of technological development indicators and LDC which are far behind DC in terms of technology level to allocate a significant amount of their budget to make regulations with the aim of increasing the quality of labor to be employed in R&D activities, and to take innovation incentive measures in order to increase the export performance of the high-tech industry.

Reviewing empirical findings regarding fixed capital investments on a country basis, it is concluded that there is a positive and significant relationship between the relevant variable and high-tech exports and improvements in this area increase high-tech exports in most of the countries classified as DC and LDC. As it is consistent with theoretical expectations, this result can be interpreted in the following terms: physical investments in buildings, roads and machinery equipment support technological development and dissemination of technological innovation embodied in machinery equipment in form of production methods among companies and sectors contributes to increases in high-tech exports.

When findings regarding FDI inflows are reviewed on a country basis, it is seen that while the relationship between the relevant variable and high-tech exports is positive in most of the DC, this relationship is negative in most of the LDC. FDI inflows contribute to technological developments both by increasing the physical capital stock and enabling countries to transfer new production methods and organizational forms.

Attracting new technologies to the country or the activities of foreign firms aimed at developing the technological level of the host country particularly support the technological capabilities of the countries concerned. The inverse relationship found between FDI inflows and high-tech exports in LDC implies that the FDI inflows toward these countries aim to make use of the advantages like low labor costs, the large domestic market or natural resources. In this context, it can be stated that MNCs operating in LDC engage in production processes requiring low quality/paid labor rather than high technology production and that FDI inflows to these countries reduce rather than increase high-tech exports. The insufficient regulations for the protection of intellectual property rights in LDC discourage FDI for high-tech industries and direct them to labor-intensive industries. High-tech export in China is not a result of intensive R&D expenditures and technological developments. Advanced technology products predominantly contain imported components and consist of assembled high-tech (Xing 2012, p. 4–9; Srholec 2005, p. 24).

The findings of the analysis in the case of Turkey do not indicate that technological development indicators have an impact on high-tech exports. A statistically insignificant relationship between R&D expenditures, the number of researchers and high technology exports in countries like Turkey with weak technological development dynamics and high-tech exports was the expected result. Indeed, Lall (2000b, p. 25) has also emphasized the necessity for Turkey, which has a weak outlook in terms of high-tech exports, to transform its production and export composition to technology-intensive products by increasing technological capability. As a result of the developments in technology intensive industries, an increase will also be achieved in the productivity of low technology industries with the spread of new technologies and an increase in technological capabilities at the country level.

The VECM results investigating short-run dynamics show that short-run imbalances are eliminated in the long-run. While short-run imbalances in DC are eliminated in 1.5 terms, the convergence of long-run equilibrium in LDC requires more time; it may take up to 5 terms. This finding is compatible with empirical literature (Amendola et al. 1993) which emphasizes delayed (4 years) effects of technological development on exports.

There is a short-run causality from fixed capital investments and FDI inflows to high-tech exports. However, no short-run causality is found between R&D expenditures, the number of researchers and high-tech exports. Outcomes of the policies aiming to improve technological development indicators and hence increase high-tech exports, are not seen in the short-run. Therefore, keeping the findings of the long-run analysis in mind, stable and strategic long-run policies of science, technology, and innovation rather than short-run and unstable approaches need to be implemented in order to improve technological development indicators.

Conclusion

Technological developments shape global competition; countries producing technology and using it effectively in economic activities have a developed economy. When the commodity composition of international trade is examined, it is seen that the share of products or production processes with technological content in total world trade is gradually increasing; increased high value-added products and monopolistic advantages obtained from products or production processes with complex technological content make this process more attractive than ever. The reflection of technology on the production process usually takes the form of an output and/or by-product of R&D activities. The fact that the countries with competitive power in high-tech goods are also the countries allocating a significant amount of their budget to scientific research proves that there is a direct relationship between competitiveness and export capability on the one hand and technological development and R&D on the other.

Using the data of countries with different development levels, the impact of R&D expenditures and the number of researchers on the exports of high and medium high-tech manufacturing industry is analyzed using the panel data method in this study. Domestic physical capital stock and FDI inflows are also used to explain high-tech exports. Stationarity characteristics of the variables were investigated by using panel unit root tests, and the long-run relationship between variables was tested by using panel co-integration tests.

Since the results of the co-integration test present a long-run equilibrium relationship between the relevant variables for both models tested, co-integration coefficients were investigated by using the Pedroni FMOLS estimator. The Panel FMOLS estimation results show that across the panel, R&D expenditures and the number of researchers are the most important determinants of high-tech exports in both DC and LDC. In addition, the estimation results revealed that the elasticity of HTEX to R&D of technological development indicators is higher in LDC than in DC. While no short-run causality is found from R&D and RP to HTEX, short-run causality is detected from GFC and FDI to HTEX in the panel VECM estimation. Furthermore, the fact that the error correction coefficient was found to be significant and negative for both models proves that the error correction mechanism works and that short-run imbalances are corrected in the long-run.

In the light of the empirical findings, in order for those LDC which are far behind DC in terms of technology to achieve a sustainable increase in high value-added exports, it seems worthwhile recommending to design/adapt, and implement policies that will transform production and export formation from low-tech to high-tech industrial goods by supporting scientific and technological infrastructure and R&D institutions. As terms of trade tend to change for high-tech goods and against low-tech ones, technological development performance is fundamental, not only for foreign trade volume, but also for national welfare gains obtained through improvements in terms of trade. Thus, LDC should give strategic priority to technological developments and their sources in order to increase national prosperity thanks to convergence, providing structural solutions for the current deficit problem and advantages arising from domestic value-added and improvements in terms of trade. In this context, it is necessary to develop policies and mechanisms towards allocating more funds from national income for R&D, making educational regulations to train highly qualified labor (human capital) required by the R&D sector, taking initiative to protect property rights to encourage innovative activities, implementing incentive policies to attract FDI inflows producing technology-intensive goods, increasing investments in physical infrastructure which is significant in terms of supporting scientific and technological infrastructure and R&D institutions of a country, as well as increasing the share of the private sector in R&D activities by providing coordination and information by sharing between the public and the private sector.

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Part II

Innovation

Business and Innovation

4

Kürşat Timuroğlu, Ersin Karaman, and Mustafa Keskinkılıç

Contents

4.1 Business

Satisfaction of human beings' needs is the basis of economic facilities and business concepts. As a result, people should work hard and be engaged in economic facilities to meet their unlimited needs. It is important to note that needs are the main reason that make people work on their own or as a group. In this context, business is an economic and a technical term that both gather up factors of production in a conscious, planned and systematic way to produce goods and services and take economic and logical decisions about the combination and use of facilities and resources.

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*,
FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_4

According to the definition, business has some key components:

- Business is a social cooperation system.
- Business is an economic unit.
- Business aims to produce goods and services to meet needs.
- Business is a technical unit.

4.1.1 Objectives of Business

Businesses want to realize many objectives. These objectives can be classified into two groups – general objectives and specific objectives. General objectives include long term profit, expansion, community service, fulfilling social responsibilities and sustainability of business. The main aim of businesses is to drive profit. This means achieving other objectives depends on fulfilling the main objective. If an organization makes losses instead of profit, it is impossible to perform community service or survive long-term.

Considering businesses as living organisms, growth of enterprises is an expected situation. The growth objective expresses the importance of progress for sustainability of businesses' assets. Increasing market share, meeting the needs of a growing population, adapting the production of goods and services to changing customers' preferences, and utilizing state-of-the-art technological tools are the main reasons that force businesses to achieve growth objectives.

Another general objective of businesses is community service. Enterprises have to look out for the expectations and wishes of society since it is the target for the goods and services they provide. In terms of social responsibility, customer protection and increasing employment should be given prominence. In other words, decreasing the rate of unemployment and contributing to the economic environment are the main benefits of businesses to society.

One of the important objectives of businesses is to survive. Although businesses make profits in a short-term perspective, a lack of continuity and sustainability make it impossible to achieve higher objectives in a long-term vision. In addition to those general objectives, companies try to gain specific objectives, such as providing high quality goods and services, improving working conditions, providing continuous employment of workers by seeking new opportunities.

4.1.2 Business Functions

In order to continue activities, businesses have to conduct certain functions. These are: management, production, marketing, finance, human resource management, accounting, public relations and research & development.

4.1.2.1 Management Function

This is one of the most important business functions. Briefly defined, management is the capability of doing business in cooperation with other people or employees. This is also considered to be an art and a profession. It has various properties and definitions. For example, management is the method of employing staff to achieve business objectives by utilizing the existing resources effectively and efficiently. However, the management term went through a change after the industrial revolution and it has been a broader discourse over the time. Management and managers have various tasks including planning, organizing, staffing, coordination and control. In addition to these responsibilities, creating policy, resource allocation, personnel management, encouragement, motivation, budget and financial affairs, customer relations, decision making and leadership are some of the tasks that managers should take into account.

4.1.2.2 Manufacturing Function

Manufacturing is the process of producing goods and services in a suitable environment by putting together manufacturing factors composed of raw material, capital, labor and entrepreneurial ideas to meet people's needs. Businesses sustain their manufacturing activities under the effect of limitations caused by the characteristics of price, quality, time, goods and services and such limiting conditions such as the uncertainty of customer demands. Managers need to work effectively, efficiently, and rationally according to these limiting conditions with the resources they have. Manufacturing management is referred to as the decision-making about the process of using the current resources of the organization efficiently and producing the products in a demanded quantity and quality based on these resources. In manufacturing management, the objective is to use the resources in the most effective way, working efficiently by reducing losses and increasing the quality to a desired level.

4.1.2.3 Marketing Function

Marketing includes the entire flow from the manufacturing center of goods and services to the customers in the sale points. In other words, it is the function of satisfying customer demands and needs with the suitable quality of goods and services. The marketing function serves as the bridge between the customer and the business. While in business, the manufacturing function creates the benefit of form, marketing creates the benefit of place, property and time. Marketing starts with market research. The objective of the marketing function is to sell the right goods and services at the right time and place to the target customer group. Marketing, in a way, is a system enabling goods and services to flow from manufacturer to consumer. If this system is to be successful, after selling goods and services to the customer, market research should be done to measure whether customer needs have been met or not.

4.1.2.4 Finance Function

One of the main functions of business administration is the finance function. Organizations need some financial resources in order to manufacture goods and services. Providing the given financial resources in a way that can meet the organization's needs and that is suitable for the organization's objectives is the topic of finance function. In this framework, on the one hand the funds that the organization needs must be met out of the most appropriate resources and in the best time, on the other hand these funds should be used in the most efficient and profitable way. In this context, within the scope of the finance function, primarily the need for cash must be met and this cash should be used efficiently.

4.1.2.5 Human Resources Management

The aim in human resources management is staff management, managing labor forces in order to fulfill the individual and organizational tasks efficiently and quickly. In order to fulfill these aims, human resources planning comprises taking advantage of the employees efficiently, motivating them and increasing their efforts. As the number of departments increases, naturally the number and the scope of tasks does so, too. In order for businesses to reach their goals, the labor force must be used efficiently. Motivating the employees and securing their safety are other important issues to be taken into consideration. The listed activities are the main objectives of human resources management. In addition to these, human resources management includes recruiting employees, giving them orientation, identifying training and development policies and trying to solve the problems of staff.

4.1.2.6 Accounting Function

Businesses have changes in their assets in a particular period. These changes must be identified and recorded. Accounting is referred to as collecting documents, recording, summarizing and classifying the activities causing financial change in the assets of the organization. Accounting collects information about the way resources are used, increases and decreases in the resources, the creation of resources as a result of business activities in order to carry out analyses in a particular period of time. This information is presented as a report by being stored on the accounting management system. These reports are analyzed and evaluated and presented to the administration and the relevant departments. Accounting provides financial information on all the economic activities. All departments of an organization, particularly the finance department, make their decisions according to the information provided by the accounting department. So the accounting function helps managers to make decisions and provides the necessary information to the related staff.

4.1.2.7 Public Relations Function

Whether businesses can survive successfully depends on the relations they establish with their environment. Every organization wants to have positive results from the relations they plan to establish with their environment. Organizations that can provide support and trust can achieve particular goals more easily. This is why an organization has to know the culture, characteristics, needs, and traditions of society and it also has to introduce itself to society. The efforts carried out with regard to this objective comprises the public relation function of the organization. Public relations is ultimately a matter of communication. One party of this communication is the organization and the other is society. An organization gives constantly correct information to society and enlightens it, thus becoming trustable. In this way it can establish a positive image, understanding and sympathy for the organization.

4.1.2.8 Research and Development Function

Research and Development comprises all the systematic and creative studies aimed at finding new materials and production processes in an organization. Organizations must closely follow the development and implementation of new technologies in order to market and produce goods and services that are to meet the needs and demands of the customers, and they must realize the innovations in time. For this purpose, studies about research and development which are closely related to the technology must be carried out in the organizations. In this way, organizations aim to survive in the long-run and to develop their current goods and services through research and development. The benefit gained as a result of a successful research and development activity is more than the money invested in research and development. The research and development function enables both the launch of a new product onto the market and the current product can be produced at a lower price.

4.2 Innovation

Innovation, as a definition, is providing something new or modifying something. In other words, innovation is starting to use new methods in a cultural, social and administrative context. However, there are some misconceptions about the term. In order to clarify misunderstandings, Schumpeter (1934) defined and discussed the term innovation from an economic perspective. The study also focuses on the difference between "invention" and "innovation". Accordingly, innovation is an inherent factor of change. While "innovation" is an economic term, "invention" is a scientific and technological one. Economy sciences define "innovation" as an internal factor of change. However, "invention" is defined as an external factor of change derived from social and cultural issues, i.e. invention is an exterior factor of change.

Schumpeter argued that economic development is realized through innovation and the new technology replaces the old one in a dynamic process which he called "creative destruction". According to Schumpeter, radical innovations cause important destructive changes, and stepwise innovations push the changing process forward. He described 5 innovations. These are:

- The presentation of new products,
- Presentation of new production methods,

- Opening of a new market,
- Developing new sources of supply for raw materials and other inputs,
- Creating new market structures in an industry.

In terms of businesses, innovations enabling significant commercial success (profit) have come to the fore. From this perspective, innovation can be formulated as follows:

$$\text{Innovation} = \text{Invention} + \text{Commercialization}$$

Invention covers all the efforts put forward in order to create new ideas and make them work. Commercialization is the process by which the results of the research projects are transformed into marketable products or services by researchers, developers themselves, or any other group (entrepreneurs, business etc.) The thing here is that innovation and invention should not be confused. One can take advantage of the results of inventions, however, it is important to do something which has an economic income. For this reason, new ideas are also important. The vacuum cleaner was invented by J. Murray Spengler but its commercialization and sale were carried out by a leather manufacturer named W. H. Hoover. Thus Hoover is known world-wide, not Spengler.

Although the concepts of creativity and innovation show similarity in the formal sense, creativity represents thinking something new and innovation represents doing something new. Innovation is the key for economic growth, increasing employment and life quality. In all kinds of industries operating in all sectors, there is a need for innovation in all business areas. Innovative businesses spend intensive effort on fundamental understanding of customer needs and problems. The intersection of customer needs and problems and business strategy will be the area where new value is found for customers. Another definition for innovation is creating value by applying new ideas. This is the most important difference between innovation and creativity. Ideas which do not create value are not innovations. The needs and problems of internal and external customers should be the compass of innovation. Innovative companies are preferred by purchasers to other competitors because of the differences they create. So these businesses sell more goods and earn more, thus gaining competitive advantage.

4.2.1 Types of Innovation

Types of innovation are classifications that help us understand where and how innovations are made during production input and output processes.

- Product Innovation
- Process Innovation
- Marketing Innovation
- Behavioral Innovation

- Strategic Innovation
- Radical and Incremental Innovation
- Architectural and Modular Innovation

4.2.1.1 Product Innovation

Innovative products offer great opportunities to businesses to enter new markets and growth. Important innovations provide both competitive advantage to businesses that operate in competitive market conditions, and a reliable fulcrum for new entrants to the market. Innovative products are referred to as innovation, change, originality and uniqueness perceived in the products. In other words, it is the development of market products and services, in terms of functional characteristics, technical competence, ease of use and other terms. Product innovations cover both the introduction of new goods and services, and major improvements made in the functional or user characteristics of existing goods and services. Perception of innovation should be considered from two perspectives: consumers and firms. From the consumer perspective, properties and changes in risk-taking behavior patterns are viewed as product innovation. From a business perspective, environmental familiarity, project business compliance, and technological and marketing aspects are considered as dimensions of production innovation. According to Wang and Ahmed (2004), product innovation is expressed as the presentation of new products which are different, important, and trendy.

In product innovation, the focus can be on different areas, both on improving the performance of existing products, reducing the costs and increasing the ease of use or on product improvements in any way. New products, in terms of their features and prescribed use, are goods and services showing significant differences from products produced before. However, by making small changes in the specifications of a product, developing a new use for that product is also a product innovation. Product innovation in services may include significant improvements in the way they are supplied (for example, in terms of efficiency and speed), adding new functions or features to an existing service or new services to the market. Product innovation covers the following basic principles:

- Determining the need for new products, processes and services,
- Determining the right direction for and suitability of new products,
- Development of new products and creation of a plan for commercialization,
- Selecting new product opportunities for investment,
- Developing organizational capabilities to create successful new products,
- Managing the creation of new products and new product development.

4.2.1.2 Process Innovation

Process is the name given to the sum of work steps required for the execution of any job. From this perspective, each job is a process. Process innovation is examining this process, developing new ideas for shortening and accelerating or reducing the costs to the possible lowest level. Process innovation includes new production methods, new management approaches and implementation of new technologies which can be used for improving management and production processes.

Redefinition of the processes suitable to the business structure creates new opportunities for innovation. Process innovation is an essential step for producing goods and products that low income groups can purchase. A process innovation is the realization of a production or delivery of a new or significantly improved process. This innovation includes essential changes in techniques, equipment and software. “What is delivered” is as important as “How it is delivered”. Delivery methods are related to the logistics of the organization and include equipment, software and techniques aimed at finding inputs, allocation of equipment in the organization or the delivery of end products.

Process innovations include the invention of new or significantly improved methods. This may include significant changes in the procedures and techniques used to provide equipment and software or services used in a service-oriented business. Examples include: delivery of GPS (global positioning system), use of tracking devices, implementation of a new reservation system in a travel agency and the development of new techniques for the management of a consultancy project. Such issues are vital for businesses as increasing productivity, reducing costs, fast and accurate delivery will only be possible by improving and perfecting the processes. Innovation in this area is one of the most important factors that will determine the competitiveness of enterprises.

4.2.1.3 Marketing Innovation

Innovations in marketing are focusing the increase of competitive advantages to reach a higher profitability level. This also contributes to maintaining or increasing the market share of an enterprise. Marketing innovation is a new marketing method including important changes such as product design or packaging, product placement, product promotions, and product pricing.

Today, looking for better ways of meeting customers’ needs, creating new markets and finding new product designs are the goals that businesses pursue to have competitive ability in a global market. One of the features of marketing innovation which is different from other changes in marketing tools is the applicability of the method to a new and inexperienced market. This new marketing method can be applied to both new and existing products. It can be also developed by innovative enterprises or be adapted from other businesses or organizations.

Marketing innovation also includes contributing and improving customer touch point-related processes. Creative ideas for marketing innovation may improve both marketing communication and sales effectiveness. In other words: businesses and organizations are forced to make innovations in marketing processes.

4.2.1.4 Behavioral Innovation

Behavioral innovation is the most important factor in the development of innovative products. Behavioral innovation can emerge on three levels in a company – on an individual, team and management level. The behavioral dimension shows the continuous behavioral change in a company in the face of innovation. Behavioral innovation on an individual level can be understood as willingness to change. On the team level it is the adaptation ability of a team to change. On the management level, behavioral innovation shows management's desire for change and their support of new ideas. Individual, team and management behavioral innovation provides the creation of an innovative culture where new ideas and innovation are important for the company. Innovation is hard to realize in companies that lack innovative culture. On the other hand, innovative culture plays a catalyst role for innovation in the companies in which it is present.

4.2.1.5 Strategic Innovation

Strategic innovation is the kind of innovation that is realized through taking advantage of a radical development in the market and redefining the sector relations. While some of these innovations that result in the creation of brand-new markets require a high level of technology and radical scientific discoveries, others result in the creation of new markets via strategic inventions. Generally, strategic innovation is used to totally replace the existing business model of a company with an ultimately different one. In particular, it is a form of innovation that is preferred in sectors with low earning rates or sectors in downturn. Strategic innovation is defined as the development of new competitive strategies that create value for a company. In most companies, strategic innovation is faced with obstacles. The lack of need for change in successful companies or the lack of management ability or managers that can take risks when facing a need for change are some examples of these obstacles. In strategic innovation, the management ability to set ambitious objectives for the company is crucial. Strategic innovation requires the detection of opportunities and the efficient use of resources and abilities of the company to produce innovative products.

4.2.1.6 Radical and Incremental (Evolutionary) Innovation

Radical innovation refers to revolutionary innovations that result in important changes in the organizational applications and technologies of a company. It requires a significant amount of new organizational information in both the components and the creation of a system since it does not focus on existing organizational abilities or capacities. This innovation can lead to important changes and improvements in terms of product, process, organization structure, behavior and performance by changing all industrial and economic dynamics. Radical innovation refers to disengagement from previous products and applications, or actualization of a previously non-existing product, service, or method. Companies that instantiate radical innovations offer totally different products and services to new markets through utilizing new technologies. These kinds of innovations are referred to as revolutionary innovations in marketing discipline. In general, radical innovations include major changes in basic technologies and methods.

Incremental (evolutionary) innovation results in small changes and improvements in existing products, organizational technology, and application elements. Initiation and application of evolutionary innovation requires little new organizational information since it focuses on existing organizational abilities and capacities. Evolutionary innovation is

Table 4.1 Radical Innovation – Evolutionary Innovation. (Source: Mohr et al. 2010)

Radical Innovation	Evolutionary Innovation
Creates new technologies, new markets	Improves existing products and processes
Actualized in R&D labs	Product specifications are more accurately determined
Functional performance is increased	Low cost provides competitive advantage
Special market opportunities are utilized	Actualized to satisfy special needs in the market
Focus on the supply dimension of the market	Focus on the demand dimension of the market
Technology push	Customer pull

usually realized through natural rhythm, and does not disturb existing applications and industries to a great extent. Incremental innovation is related mostly to the short-term perspective of a company. These innovations are evolutionary innovations that are the counterpart of revolutionary innovations, and are actualized in line with market demands. While the first version of Windows is a radical innovation, later versions are examples of evolutionary innovation (Table 4.1).

4.2.1.7 Architectural and Modular Innovation

These two kinds of innovation are the ones that do not lead to important changes in the existing composition of the technological, product and organizational process but are innovations either only in the existing parts (modular), or innovations that are realized through new and different combinations of existing organizational applications and technologies (architectural).

Architectural innovations provide a platform that facilitates the production of new company products and simplifies the complexities. These innovations include the changes that are realized by a new and different construction of the existing system and reorganization of existing components in a different way. The Walkman is one typical example of this kind, since it actually includes few new components and technology. Most of the components and technologies used in the Walkman were previously used and tested. The organization and recombination of all these components to create a portable tape player is an architectural innovation. Today, platforms and products are considered together, and this is considered as the key to long term growth.

In modular innovations, the aim is the improvement of the product by adding new components without changing the existing system, technology or structure. For example, the integration of timing systems to an electric furnace can be considered as a modular innovation, since this integration does not require any change in the functioning system, technology or structure of the furnace but the usability of the product is improved by the timing system.

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Strategic Reorientation Due to Competitors' Disruptive Innovation

5

Alexander Schmidt

Contents

5.1 Introduction

5.1.1 Problem Statement

In a globalized world with constantly increasing price and technology competition, innovations become increasingly important as engines of economic development (Howells 2011). Christensen (2011) states that there are regularly certain innovations that enable products which substitute (at that date) prevalent technologies and therefore radically change the market. When facing such irreversible market changes, even flawlessly managed companies can fail and can get pushed out of the market completely. Examples for such substituting technologies are numerous. For instance, the replacement of ana-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_5

log photography with digital photography, the replacement of CRT-televisions with LCD-televisions, and the replacement of cable-based telecommunication with mobile telecommunication (Christensen 2011).

In 1995, Christensen et al. (2016) introduced the theory of disruptive innovation which explains parts of this phenomenon. Since then, it has become clear that different kinds of innovation call for different strategic approaches. Normally, when small competitors operate at the edge of a company's market they should probably just be ignored, except when they are on a disruptive path. In this case they can become an essential threat. Therefore, the right strategic orientation and reaction of incumbent companies is of utmost importance.

5.1.2 Purpose and Approach

The purpose of this article is to examine the influence of competitors' disruptive innovation on incumbent companies and to review promising response strategies. The focus lies especially on the creation of comprehensible and practical decision framework for the determination of coping strategies. Further, thought is subsequently based on the guiding question: Which strategic options exist for incumbent companies to react to disruptive innovation and which strategies are successful?

The outline is as follows: Firstly, the basic notions of innovation are differentiated and the concept of disruptive innovation is described, including its possible effects on incumbent companies. Subsequently, strategic implications are derived, different strategies are assessed and a general decision model is proposed. In the last section of this article, the central thoughts are recapitulated and critically reflected.

This work is based on qualitative content analysis of research on strategy, disruption and innovation. Therefore, the reliability and validity of this article depends on the underlying research. The quality of original sources is ensured by critical literature review and sound research. Furthermore, the majority of applied sources is either peer reviewed or empirically based. Through the guiding questions and defined strategic dimensions, the methodology to choose one strategy over another is transparent and reproducible.

5.2 New Competition Through Disruptive Innovation

5.2.1 Conceptual Delimitation

The scientific discourse on innovation led to a variety of different characteristics for innovations which operate with opposing conceptual pairs. As example for the (existing) dichotomy, the following terms can be named: radical – incremental, major – minor, revolutionary – evolutionary, discontinuing – continuing innovation. Hausschildt and Salomo (2010) criticize this state as barely manageable. Green et al. (1995) also point out that there is no commonly accepted definition e.g. for radical innovation and moreover that there is no way of measuring them. In studies that claim to examine radical innovation, neither the validity nor the reliability of the measurement is proven.

In economic practice, this has caused a blurry usage of terms and made comprehension and manageability difficult. This article is not just about adding a new conceptual pair (disruptive – sustaining); therefore, what to understand as disruptive innovation (in the sense of this work) shall be clearly defined. As almost each conceptual pair connected to innovation is highly ambiguous, a narrow definition is needed.

According to Christensen (2011) who initially coined the term, the phenomenon disruptive innovation is bound to technological developments which make products possible that at first provide product parameters below the demanded level, but have certain other demanded features. Through continuing innovation, the technologically inferior product features are developed further so that they match the demanded performance level. Finally, the possibility of replacing of incumbent technology/product is given and subsequently the risk of disrupting the market or present business models exists.

When applied to each type of innovation, the theory loses its value (Christensen et al. 2016). Therefore, for this paper's purposes, the terms shall be defined as follows: Disruptive innovations in the narrow sense are based on technological improvements. Disruptive innovations in the broader sense, on the other hand, can be radically new business models or products. Where not stated otherwise, this article refers to the original concept of disruptive innovation in the narrow sense: Technological inventions which lead to products that have the potential to replace existing goods through so-called sustaining or continuing development.

Normally, technological innovation increases the performance of a product in one or more dimensions to match the demand in the addressed market. Disruptive innovations are different because they initially cause worsened product performance. Therefore, they cannot compete against existing solutions in the main market but they have other features for which some – usually new – customers are willing to pay. Products which result from disruptive innovations are often cheaper, more convenient to use or simply smaller (Christensen 2011). Televisions based on "classic" innovations, for instance, would offer a better image quality, larger screen size or a more realistic sound system. A disruptive development would enable a portable, cheaper version with smaller resolution e.g. for so-called developing countries.

However, this decline in product performance is just the start of the development. Christensen (2011) observed in the HDD branch that almost every technology is constantly improved (sustaining technology/innovation) and that performance is normally increasing faster than the level of demanded functionality. This means that a lot of suppliers will exceed market demands in order to distinguish themselves from competitors and realize higher prices and thus higher profits. Subsequently, even the demand of the high end customer segment can be overshot. Products based on disruptive innovations are also developed further and can eventually become completely competitive and match the demanded performance in the main market.

The graphical overview of the observations described above in Fig. 5.1 shows what Christensen et al. (2016) mean when they state that disruption is not an event but a process.

As Fig. 5.1 shows, disruptive innovations are substantially different from successive, sustaining innovations. Product performance is not improved but rather decreased. On the other hand, those products offer other useful attributes. This can be seen as a tradeoff. A possible higher product performance is traded against an improvement along one or more new dimensions. Therefore, it would fall short of the mark to speak only of innovative, cheap substitutes because these products can become attractive even for selective customers through constant improvement. The following sample shall illustrate the concept once again.

Gross (2012) points out that 20 years ago cathode ray tubes (CRT) dominated the home entertainment market. But meanwhile they have been almost completely replaced by liquid crystal display (LCD) or plasma televisions. The development of the LCD technology was mainly influenced by the US-American consumer electronics company RCA. In 1967, electric engineer George Heilmeier lay the foundation for LCDs and tried to convince the RCA management of his vision of liquid crystal monitors. But the executives were not convinced of the utility of this technology and kept their focus on the profitable and at that time quite successful business with CRTs. Therefore, Heilmeier's advance was rejected.

The Japanese watch manufacturer Seiko, on the other hand, used the knowledge gained through regular visits at RCA to implement the LCD technology in digital watches. This

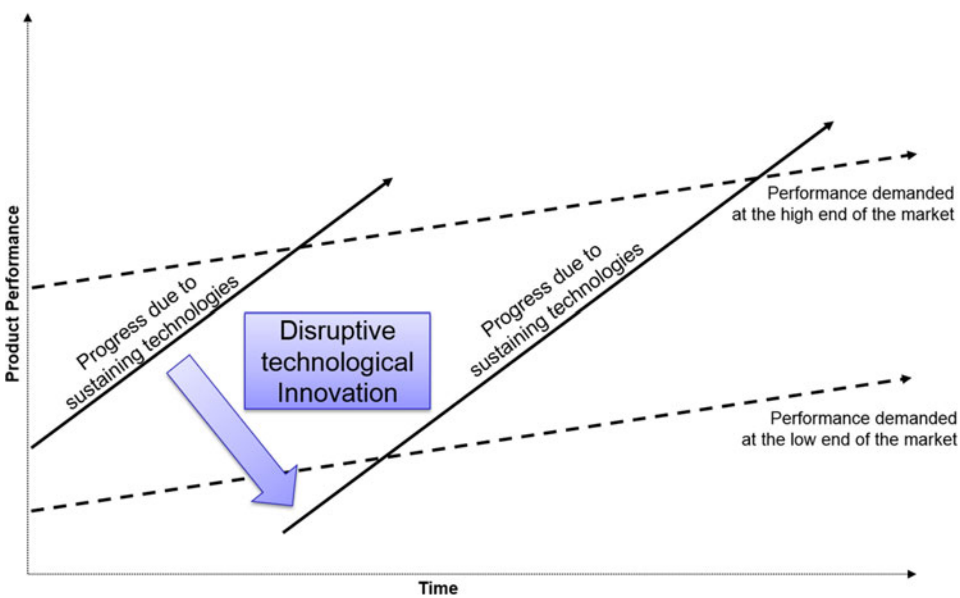

Fig. 5.1 The Impact of Sustaining and Disruptive Technological Change. (Source: see Christensen 2011, p. xix)

cheap and low-energy permanent display technology soon made its way into other areas of consumer electronics like digital calculators. Through a series of sustaining innovations, even moving pictures could be displayed with limited image quality. Those were used e.g. for portable electronic games and MP3-players (Sandström et al. 2009). Some Japanese companies focused on the LCD technology and when Sharp presented the first 14 inch-color-LCD in 1988, there was no longer doubt that the new technology could become a serious threat for CRTs. LCDs were better applicable to laptops, cell phones and digital cameras than existing technologies. In 2005 finally more LCD televisions than CRTs were sold (Sandström 2009).

The LCD technology initially offered a worse image quality than CRTs and was therefore only used for small displays. So at first the product performance along the demanded product attribute image quality was below the quality of existing products. LCDs, on the other hand, were used in small electronic devices. This application can be regarded as the lower level of the market. Through a series of improvements, it was possible to display pictures in higher resolution which was interesting for the majority of customers. At the same time, LCD devices were slimmer and lighter, and finally displaced the incumbent technology almost completely.

5.2.2 Possible Effects of Disruptive Innovation

The following paragraph shall show selected effects of disruptive innovation on incumbent companies that can be derived from the technology and product life cycle theories. According to Afuah (2003), the idea of the technology life cycle can be traced back to Foster who states that the rate of technological development is at first increasing slowly, then grows rapidly and finally tends towards zero as soon as the physical limits of the technology are reached. The rate of technological development can typically be expressed as an s-shaped curve which depends on the effort or invested time connected to the improvement.

The product life cycle, on the other hand, depicts the sales development of a certain product over time and is based on Vernon's research (1966). In other models e.g. from Olbrich (2006) the revenue, profit or profit margin is shown in relation to the time dimension. The curve typically resembles a normal distribution which is skewed to the left and can be split into the following five phases: Introduction, Growth, Maturity, Saturation and Degeneration.

Both models can be considered to be linked because the actual sales performance normally depends on the performance spectrum of the product and therefore depends on the underlying technological development. The obtainable price is influenced by the performance which affects the utility value. Therefore, the effect of disruptive innovation on the mentioned cycles as shown in Fig. 5.2 seems possible.

In the first coordinate system in Fig. 5.2, the development of Technology 1, whose performance is defined by Application A, is modeled as an s-curve. Technology 2 follows a similar course in the second coordinate system, but its progress is defined by other per-

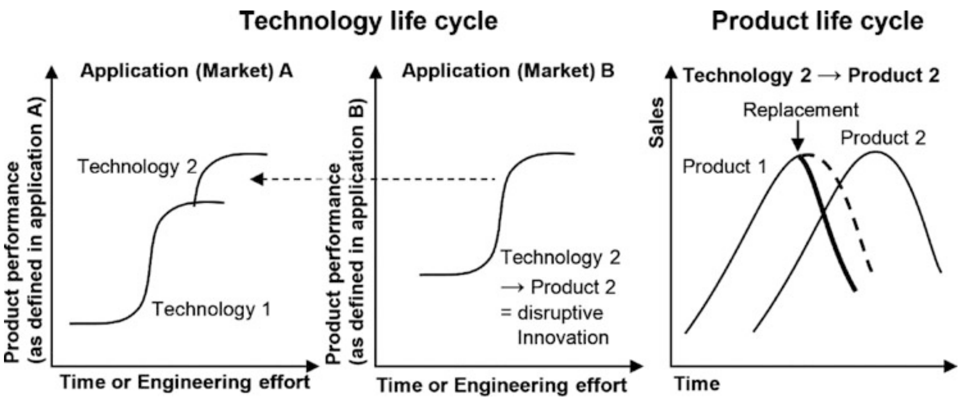

Fig. 5.2 Impact on technology and product life cycle, adjusted representation. (Sources: see Christensen 1992, p. 361; Feldhusen and Gebhardt 2008, p. 2–3)

formance criteria on a different market until Technology 2 is also used in Application A. Starting with this market entry, the product performance increases along the s-curve until limited by technical feasibility. The corresponding new Product 2 replaces the incumbent Product 1 due to its higher performance in Application A and B and therefore shortens the product life cycle of Product 1, as shown in the third coordinate system. Whereas an earlier or later technological superiority is imaginable, the effect on the product life cycle remains similar: a shortened and flattened life cycle and the replacement of the product.

As early as 1980, Porter (2008) stressed within his "Five Forces" framework the possible threat through substitutes for incumbent companies. Downstream and indirect substitutes in particular are easily overlooked until the profitability of one's own business model decreases. A similar development can be observed when dealing with disruptive innovation. Technologies and products that occasionally originate from different markets can, through constant development, become a substitute of one's own product.

So if this phenomenon can threaten a whole industry, why do incumbent companies not develop disruptive innovation on their own and change the market? Christensen (2011) argues that investments in disruptive innovation are no rational choice. The prices and margins of those new products would at first be low and address only the lower end of the market, whereas the most profitable customer would have no use for the inferior product. Christensen et al. (2016) also state that sustaining technological innovation would focus on improving existing products e.g. the fifth blade on the razor, the sharper image of a television and the better reception of a cell phone.

In addition, Margolis and Liebowitz (2000) mention the so-called economic path dependency. As soon as an innovation is wide spread, it can set a self-enforcing standard. A lock-in situation, therefore, can occur in which the existing technology, which is inferior to other alternatives, has become the basis of a variety of other developments. Samples for such de facto standards are the QWERTY-keyboard which has originally been developed to slow down the speed of typewriters, the VHS-technology which dominated the home entertainment market alongside improved analog systems, or the Microsoft Internet Explorer web browser which is pre-installed with each Windows version.

Miller et al. (2009) propose that the introduction of the DVD-standard, for instance, was a severe strategic disadvantage for producers of analog video playback systems if they could not apply the new technology. When determining the high-definition successor of the DVD, the economic path dependency among other reasons led to fierce confrontations between advocates of the Blu-ray and HD DVD, the overrated "high definition optical disc format war".

Depending on the situation, this can be an advantage or a disadvantage for incumbent companies who are threatened by competitors' disruptive innovation. The lock-in effect establishes a market entry barrier and secures the prevalent technology against substitutes. But if new technologies spread and eventually become the new standard, this obstacle works in the opposite direction. Then the prevalent products might be affected by a plunge in demand.

5.3 Strategic Reorientation of Incumbent Companies

5.3.1 Generic Strategies

Porter (2004) distinguished the three strategies: cost leadership, differentiation, and focus, whereby focus on a limited market segment can again be split into cost focus, differentiation focus, or cost and differentiation focus (Ormanidhi and Stringa 2008). The following paragraph briefly discusses the application of these generic strategies to come to terms with the threat imposed by disruptive innovation.

Products based on disruptive innovation are normally easier and cheaper than the prevailing products on the market (Christensen 2011). Subsequently, to strive for cost leadership as a response leads to at least two challenges. To begin with, Arndt and Zimmermann (2011) propose that the first mover advantage is with the competition. This means that the disruptor already attained the first learning curves, economies of scale and probably also gained great awareness. Secondly, the innovation itself is a characteristic of differentiation which normally cannot be imitated easily at low cost (Dess et al. 2012). Thus, Christensen and Raynor (2003) point out that absolute cost leadership seems to be barely manageable during the introduction and growth phase of the product.

To avoid the loss of unique selling propositions through the process of commoditization (Weil 1996), Dess et al. (2012) propose the differentiation of one's own product portfolio through brands technology or service can be a successful strategy. However, Grant (2008) states that this differentiation normally goes hand in hand with higher quality, additional costs and higher prices. Viellechner's research (2010) shows that the differentiation strategy, under the precondition that customer and brand loyalty are high enough, can be a successful response strategy to competitors' disruptive innovation. However, concentrating the marketing on certain customer groups can make companies more dependent on this buyers and thus entrepreneurial risk increases.

Anthony et al. (2008) state that the consumer electronics company Apple is an example for continuing differentiation. After the successful introduction of the iPod with different storage capacities of up to 20 Gigabyte, new versions with less storage (iPod shuffle), increased scale of miniaturization (iPod nano) and touch display (iPod touch) were launched. Through the continuing differentiation of the product range, Apple was ahead of competitors and realized a huge revenue growth.

Focusing on certain customers or market segments may also enable the company to use a niche. The potential for success of a highly specialized approach can be observed for example on so-called hidden champions, small- and medium-sized companies that are world market leaders for a certain product with outstanding profitability (Simon 2009). According to Schot and Geels (2007), concentrating on a niche can inhibit other companies to advance in this area, either because the segment is not attractive and large enough, or because market penetration, know-how advantage and the like of the incumbent company are too large. In this regard, the focus strategy can be an effective alternative when dealing with disruptive competitors but only if the innovation does not threaten one's own niche either directly as substitute good or indirectly when other companies need to refocus and evade into the very same market segment. However, if a company is not already occupying a niche it is uncertain that it can and will seize a niche in the foreseeable future.

In 1969, Hasselblad, a Swedish niche supplier of high-end cameras, attracted international attention because Neil Armstrong took the first pictures of the moon with a Hasselblad camera. However, around 1980, the company was threatened by the upcoming disruptive innovation of digital photography. Since the company was too small and had insufficient funds to invest in both, digital and analog photography, the resources were allocated alternating between the two. Together with an unclear focus, this inconsistent strategy led to competitive disadvantages and almost to insolvency. This example of a flawed niche strategy shows that a blurred scheme can lead to severe problems. After an acquisition to gain know-how, Hasselblad is focused today on digital cameras for professional photographers and is again profitable (Sandström et al. 2009). In this case, high specialization restricted flexibility and technological change was inhibited by the company's size until a new niche was found.

5.3.2 Strategies for Competing Innovation

In the following paragraph, only the three alternatives for dealing with competitors' innovation shall be covered briefly: Imitation, M&A and Retaliation.

Valdani and Arbore propose to imitate the innovation as one possibility to react on a potential threat posed by new products (2007). Geisendorf (2009) agrees that the imitation of an innovative product can be a profitable strategy. The replication, modification and enhancement of other companies' ideas can also lead to noteworthy innovation like the semiconductor memory or the Macintosh. According to Cozzi (2001), the information needed can be obtained for instance through congruent development, reverse engineering or enticing staff away. Furthermore, in our era of information, reports about product innovation quickly spreads to other markets as well so that other competitors can offer similar products on their home market promptly.

Slivko and Theilen (2013) state that the imitation strategy as answer to competitors' innovation is mainly limited by the protection and enforcement of copyright. If intellectual property protection is strong, the incentive for investing in one's own research and development is high. However, as the international dispute on patents between Apple and Samsung shows, it is increasingly difficult to evaluate potential copyright violations for products which are based on hundreds of patents. Therefore, the imitation of a disruptive innovation seems to be a valid option as explained in paragraph 3.3 (Adopt Strategy).

A totally different strategy to get know-how about competing innovative products without research and development of one's own are merger and acquisition transactions (M&As) as suggested by Banker et al. (2011). However, Bresser (2010) emphasizes that both transactions are complex, expensive as well as risky and need thorough planning. This strategy requires amongst others legal know-how, corresponding financing options and due diligence. M&A can be an appropriate means to exploit technological knowledge and to gain e.g. the needed workforce and production capacities at the same time. However, Schön (2013) states that the success of an acquisition depends on a number of different factors, including, for instance, the know-how of the buyer, the scope and depth of the acquired knowledge, as well as similarity of the used product and production technology. The acquisition of a company takes time and is complex and therefore can be considered only a long-term alternative when dealing with disruptive competitors' innovation.

International IT companies like Google, Yahoo and Facebook act in a diverse, fast-paced environment. They often use acquisitions, e.g. of start-ups to ensure access to potentially disruptive innovations or ideas and therefore pursue a strategy of M&A/Embrace & Scale up. There is also the possibility to develop new fields of business, like in the acquisitions of Motorola Mobility through Google or Tumblr through Yahoo, and to realize synergy effects with existing operations (Empson 2013). M&A therefore is one possible option to gain the needed know-how and can be combined with other strategies, as the Hasselblad case showed.

Another strategic option is to hamper the market entry of the competitor altogether as proposed by Kemp and Hanemaaijer (2004). This can happen through the so-called retaliation strategy by which the incumbent shows his willingness to defend its market share. The different measures consist of e.g. increased marketing expenses, strategic investments and hostile takeovers. Arend (2009) further states that depending on the timing, the actions can be containing, absorbing, neutralizing or annulling and reach from the lock-in of customers through increased switching costs to the introduction of a sub-brand to protect the main brand from the lower market segment. Incumbent companies which use such counter measures have, compared to the competitors, lower but less volatile and sustaining profit margins. These short term measures also seem to be applicable to competition through disruptive innovation.

5.3.3 Response Strategies to Competitors' Disruptive Innovation

The recommended options in this paragraph are based on Charitou and Markides' action-response framework (2003). Both researchers studied the response strategies competitors' disruptive innovations. To derive general applicable rules, they evaluated the survey results of 98 companies in eleven different industries that faced disruptive strategic innovation. The insights derived from this research on disruptive innovation in the broader sense is also applicable to disruptive innovation in the narrow sense as used in this article. Charitou und Markides identified five different options which can be arranged along the dimensions "Ability to act" and "Motivation to act". These strategies are as follows: Ignore, Concentrate on own business, Attack back & Disrupt the disruption, Embrace & Scale up and Adopt & Separate/Adopt & Keep internal. The following paragraph shall briefly describe those alternatives.

The methodical analysis of available information about the disruptive innovation is, according to Charitou and Markides (2003), the first step toward determining the strategy. Such an evaluation could, for instance, shows that the innovation has the potential to change the industry, but the own market segment remains untouched and therefore is not threatened. If there are no realizable growth opportunities through the new technology for the incumbent company, the rational decision could be to ignore the innovation and continue carrying on (Ignore).

When an effect on one's own market cannot be excluded, but it seems unlikely that the products which are based on the disruptive innovation can become technologically superior or that they will address the whole market in the future, Charitou and Markides (2003) recommend concentrating on one's own business. The targeted costumer groups can be better addressed through selective investments as well as specific marketing so that competitors will have difficulties accessing this target group with high customer loyalty (Concentrate on own business).

For instance, instead of entering a price war when facing disposable razors with lower product quality, Gillette continued concentrating on their own business. They not only produced disposable razors as a defensive counter measure but also developed the new razors, Sensor and Mach3. The focus on the traditional main business increased the distinguishing feature of the close shave whereas disposable razors could only compete through price (Charitou and Markides 2004).

Christensen (2011) claims that products based on disruptive innovation are often cheaper, easier or smaller, and can thereby influence customer preferences. Charitou and Markides (2003) therefore suggest responding to this by shifting the focus back to other product features such as style and design to disrupt the disruption. Examples of companies who reacted in that way to cheaper substitutes are Swatch, Apple and Sony (Attack back & Disrupt the Disruption).

An example of Attack back & Disrupt the Disruption quoted by Charitou and Markides (2003) is the Swiss watch manufacturer, Swatch (formerly SMH, after a merger with ASUAG and SSIH and a change of names to Swatch AG) in the 1980s. In the early 1960s, the Swiss suppliers dominated the global watch industry, until the 1970s when Seiko (from Japan) and Timex (from the USA) introduced cheap quartz watches with additional functionalities (alarm, time display, etc.) into the market. Over the next 15 years, the market share of the Swiss watch manufacturers dropped by more than 30 percentage points until this trend was reversed in 1983 by the introduction of the Swatch-watch, as it is known today. The Swatch wristwatches were three times more expensive than comparable Seiko models, but were cheap enough and at the same time superior in terms of style. Instead of striving for absolute cost leadership, the Swiss company maximized its performance based on an affordable price. Aside from price, Swatch gained further distinguishing features (Style, Swatch club) and attacked back on the disruptive competition (Swatch Group Ltd. 2015).

An often-neglected alternative brought up by Charitou and Markides (2003) is the possibility to abandon one's own business model/technology and to take over the disruptive innovation completely. This strategy is not about imitation but about expanding the scale significantly and bringing the product to the mass market. Incumbent companies can use their relative competitive advantages like their sales setup, production technology and industry know-how to possibly overtake the disruptor (Embrace & Scale up).

Charitou and Markides (2003) further state that a detailed cost-benefit analysis could also result in a takeover of the disruptive innovation into the existing portfolio that is beneficial. For such a dual business model, there are two possibilities: offer the product through your company or exploit the innovation in an independent legal entity (Adopt & Separate/Adopt & Keep internal).

In 2000, for example, the Healthcare segment of General Electric faced according to Immelt et al. (2009) the challenge that they could not offer affordable medical devices for developing countries like China and India. Conventional high-end ultrasound scanners with advanced medical imaging which are used e.g. in the USA, cost USD 100,000 or even more which is why those machines sold poorly in China. Local suppliers tended to split the whole market with cheap alternatives among themselves. But GE decided to anticipate this development and offered a portable ultrasound scanner for USD 30,000 that was assembled in India. The new device was based on a laptop, a specific probe and a highly developed software. It was easy to use and delivered an image quality which was sufficient for most preventive medical checkups. Further developments decreased the price and increased the image quality and GE recorded double digit growth rates. GE's approach can be seen as an example of the Adopt & Keep Internal strategy in which disruptive innovations are used to realize or create growth opportunities within the existing organization.

5.3.4 Integrative Decision Model

Together with the other useful generic and innovation-related strategies outlined, the framework of Charitou and Markides is the basis of the integrative decision model which uses six different strategic dimensions to structure the alternatives.

In general, the dimensions "Time to act" and "Strategic Approach" seem applicable for the generic focus strategy and the derived variation niche strategy (Schreyögg and Koch 2010) as well as for the instruments Retaliation and M&A, whereas the latter options normally take more time. This approach can be considered a mixture or blend of different strategic mindsets. According to Porter (1998), both focus and niche strategy could be interesting for small companies because they could occupy a position that is either hard to imitate or not worthwhile for competitors. Acquisitions or Management-Buy-Ins to gain knowledge as proposed by Jansen (2008) are plausible strategies when dealing with disruptive innovation and are often used in the IT industry. However, Probst and Wiedemann (2013) emphasize that time remains a limiting factor and decreases the choice between the possible alternatives. In this context, the early definition of countermeasures seems decisive. Therefore, the anticipating retaliation as proposed by Arend (2009) can be an option to hamper the market entry of a competitor or a product and to inhibit or delay the full exploitation of the idea.

In addition to the dimensions, "Ability to act" and "Motivation to act" introduced by Charitou and Markides' action-response framework (2004), the so-called dual business model approach (Adopt & Separate/Adopt & Keep internal) also provides additional insight when expanded by the dimensions "Difference to existing business model" and "Conflict to existing business model". Then the following four forms are distinguished: Separation, Phased Separation, Phased Integration and Integration, whereby the two latter options are normally only applicable if huge/great similarities between the operative business and the addressed markets exist.

The larger the conflict between both business models, the less the synergy potential and the more a complete separation is encouraged to reduce the risk of insufficient focus on the core business and to use the chance to realize growth opportunities. In this context, Charitou and Markides (2004) found that the success of the independent legal entity correlates with the degree of operational and financial freedom. It is also possible that there is no difference between the business models, rather that the markets addressed are basically different. Then a phased separation, meaning the development of the new business model within the incumbent company before separating it, could be a valid choice. The new branch can use existing resources as well as the know-how of the core business and is then led independently.

According to Charitou and Markides (2004), the opposite case also exists, e.g. when the addressed markets are quite similar but the business models contradict or cannibalize each other. Under such conditions a phased integration is recommended. Thereby, the respective businesses remain separated until they are finally and slowly merged to minimize conflicts between competing concepts. If there are hardly any conflicts between both business models and potential synergies can be realized, the integration of the innovation into the existing infrastructure seems an appropriate strategy. Thus the change can be considered a chance to grow and expand the companies' competencies.

The choice between the basic options, separation and integration also depends on the stability of the corporate environment. Highly dynamic conditions hamper, for instance, the complete integration of new business models. Under such conditions, a separation would normally be more promising. Though most companies also use some elements of integration to realize possible synergies, because even for the separation strategy it could be important to use existing strength like brand, financial resources and industrial know-how. It is thereby advisable to protect the innovative business from excessive interference through the incumbent company's management to prevent negative effects on operational activities (Charitou and Markides 2004).

However, it is only possible to react to disruptive innovations when they are recognized as such. To simplify the differentiation between non-disruptive and disruptive innovation in practice, the Disrupt-o-Meter by Anthony et al. (2008) represented by Fig. 5.3 provides orientation as to which characteristics normally accompany disruptive developments. The more disruptive criteria are fulfilled, the more likely the disruptive character of the innovation.

As individual strategies will always have pros and cons, only the holistic consideration of the different options seems appropriate. Firstly, the question has to be posed if it actually is an innovation; secondly, if this novelty has the potential for disruption. If both questions are answered in the affirmative, the dimensions time, strategic approach, ability to act and

Area	Least disruptive	Somewhat disruptive	Most disruptive	Rationale Disruptive Solutions…
Target market for first year	The mass market	A large market	A niche market	… typically start in a limited market.
Customer needs the product to be	Better	Cheaper	Easier	… provide improvements along new dimensions such as convenience or simplicity.
Customer perception of the offering	Perfect	Good	Good Enough	… should be perceived as "good enough" early on.
Price	High	Medium	Low	.. are generally cheaper than existing solutions.
Business Model	Proven	Slightly improved	Radically different	… often follow very different business models.
Go to market **channel**	100% Existing	At least 50% new	Entirely new	… occupy distinct channels to market.
Expected **reaction of competitors**	Instantly develop countermeasures	Monitor closely	Ignore	… use competitive weakness and blind spots.

Fig. 5.3 Disrupt-o-Meter, Adapted presentation. (Source: see Anthony et al. 2008, p. 156–157)

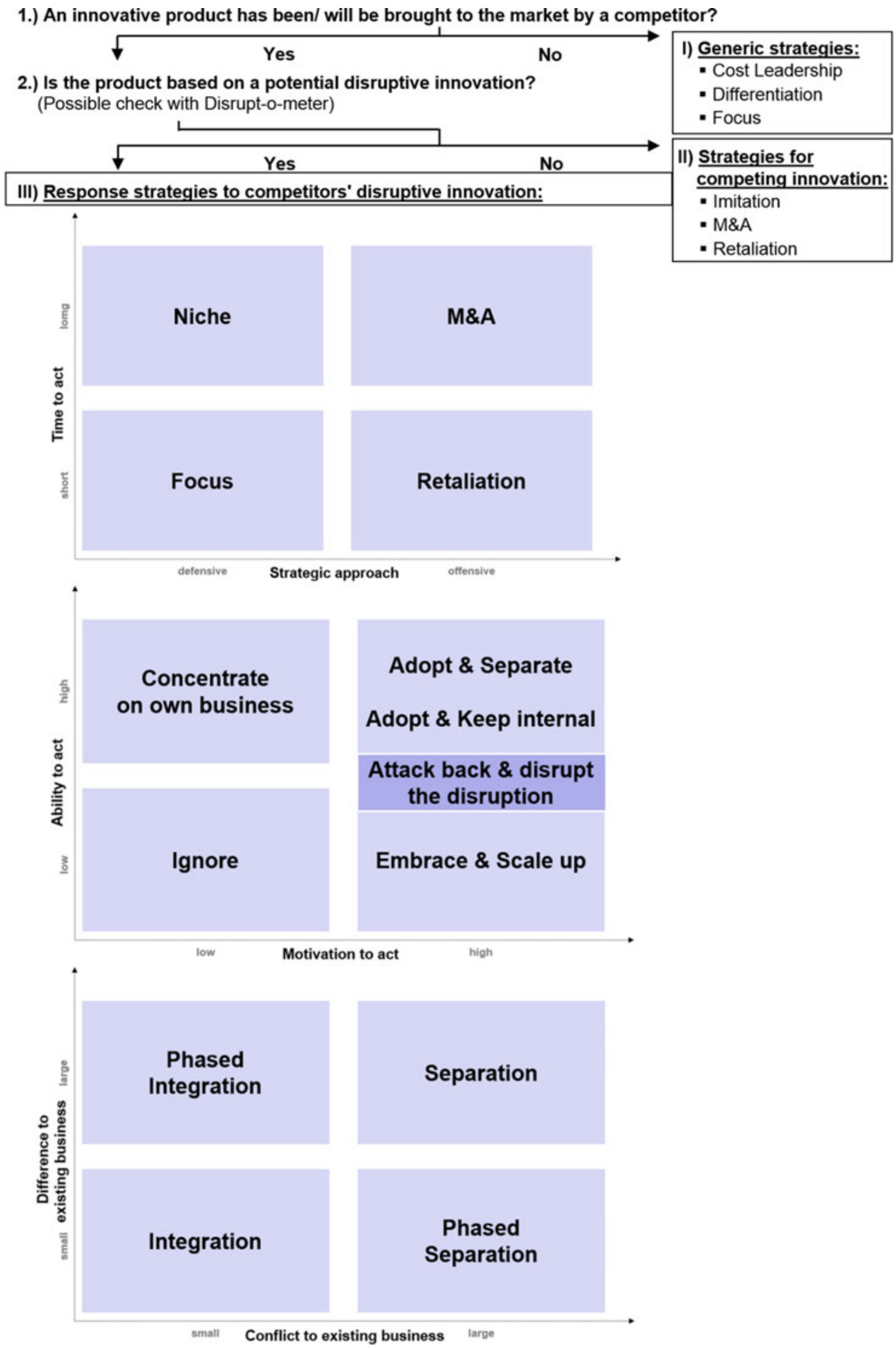

Fig. 5.4 Integrative decision model. (Own representation based on Charitou and Markides 2003, p. 57–63, 2004, p. 24)

motivation to act can be considered. If a dual business model is applicable for the incumbent company, the dimensions conflict and difference to existing business model become relevant. Fig. 5.4, therefore, summarizes the strategies explained in the previous chapters through various questions and the relevant six internal and external strategic dimensions.

Conclusion

Limitations

There are several influential factors that limit strategic determination, but only two issues, uncertainty and organizational inertia, shall be discussed briefly in the following paragraph.

Normally, there is a gap between the need for strategic information and the information available. Therefore, Rosenzweig (2007) states that deciding with uncertainty is one essential component of strategic management. As real-life situations with complete information are scarce, strategic planning is often based on incomplete information, meaning that neither the possible alternatives nor the ramifications of the available options are completely clear. To decide based on uncertainty, therefore, causes a variety of challenges. According to Ermoliev and Hordijk (2006), even the knowledge of manageable choices does not provide insight on a potentially optimal solution. Socioeconomic, technological and environmental trends as well as general risk can lead to a large variation of favorable or unfavorable results. Further, Saliger (2013) proposes that whether a strategic choice is economically correct, can usually only be evaluated afterwards. One problem connected to this is the prediction of disruptive development.

Especially in the early stage of the product life cycle, uncertainties about the potential of an innovation prevail. Afuah emphasizes (2003) that the evaluation is normally hampered due to missing information and lack of clarity about which technology will prove itself in the market and be preferred by the majority of customers. However, the potential development can be derived from basic customer preferences. Space, time and amount are dimensions which are considered to add value by most customers. Therefore, customers are normally willing to pay more for products which require less space, offer more capacity or are faster and require less time. Lastly, customers tend to prefer more efficient and economical products, so that fewer of them are needed. Therefore, technological development along these three dimensions seems likely.

In addition to this external restriction, there are also internal limitations which generally inhibit a timely response strategy, namely organizational inertia. In physics, inertia denotes the inclination of objects to remain in their current state as long as no external impulse acts on them. In psychology, inertia can be understood as often unconscious behavior pattern of individuals to withstand an activity or limit the effect of implemented changes to maintain the status quo (Dorsch 2004). According to Welsch (2010), the inertia or rigidity of an organization is not limited to its inability to recognize the need to change, but also comprises its failure to implement needed changes efficiently. Moreover, it is possible to distinguish between individual and collective inertia which can both be subsumed under the term organizational inertia. Yet, inertia is not only negative because it is also responsible for the stability of a system.

Valuable insight on this is provided by Gilbert's study (2005) on companies that were threatened by discontinuing technological change, namely newspaper publishers through the Internet. Inertia can be divided into resource rigidity, the incompetence to change the allocation of resources, and routine rigidity, the futile attempt to change organizational processes. The rigidity depends on a variety of factors from the perception of threat, over focus on existing business, to resource dependency. Christensen et al. (2016) argue for instance that incumbent companies' missing attention towards disruptive innovation might have led to failure in some cases.

According to Viellechner (2010) who studied the European aviation sector, the following points are relevant for incumbent companies when dealing with market-changing innovation: First, observe all important innovation in the market and adjust the portfolio regularly. Second, recognize the threat and be aware that concentration on the core business will make the company more dependent on certain customer groups. Third, fund a separate organization to provide for the freedom for operational and strategic decisions. Fourth, know that even a delayed reaction is better than no reaction at all.

Conclusive Remarks

At the very beginning, the theory of disruptive innovation was only a statement on correlation, but through research a causal connection was derived and verified in industries like computers, printers, semi-conductors and cameras (Christensen et al. 2016). However, besides the efforts of Christensen and other researchers to develop the model of disruptive innovation further and the general attention this topic has attracted, this concept has its limitation and Larry Keely, co-founder of the consulting company Doblin, summarized them when he stated: "The theory is more descriptive than prescriptive" (Wieners 2012). This criticism is anything but new because others like Daneels already brought up similar questions on disruptive innovation (2004). What about the prediction of further developments? Why were incumbent companies not affected by disruptive innovation successful?

This was the starting point for Charitou and Markides and others when they tried to apply Christensen's idea and narrow down successful response strategies in real life. This article used this preparatory work to extend the usability of the original concept of disruptive innovation, illustrated it with examples and made it more accessible for practitioners, in order to render the success of incumbent companies which dealt with disruptive innovation understandable and therefore reproducible.

Like most economic research, this research has its limitations. A lot of statements and evidence are based on qualitative content analysis of relevant scientific articles. No comprehensive meta-analysis of the existing literature has been conducted; therefore the perspective is only limited. For the sample cases, a certain "survivor bias" is inherent which means that the observation is focused on companies that overcame disruptive innovation and still exist today. Interestingly enough, Christensen states that success is not part of the definition of disruptive innovation et al. (2015). Therefore, other relevant companies could have been neglected due to their lack of visibility. In addition, each advance to set up a common decision framework related to disruptive innovation is limited by the heterogeneity of the incumbent companies as well as the diversity of the different industries. However, the most severe limitation remains that the decision framework as a whole is not empirically validated and whereas each strategy is a valid option on its own, neither the interaction nor the combination of alternatives are proven by measurement data.

Besides minimizing the mentioned limitations, this multi-dimensional approach could be the basis for further research. In addition, the temporal classification of different successful strategies could provide additional insights on the optimal strategy determination of the respective actors. Possible guiding questions could be: How does a company need to be organized in order to react flexibly on disruptive innovation? Which strategic combinations are most successful on an empirical basis? Is a further split within disruptive innovation needed?

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Public Innovation Management Support in Rural Areas: the ARTIE Case in Germany

6

Hartmut-Heinrich Meyer and Bastian Paulsen

If you always do what you've always done, you'll always get what you've always got.
Henry Ford

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6.1 Introduction

In rural areas, smaller companies are the backbone of employment and economic welfare. In innovation-oriented economies, with the increasing importance of e-commerce, location is of only minor interest in marketing a product. However, to obtain access to the resources that are necessary for innovation, location appears to be a distinctive factor. With the objective of maintaining a competitive edge in a globalized economy, knowledge generation and transfer, the application of knowledge or new technologies, and the

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_6

opportunity to exchange knowledge is fundamental in maintaining organizational competiveness (Paulsen and Ziegert 2014).

In recent years, innovation cycles have accelerated and the intensity of competition has increased due to Internet-based knowledge management. Today, "Made in Germany" is still an indicator of innovative, high-quality products. Indeed, 12% of world trade in innovative and research-intensive products involves German products (Research Report, 2014; Federal Office for Research and Education). For German enterprises operating in a globalized economy, success means the application of high standards of research and development in contemplation of the following challenges: CO^2 reduction, sustainable energy supply, improved health through a better diagnostic and efficient health care system, a long self-determined life, sustainable food and mobility, access to digital information technology, and the adoption of Industry 4.0, or Internet security. The task of securing competiveness involves fostering innovation, with the objective of applying or adapting new knowledge to increase production efficiency or reduce the time to market. Knowledge generation and application, however, are social processes with the means of bringing brilliant heads together and encouraging entrepreneurs to take advantage of market opportunities by taking controlled risks. In particular, the task of networking enterprises and research institutions is part of the German innovation program 2020 as well as the European innovation horizon program 2020 (Research Report 2014).

In transferring the need to adapt for technological development and the idea of a supporting environment to foster innovation to smaller companies in rural areas, the problem becomes twofold. In the first place, well-researched barriers to innovation exist in smaller companies, and these are not restricted to human and financial resource problems. According to the KFW Entrepreneurship Monitor in 2014, other barriers include management resistance to innovation due to a false risk perception as well as complex administrative and legal procedures for licensing or production authorizations to apply for public funding. According to the German Statistical Office, the economy spent more than €79.6 billion for private and public research activities in 2014, and 50% of this amount came from private enterprises and was application oriented. More than 600,000 people are employed in this sector. However, these activities appear to be concentrated in metropolitan areas which prove to be a disadvantage to the rural areas. Rural companies face difficulties in acquiring access to knowledge which may lead to a lack of innovation in the long term.

To close this gap, professional support of smaller companies in rural areas is needed to reduce the complexity of the innovation management process. Knowledge transfer to promote an innovative culture in enterprises is a subject for direct social interaction. A bridging exercise that promotes networking between smaller companies looking for external knowledge and the experts offering this service seems to be necessary. In the ARTIE case, this task was transferred to public regional development institutions to channel the need for networking toward services that assist in public funding and project management. As this public service is financed by taxes and may interfere with market forces, an analysis of this scheme will help us evaluate the effectiveness and efficiency of public innovation management support.

6.2 Innovation Management for Smaller Companies in Rural Areas

Rural areas are often defined in comparison to urban areas, and the main criterion applied is population density (see for example BBSR 2009; OECD 2007). However, reducing the definition to this criterion alone does not permit an adequate understanding of rural areas. Today, rural areas are viewed more by their structural elements, such as their spacious location, level of infrastructure, structure and extent of non-agricultural business activities, the touristic attractiveness of the region, demographic developments, and cultural behavior of the inhabitants (Weber 2002; Dannenberg 2010). In relation to economic attractiveness, rural areas have also been defined by premises cost and site accessibility, including the availability of a professional workforce. Due to the shift in our economy from being efficiency driven to innovation driven, entrepreneurial activities that were concentrated within metropolitan regions and started more as spin-offs in closed neighborhood shave shifted to research centers or have become main leading innovative industries (Metzger 2008). With the increasing quality of information technology access and the shift to sustainable energy generation, the attractiveness of rural areas has recently been rediscovered. Politicians began developing business development schemes to promote the shift from over populated urban areas and to ease the effect of the demographic change.

In entrepreneurship theory, the idea of organizational competiveness is based on the concept of innovation. Innovation means that an organization is able to supply its environment with new solutions for existing problems as well as solutions for new problems in our environment (Hausschild and Salomo 2007). Due to this, innovation need not be solely understood by its disruptive effect on the market because of the fundamental development and application of new technology. Innovation can also be understood as the application of new technology within a certain branch, the application to new products, and the relaunch of products to reflect shifted consumer behavior. However, innovation as such often implies organizational change or a change in the market behavior of a company.

Research on innovation management in smaller companies can be clustered into several entities, as outlined in Fig. 6.1.

As can be seen, the problem of innovation management in smaller companies needs to be separated into internal and environmental management tasks. The environmental management tasks in the context of smaller companies are the well-published innovation barriers such as the problems of funding or risk management. In particular, the human resource problem is a major innovation barrier in evaluating market opportunities, competitive forces, technological developments, and the management of government support schemes. The performance of these management processes need to be embedded by an innovation culture and managerial motivation. The conversion of innovative ideas into an innovative process requires the reduction of complexity for management, the main objective being to minimize managerial resistance. Creating a management position to function as a guide or a "push factor" is required in the development of an innovative culture. The task of this role is to ensure that the enterprise sustains the long-term innovative process from the initial idea up to the market launch of the new product or the adoption of new

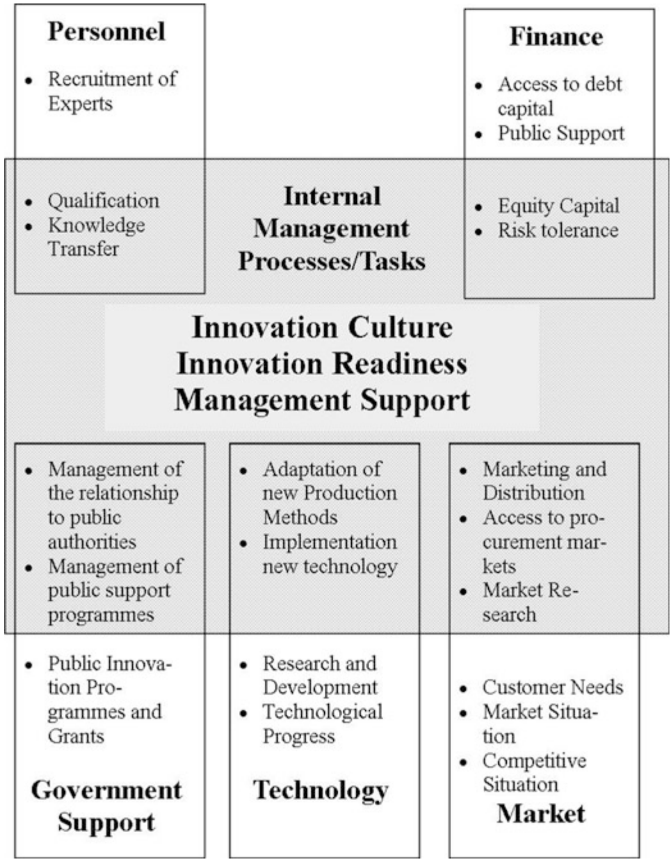

Fig. 6.1 Cluster of Innovation Management Research in Smaller Companies. (Source: Gelshorn et al. 1991, p. 21 with own additions)

technology. Research shows that smaller companies avoid or abandon this process due to a misleading appraisal of market and financial risks, the fear of false investments in a cut-throat competitive market, gaps in implementation knowledge, and missed opportunities to deal with complexity (Thomä and Zimmermann 2012).

With the objective of understanding the process of innovation and the need for support, a model propounded by Kline and Rosenberg (1986) is used. The model (as shown in Fig. 6.2) explains the development of innovation as an interactive process. The starting point here is the transformation of fundamental or applied research into explicit knowledge and tacit knowledge. This primarily refers to the application of knowledge in the combination of formalized and experience knowledge (see also Probst et al. 2003). Both sources of knowledge are not necessarily available from the same place. Although formalized or explicit knowledge may be gained through various means of applicable information technology, understanding the knowledge in such a way that it can be applied to specific questions or products may be a problem. Applying and transforming knowledge to answer specific questions is a multilevel task that requires a high degree of knowledge exchange.

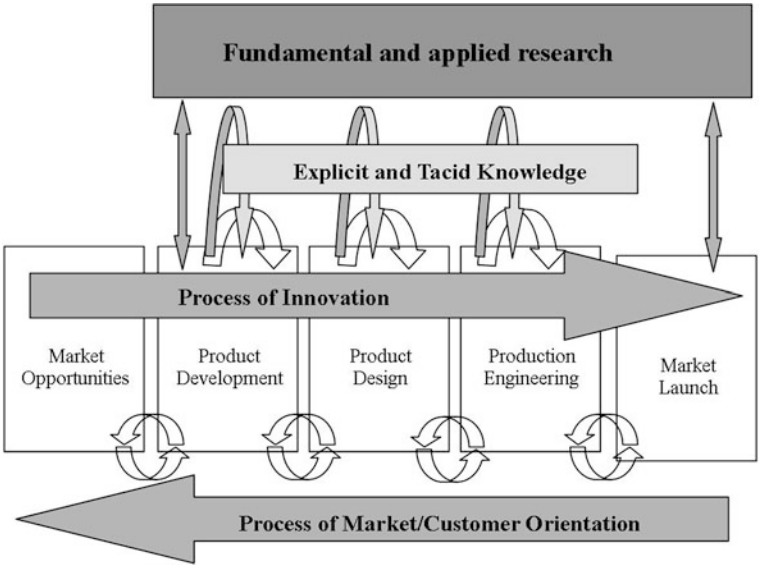

Fig. 6.2 Development of Innovations as Interaction Model. (Source: Kline and Rosenberg 1986, p. 289 and according to the demonstration of Meng 2012, p. 61)

For success in this vulnerable situation, a structured project approach is necessary (Meng 2012). As research shows, the skills required to apply the knowledge often do not exist, and this to a large extent accounts for the innovation problems in smaller companies.

Furthermore, in the context of smaller companies, Lahner and Müller (2004) noted that one of the strengths of smaller companies is the application of technical knowledge by its management and staff—an "attitude tinkerer" with good market knowledge and a high customer orientation is often present. However, due to the demands of day-to-day business, managers often lack the strategic awareness and the process knowledge to manage such a long-term process. Moreover, they may further lack the ability to visualize and to communicate their innovations to customers. As a result, away to channel the exchange of knowledge to initiate and guide an innovation process is needed. The objective must be to defreeze existing thinking and structures to take advantage of the existing high technical and market knowledge of small-business managers. To generate innovation, this knowledge must be set into new frames and linked with new technology. Both Meng (2012) and Lahner and Müller (2004) confirmed that once this process has been initiated, positive implications to the performance and competiveness of smaller companies can be observed.

6.3 The ARTIE Case

The need for public intervention can be grounded on the arguments of creating and maintaining employment. This demand appears even more evident in rural areas, as particular smaller companies often take on the role of a major employer. The lack of innovation can result from the necessity of complying with meta-economic trends in such areas as environmental issues, demographic change, information technology-based engineering, and software-interaction or network security.

The ARTIE rural innovation support program was founded due to the initiative of several regional development agencies in Northern Germany. Its objective was to build a networking scheme among local regional development offices, research centers, and individual experts who were tasked with providing missing innovation management project know-how. The tasks and objectives of this innovative support scheme program are defined as follows:

- To build up a network of experts and enterprises to promote access to and exchange of knowledge as well as to activate this process.
- To offer a comprehensive service in the innovative management process by providing free human resources. The additional human capacities offered a definition of the nature of the innovation project, risk appraisal, production, market research, and strategy building. Moreover, further services were offered in the application for public grants and the management of public administrative requirements.
- To promote long-term cooperation between enterprises and research institutions.

The main focus of the program was to reduce resistance to initiate an innovation process in smaller companies, as outlined the Fig. 6.3. Through providing additional free human resources to the organization, project management throughout the seed phase was ensured. The program took place in Northern Germany in the area between Bremen and Hamburg. This rural area is known for its agriculture and manufacturing. Moreover, leading German chemical plants as well as logistic and aerospace organizations are located in this region. Here, smaller companies often operate as contractors for services or manufacturers of specialized parts. Due to a low geographic density, smaller companies face difficulties in accessing the knowledge of metropolitan research institutions and higher education organizations.

The program was marketed by different public relationship management tools employed by the regional development agency, including the publication of best-practice examples. As a result of the local branch network and of being personally connected to small-business managers, the first contact was easily established by the regional business development agency. In a recorded conversation, the project idea and the existing innovation barriers were determined. The objective of this first contact was to identify the need of support for further referrals within the existing network and initiate the first contact with appropriate experts. After the first contact, the case was transferred, for example, to

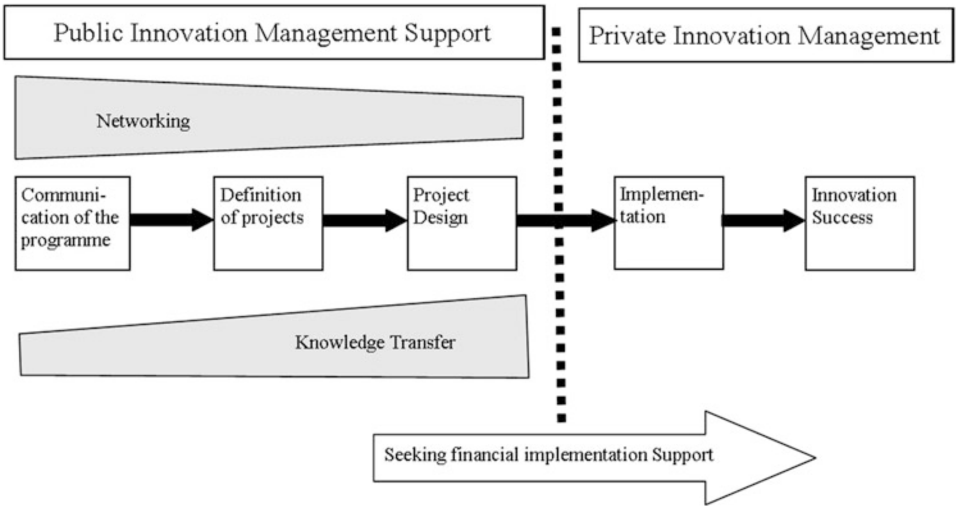

Fig. 6.3 The public innovation management support process

a regional technology transfer center. These centers suggested experts from within their wide network which encompassed members from universities and colleges, research institutions, and other freelancers from international companies. On the basis of the first analysis, the project was discussed in more detail, with the objective of defining strategies for the innovation project. For more complex projects, support was extended to an application for public funding. The service of the regional business development center or regional technology center was financed by a regional development program and the European Development Fund. The service was free of charge for the enterprises and ended once the innovation project was ready for implementation. The main areas of engagement covered the following technology areas:

- Communication and information technology
- Process-measuring and control technology
- Micro- and nanotechnology
- Sensor technology
- Manufacturing technology, including surface and materials engineering
- Life-science engineering, including bio-engineering, medical engineering, and pharmatechnology
- Environmental engineering, including energy and resource efficiency
- Management services, including corporate planning and organization

Example of ARTIE: Plastics processing and machinery manufacturing plant

The company manufactures blow-molding machines that are not only equipped especially for the manufacture of technical parts, but are also suitable for the plastic packing-materials segment. The products are used in the manufacture of blow-molded plastic parts as well as packing materials. In this case, the problem was to develop a new generation of “green machines” to cut energy costs. New knowledge was therefore needed to redesign a hydraulic system and improve the efficiency of the power unit used in the firing and refrigeration units.

After initial contact with the local business development agency, contacts were established in the department of engineering of the regional university of applied science to optimize the material flow and the use of the latest information technology. Moreover, using further expertise from the institute of product engineering, the energy efficiency of the plastic molding was optimized when the current state of research and market developments were considered. Furthermore, cooperation was established between the company and a technology research institute to jointly develop new concepts to reduce the amount of compressed air in the molding process.

As a result, today the company is operating in a very specialized niche in materials and plastic parts manufacturing, has increased its revenue and its number of employees, and is working together with the institutes for future projects in this area. However, the associated research institutes were able to offer their students a number of applied research assignments and as a result developed future fundamental research in their field.

The ARTIE program attempted to combine technological knowledge with market experience for the sustainable competiveness of the companies. With this approach, the innovation problems of smaller companies could be directly addressed. Moreover, the political objective to foster networking activities in the exchange of knowledge could be met, as according to the research of the Chamber of Commerce in Germany, the program could also assist in coping with administrative burdens as well as in protecting their innovative knowledge (DIHK 2015).

6.4 The Research

The main objective of the research was to measure the efficiency and effectiveness of public innovation support schemes on behalf of the ARTIE case. The qualitative analysis approach offered valuable insight in better understanding the opportunities and problems involved in public business development support. Efficiency was understood to be a measure of internal allocation of resources, for example, the efficiency of the networking, process management, and collaboration between individual entities. Effectiveness was understood to be the realization of the innovation process, the performance of follow-up projects, and the economic effects on competitiveness and profitability of a company.

In total, 11 innovation projects of small rural companies in Northern Germany were analyzed. Prior to the interview, the enterprises received a written questionnaire that collected economic and demographic data as well as data reflecting the whole support process. The first results were followed up by an in-depth interview. Moreover, the committed consultants and regional development agencies were also contacted for an interview. Of all the enterprises involved, 70% were manufacturing companies, and 90% had less than €5 million in revenue.

6.5 Experiences, Evaluation, and Lessons Learned from ARTIE

The first step of the evaluation assessed demographic data and the likelihood of the company using this program. Despite the fact that the majority of the companies were in the manufacturing sector, it was found that research and development activities were generally assigned to the owner or managing director of the enterprise. In only 36% of all cases was it noted that a special position had been established specifically for research and development activities. Despite this fact, more than 80% reported ongoing research and development processes. The majority of the managers of these smaller companies had technical training, and more than 40% of the respondents had an engineering degree. This concentration of higher-education degrees suggests a higher likelihood of taking on an innovation process as well as less fear or trepidation of interacting with the experts of technology centers. In relation to the evaluation of the initiated innovation process, 50% of the enterprises reported an increase in revenue as well as an increase in number of employees. Moreover, these companies reported an increase in their range of goods and services along with a positive development in their cost structures.

Further assistance in applications for public grants and in mitigating other administrative obstacles was a major step in converting an innovation idea into a business venture. The majority of all entrepreneurs as well as the associated consultants and public support agencies reported a lack of project experience in the performance and administration of innovation projects. Moreover, the interaction with experts significantly contributed in allowing analysis of the innovation on a basis other than risk alone.

With respect to innovation barriers, it was noted that the knowledge transfer within the innovation process and the assistance in applying for public support were the main factors in releasing these barriers. Not only did the demonstration and application of further financial grants reduce the financial risks, but the new knowledge also allowed a better communication of the innovation to customers or potential investors. By providing further market knowledge and possible cooperation, management also started to evaluate the innovation in question based on its market opportunities and the long-term goals for their enterprise. Moreover, due to first-time successes, they reorganized their resources and learned to install a management system to monitor risk.

All enterprises in the sample confirmed that the provision of a knowledge network played a major role in the decision to take up the innovation process. Most companies evaluated the illuminating expert services positively, and the free service eased the threshold fears of a first contact because their daily involvement in finding resources for their own structured approach appeared to be a high burden as was measured in the follow-up projects of more than eight cases. In particular, the seed phase of further projects was conducted without any public consultancy support. The relationships within the network continued in a long-term exchange of knowledge without public funding. In all cases, resistance toward innovation was significantly reduced. Because of the guided first-time experience, the perceived barriers were dismantled. The initial expert advice in defining and structuring the project, as well as in seeking solutions to promote the project, influenced the decision to open up the enterprise and its management to innovation.

Concerning the quality of the knowledge and the quality of the applicable knowledge transfer, here also the majority of the enterprises stated their satisfaction. More than 55% reported an increase in their knowledge through the exchange with the experts. The prior project definition ensured that the interaction and provision of knowledge was specific to the problem or solution. Hence, the provided knowledge could be integrated with the technical experiences of the entrepreneur to increase the implementation or application of the knowledge for the project in question. In particular, this joint effort not only contributed to a better acceptance of external expertise but also resulted in personal satisfaction for entrepreneurs and their staff.

Nevertheless, it was also observed that no structured approach for establishing ongoing knowledge management was prompted, even after a successful innovation process. Although the transferred knowledge was stored and subsequently used for follow up projects, no intention was observed to define a strategic knowledge strategy for future innovation processes. Moreover, an attempt to measure the effects of the innovation using key performance indicators was not applied. Innovation as such appears to remain a matter of reacting to market or technological developments or perceived customer demands rather than being a long-term structured approach.

The low-threshold approach of the program to allow a knowledge transfer certainly contributed to building an innovation culture within the companies. Moreover, the first-time perceived success in being a part of innovation within a region and to be recognized by the environment as an innovative enterprise contributed to a change of attitudes. In particular, it was observed by business development agencies and experts that entrepreneurs at least started to think strategically in order to maintain the competiveness of their enterprise.

Nevertheless, the sustainability of the project must be critically regarded. Although the initiation of an innovation process was stimulated by the interaction of the business development centers and the provision of free expert advice, there remains a risk that follow-up projects would only be initiated through a repeated provision of assistance. Only where the project or innovation problem remained in the same problem area, it was observed that long-term cooperation between experts and the organization could be sustained. The established innovation culture still needs new external impulses to avoid being overrun by day-to-day business pressures and cost struggles. The core business of smaller companies is not research and development. As this is the case, they still perceive themselves to be in a more reactive role as they continue to offer customer-oriented solutions to maintain their competitive advantage in their selected niche market.

However, a mutual benefit between the enterprise and the research institution in question could also be established in defining propriety new projects. The project could be initiated without the support of regional development agencies, indicating the value of a gate-opening project funded by public grants.

Conclusion

Innovation support is a result of networking, financing, and supplying external assistance to develop an initial innovation process. In the context of small businesses, this must be extended to project management as well as the complicated public application process for grants. In Germany, in particular, this appears to be the first big burden. However, the need to assist in an "ice-breaking project" was also evident, as smaller companies in rural areas began learning innovation management very quickly once they conceived an idea, evaluated the use, and obtained access to an expert network. Moreover, for subsequent projects, problems of finance or project management were secondary, or at least they were treated as manageable.

The research confirmed a strict relationship between the likelihood of taking up an innovation process and the provision of publicly funded expert advice. This purpose orientation brought more attention to the real burdens of small-business innovation management rather than examining only the restricted access to finance. Despite the provision of additional expert advice, support is needed in applying for grants and in complying with administrative requirements to acquire access to public support. The investigation also clearly suggested that the enormous administrative burden is a further major barrier that rivals that of the actual project cost. In Germany, in particular, where a good support network exists, there is a need to rethink the management of the program and the complexity of its accessibility.

On the question of efficiency and effectiveness, the ARTIE program must be positively evaluated. The majority of participating enterprises considered the program to be successful, and the effects of the cost release were regarded as being of major importance. Nevertheless, this program cannot be viewed as a single-time-and-place exercise. The experiences of this program show quite clearly that innovation management in smaller companies needs a constant external interaction in order to foster the need for innovation.

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7 The Innovative Role of Social Media in Healthcare

İmran Aslan

Contents

7.1 Introduction

Traditional treatment methods give the empowerment to healthcare professionals without knowing whether patients take medicines on time or not and obey their suggestions in their daily life. However, Health 2.0 has decreased layers and patients can get more empowerment by self-caring their illnesses, especially for chronic cases, instead of going to healthcare centres regularly. Many patients and healthcare staffs with similar illnesses can come together and share their experiences. Some professional healthcare staffs can organize the community or groups by answering questions or making some promotions. In Turkey, there are many healthcare SM web pages like Uzmantv.com, which show short videos about illnesses and treatment suggestions. Moreover, patients can ask questions to the experts in open or closed networks. In addition, many experts have their own web pages, like Twitter or Facebook accounts, blogs etc. to help patients. Many patients prefer to listen to their suggestions instead of going to a hospital and healthcare staffs can use

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the benefits of SM by getting online photos or test results through WhatsApp to help patients at remote areas with the support of nurses or citizens, mainly friends or relatives of patients.

Regarding healthcare Turkey can be considered a developing country. It increases the budget share of healthcare and applies many new technological methods for more efficient healthcare management like e-prescription. But the usage of SM is very high and many educated and young people try to use the flexibility provided by SM in healthcare. The Chronic Kidney Diseases (CKD) Facebook group, which have 3000 members, motivates many patients to share their experiences and help each other. They give suggestions like which hospital is good for CKD treatments, diet, sport, kidney transplantation, psychological supports etc. For that aim, the pilot city Bingöl is selected to make some questionnaires, interviews and observations to find barriers and opportunities in Health 2.0 and increase the positive usage of it. Healthcare students at Bingöl University, CKDs patients at a sole private hospital at Bingöl, and some healthcare staffs and patients at main government hospital were surveyed in 2015 to find the innovative role of Health 2.0 according to education level, age, having internet at home, trusts and privacy.

Bingöl is a city in the Eastern of Turkey, which has established a new university in 2008. Problems like the missing offering of different social activities, security problems, lack of infrastructure, a not developed industry, lack of controls by governments at investments with low returns of investments, a negative image of the city developed by the media, emigration of people to find jobs in Europe like Germany or other developed cities in Turkey, not having a medicine faculty at universities, lack of buildings in healthcare and some social problems are the main reasons why healthcare is not developed in this city. Many patients have to go to neighbour cities for treatments. The city's population is about 100 thousand people and about 200 thousand live in rural areas. This makes the reachability of healthcare services more difficult. Moreover, many healthcare staffs like doctors prefer to work in other developed cities. SM can increase the reachability and access of patients to healthcare services by connecting doctors staying at the city and other private hospitals to arrange appointments and take advices.

7.2 Literature Review

Eysenbach (2008) defined Medicine 2.0 as "Web-based services for health care consumers, caregivers, patients, health professionals, and biomedical researchers that use Web 2.0 technologies and/or semantic Web and virtual reality approaches to enable and facilitate specifically social networking, participation, Apo mediation, openness, and collaboration within and between these user groups" (Eysenbach 2008, p. 22). "The right message at the right time, in the right place to the right consumers' segment or patients" increases the possibility of reaching healthcare providers to influence consumers' behaviours and perceptions (Adel 2015, p. 267–285). In the area of patient-reported outcomes of adverse events (PRO-AEs), industry, regulatory authority, academic, private sector and patient representatives come together to get the patient ‘voice’ improving patient safety with benefits and risks of medicinal products, dependent on healthcare professionals currently, through the voice of the patients by PRO-AE guidance containing the benefits of wider use and approaches for data capture and analysis of data collection mechanisms, and suitable analytical methodologies taxonomies (Banerjee et al. 2013, p. 1129–1149). Social networking can help healthcare staffs to reach far patient, to share and transmit their information (Gee 2015). A “patient portal” like Twitter, Facebook, Instagram, and other social media platforms have helped many patients to find alternative doctors and share their experiences with new patients of systemic lupus erythematosus and other dangerous illnesses. Moreover, many patients stay in contact with their retired doctors to get advices (Greene 2015). Re-tweets, replies (InReplyTo), and links (URLs) are used by the Twitter feed of the Canadian Cancer Society, which have thousands followers. Twitter is used as a short message service (SMS) and a social networking site (SNS). Breast cancer screening, smoking cessation, the risks of tanning beds and health promotion messages are also tweeted and families of patients can participate in the forum to exchange information (Marton 2012). The granularity of individual situations has forced the use of social media by physicians and institutions with increasing awareness of supporting existing healthcare services (Adams et al. 2015, p. 293–302). Web 2.0, Health 2.0, Medicine 2.0, Patient 2.0, virtual community, social network, virtual network and portal are kinds of SM used to share information in open networks. Doctor-Healthcare, Staff-Patient and Patient-Patient are the main models of new 2.0 communication channels in healthcare. In SM, health related researches regarding the looking for women illnesses have increased from 5% in 2000 to 13% in 2005. 16% of SM users have searched for alternative medicine in 2005. Diet with 15%, cancer with 12% and depression with 10% were other main usages of SM in 2005 in healthcare. Women use internet more than men and users with less experience search less healthcare information in SM. Having internet at home does not have an effect on searching healthcare information on internet. Firms and other healthcare providers can use SMs or YouTube for healthcare or medicine marketing, which is mainly banned by governments as means of a cheaper way to reach more people (Hartmann et al. 2011). 947 residents in Izmir/Turkey were surveyed and it was found that 41.9% of the participants have used SM for choosing a doctor, 34.1% for choosing a dentist and 41.7% for choosing a hospital (Tengilimoglu et al. 2015).

Mobile phones, electronic health records, social media, and other sources can be used by decision makers at government positions to improve healthcare. New analytical tools with complex multidisciplinary research are needed to categorize data in order to get benefits for professionals and authorities (Fernández and Bau 2015, p. 67). Hospitals on Facebook’s five-star rating scale, 30-day readmission rates, and hospital characteristics including beds, teaching status, urban vs. rural location, and ownership type were analysed from 679 hospitals. Better performing hospitals (215 hospitals) as the national average use more Facebook than others (364 hospital), based 30-day hospital readmission rates while others have higher unplanned readmissions than hospitals. Hence, Facebook findings show that patient satisfaction measurement is correlated with traditional measures of hospital quality (Glover et al. 2015). Online social networks and health-related behaviour studies have been becoming popular such as measuring SM and obesity relationship with secondary disorders diabetes, heart diseases and cancer. The Facebook application Calorie Cruncher was developed to find this relationship by using Facebook communities, network data and discussions. Value system, social pressure and control, and emotional support intervening factors are developed to find people social networking and their health related behaviours. Based on users' information, interactions and network friends, a study was carried out. Calorie cruncher users can see their results and data and other users can be encouraged by them with current 30 users. It showed that technology is one of the main reasons of obesity. The new pilot application is aiming to find causes of obesity and increase awareness about it (Teoh et al. 2013). Calorie Cruncher is an application of Health 2.0 Facebook and gives more patient empowerment for dealing with obesity epidemic by bringing together many similar patients and communicating different strategies for their life. It also can be used to monitor social pressure and control, emotional support, socializing aspect, calorie usages, statistical analysing etc. to improve life quality of patients (Wickramasinghe et al. 2013). Counter scepticism and improve community stickiness can be done by examining and giving emotional support in virtual communities to help them against challenges like financial, healthcare or legal matters. These can be reported to managers of service providers to increase satisfaction and benefits (Lowe 2014, p. 1–10; Rahim et al. 2014). Health 2.0 expands its potentials in healthcare with the help of open networks and mobile applications like WhatsApp or YouTube. Many traders, healthcare professions, medicine firms, governments, learners etc. use it for their purposes with less expenditure. Especially for chronic illnesses, it is difficult to go to healthcare centres each day. The patients can manage some of their problems via Health 2.0. People can take appointments, check their lab results and tests, get medicines and send texts to doctors by e-health in Turkey. Data collected by Health 2.0 are used to make politics about healthcare and bring all participants together to improve the health of citizens as shown in Fig. 7.1.

Trip route mapping, distal learning opportunities, seeking a potential soul mate, booking travel, social and career networking and, of course, communication and information are facilitated by computer-mediated communication (CMC) at millennial online migration named as millions of "digital immigrants" ("Generation X" and older) and "digital natives" ("Gen Y" and younger). Cyber bullying, online stalking, "catfishing", malware, identity theft, the potential compromising of privacy, a burgeoning illicit digital sex trade, fraud, illegal online prescription for drug procurement, and the covertly infamous "Silk Road" online market are major problem of new era. Social intimacy, authentic interpersonal relationships and increased isolation are the consequences of computer-mediated communication (CMC), which is different from the face-to-face (F2F) with migration and from face-to-face to online recovery. The F2F support for a better success to achieve sobriety seemed to be more beneficial at fighting alcoholism (Grant 2014). Tweets in Twitter during a surgery sometimes with live-streaming videos and valuable stream of medical operations for births or other operations to educate people is used in many developed countries by protecting the privacy of patients (Adams et al. 2015, p. 293–302). The prob-

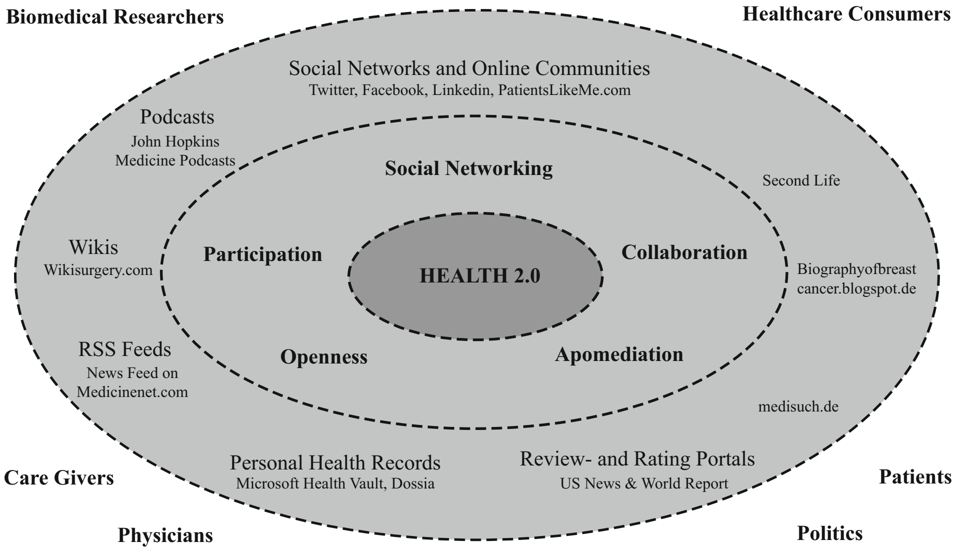

Fig. 7.1 Characteristics, applications with respective examples and key stakeholders of Health 2.0. (Source: Lagu et al. 2010; Frost and Massagli 2008)

lematic of the security of reliability or validity of the data as well as a higher frequency of undesirable events in SM were found as main problems by the analysis of 16 databases and two Internet search engines UK's SM (Golder et al. 2015). Different types of breaches of professional conduct can be hindered by healthcare professionals (Neville and Waylen 2015, p. 475–478). Methodological and ethical issues of engaging in health research using social media are required to get more scientific results from huge amount of SM data (Gustafson and Woodworth 2014). Preserving privacy and confidentiality of online users is the main concern of data usage of patients to prevent abuse of data (Denecke et al. 2015, p. 137–147). Quality, accuracy, reliability, confidentiality and privacy of SM data have to be controlled in order to decrease potential pitfalls of SM (Jermacane 2015). SM in researches, public health, mobile health applications, and global health results are used in major ethical issues like informed consent for research and inequalities in global health (DeCamp 2015, p. 1–9). Phenomenon participant-led research leading faster academic and public researches and collecting the adverse of medicines is the new kind of treatment. Thus, sets of standards are required like uniform ethical and scientific standards for all (Vayena et al. 2015). Moreover, the sexual and social situation of teenagers like self-esteem and high-risk adolescent behaviours are negatively affected by SM when there is no control by parents (Lisa et al. 2015).

Effective healthcare strategies and intervention can help patients to participate in their treatment by using SM. Websites of twenty Nigerian teaching and specialist hospitals were analysed to examine the usages of SM. Getting feedback from clients with 100%, presenting their vision and mission statements with 65%, post administrative and personnel structure information with 65% and give details of contracts with 60% are the major usages of SM. It is not fully utilized in health promotion with 25%, financial transactions with 10% and interactive engagement with clients with 0%. Web pages can be categorized as employee/public relations content with 100%, in-patient and out-patient–specific content with 30%, and public health promotion and education content with 25%. As a result, SM web pages can be more effectively used in Nigeria if patients can share their stories (Batta and Iwokwagh 2015, p. 176). It is found in Texas/USA that many health topic messages of management strategies can be communicated to patients with SM through Facebook, Twitter, and YouTube and measuring their returns (Castle et al. 2015). In the Arab world, the use of SM in healthcare is very low. To check the usage of SM in Saudi Arabia, a web-based survey among Twitter participants was carried out for four months in 2015 to measure the self-reported rates of Twitter use, perceived effects, and the influence of Twitter information on clinical practice on Twitter. It is found that doctors, especially young ones, seek information with 79%. 71.4% agree that Twitter is useful for the treatment of patients and increasing of medical knowledge by searching women's health, non-communicable disease and psychotherapy with 20%, 18.1% and 14.5% respectively (Al-maiman et al. 2015, p. 263–266). 246 German web portals with health care related content were analysed to learn their degree of specialization in healthcare, web 2.0 products and services, actors and revenue such as language and regional or national. Orientation, portal specialized in a certain healthcare topics, communication etc. were found to be main aspects for health care virtual communities (Görlitz et al. 2015). Social networking sites (SNSs) were used to search health-related information by 59% of American adults in 2012 – mainly same or similar health conditions like TuDiabetes for diabetes mellitus. Moreover, 94% of Americans were willing to share their health data for the improvement of healthcare and 76% of them were afraid that data can be used for detrimental purposes. Apo mediation makes stakes holders independent by having the researcher and the data owner on the same hierarchical level (Grajales et al. 2014). Exercise (86%), change current medication (63%), and the add of new medication (53%) were suggested to Parkinson disease patients from August 2012 to May 2013 – 55 patients in 5 states in USA by a free telemedicine consultation with a specialist.

90% satisfaction of patient with aspects of their telemedicine visit based on ability of specialist communications and explanations (75%), ability of conveying feelings and symptoms to specialist (70%), specialist recommendations to increase life quality (70%), videoconferencing (60%) and connection speed (50%). Modifications of diet were done to 20% of the patients. They were willing to spend \$0–\$49 (55%), \$50–\$99 (21%), \$100–\$149 (15%), \$150–\$199 (3%), and more than \$200 (6%) per month for that service (Venkataraman et al. 2013). Situated Learning Theory Ubiquitous Learning for chronic patients helps patients to learn from their day-to-day activities and real situations via sensors installed at home or mobile phones. Doctors use this data to improve the treatment of quality and support self-treatment methods (Neto et al. 2014). Wearable devices, like Fitbit and JawboneUP, modern activity trackers, multimodal smartphone technology and ambient sensors can give more empowerments to patients for diet, physical activity,

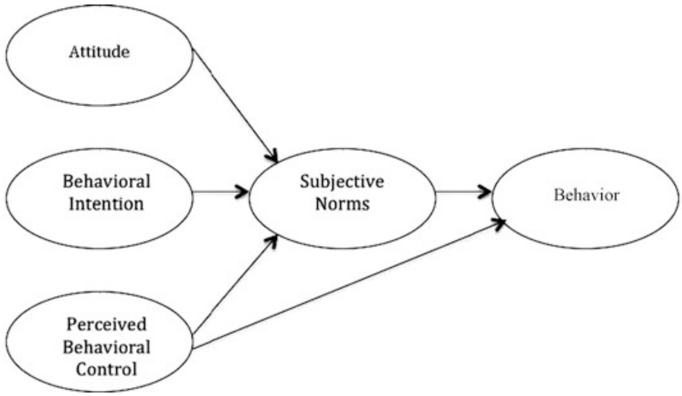

Fig. 7.2 Theory of Planned Behaviour. (Source: Hanson et al. 2014, p. 270)

weight, and stress and personal communication especially with chronic diseases. They allow measuring steps, blood oxygen saturation and pH outside of hospitals and controlling indoor and outdoor activities (Schroeder et al. 2015, p. 13). The Empowering of patients can be achieved by SM with the help of much new information like flu outbreaks or new vaccines by collecting patient data, personalize their communication and services, and reward healthy behaviours with combined statistics, natural language processing, and visualization. Keywords and user navigation graphs, a ranking algorithm, detecting drug safety signals by SM, Consumer Health Vocabulary (CHV) to help of decreasing grammatical errors and collecting data of SM providers are new improvements in SM to create a patient-centred treatment. The use of SM for outbreaks like the recent Ebola virus scare based on 26 million tweets between 30 September and 29 October 2014 was analysed that media campaigns in co-operation with media outlets can be used to develop the awareness and increase cooperation (Househ 2015).

Improving affordability, health status and patient experience are positive domains of healthcare quality management and e-Health. The Theory of Planned Behaviour (TPB) model is used to learn factors and behavioural intentions usage of Health 2.0 with 1–5 Likert Scale as shown in Fig. 7.2 (Hanson et al. 2014).

7.3 Material and Methodology

The survey prepared by Doctors 2.0 (2015) is used to learn the usage of SM in healthcare among patients taking dialysis at a private hospital and a main government hospital and students of health school at Bingöl University. To test the theory of planned behaviour of SM in healthcare, items developed by Hanson et al. (2014) are used to evaluate the trust factor (Han and Windsor 2011). Six trust items are used to evaluate the connection of trust with TPB. Cronbach's Alpha of 24 is 0.886 having enough reliability.

- H1: There are significant relationships between Trust and Intention to Use (ITU), Perceived Controls (PC), Attitude (AT) and Behaviour social media in healthcare as shown in Fig. 7.3, separately.
- H2: There are significant relationships between Trust and Behaviour to use social media in future in healthcare.
- H3: There are significant relationships between Social Norms (SN) and Intention to Use social media in healthcare.
- H4: There are significant relationships between Social Norms and Perceived Control of social media in healthcare.
- H5: There are significant relationships between Social Norms and Attitude to use social media in healthcare.
- H6: There are significant relationships between Perceived Controls and Behaviour to use social media in healthcare.

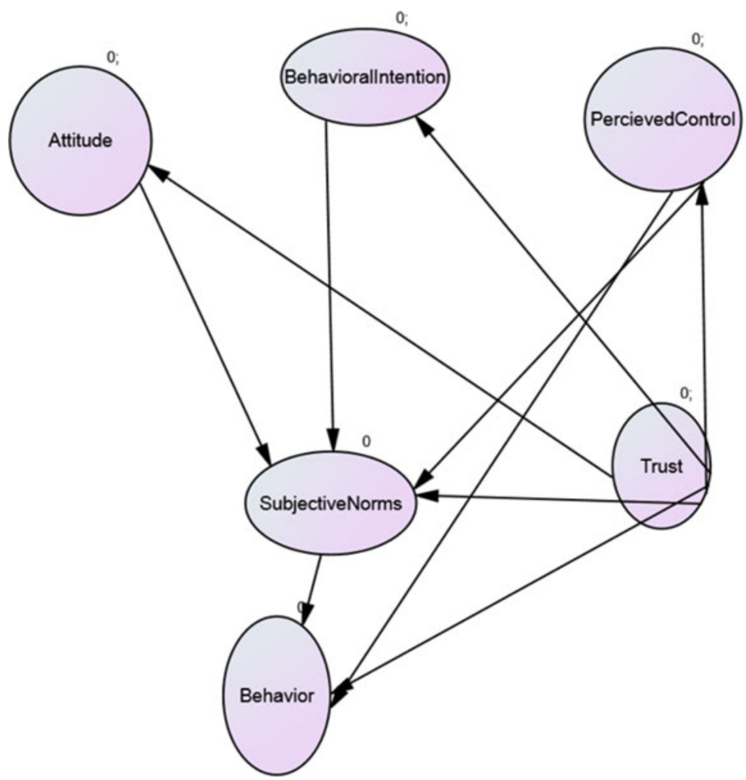

Fig. 7.3 Modelling of SM in Healthcare with TPB model

7.3.1 Results of Surveys

205 questionnaires were carried out at Bingöl University, main government hospital and at a private hospital at the end of 2015. Surveys are grouped as patient survey and staff survey. 85 of the surveyed persons from patient survey are from Bingöl city, 15 are from Diyarbakir. The rest of the respondents are mainly from close cities like Mardin. 56 are women and the rests are men. The average age is about 29 years. They mainly live in cities and have the option of getting via technology connected with different people. 87% have a monthly income of 1000–2000 TL and just eight respondents have an income of 2000–3000 TL. Just 10% are a member of web page expert sized in healthcare. Moreover, 35% have their own computer and 37% have a private internet connection. Moreover, 70% have an android cell phone connected with internet. The frequency of usage of internet for healthcare purposes is sometimes (60%), just 2% use the internet always for healthcare purposes. Respondents for care their health with 35.7% – thinking all time and 32.5% – thinking frequently. Just 25.4% use the internet for themselves, 15% use it for their families' or friends' health. The internet is mainly used for entertainment with 54 and 19% for research and just 24.5% of the respondents use it for searching healthcare information.

The average of age for staff survey is about 28 years, 51.3% are female and 70.5% live in urban areas while just 15.4% of them live in rural areas. 56% are between 21–30 years old and just 3 staff members are between 31–39, which shows that the staffs are mainly young. 31% of them care for their health frequently and 29% care for their health always. 58.7% have a monthly salary of 1000–2000 TL, while 30.4% have a 2000–3000 TL salary. 80.8% are not members of any expertise health related SM. 62.3% have their private internet. About 90% use the internet for healthcare purposes and their life or surrounding people with high frequency. SM is mainly used for communication and entertainment with 80.8 and 2.6% of the respondents use it for searching healthcare information.

Ranking points are developed in Table 7.1 to measure the result of each item from scales. Being greater than 3.4 means, it is desirable and being less than 2.60 means that respondents disagree with that item. Three questions are supported while nine items are not supported as seen in Table 7.2. Items for each group are shown in Table 7.2. And means of both survey are compared based on decision and mean differences. BC1, B2, AT1 and AT3 items have important higher mean for staff while other items fall in the same decision region as shown in Table 7.2.

Table 7.1 By using max(5) and min(1) of likert scale, the score range is 0.8

Range	Affect	Scale
1.00–1.80	Not effective	Totally Disagree
1.81–2.60	Little effective	Disagree
2.61–3.40	Moderately	Moderately Agree
3.41–4.20	Effective	Agree
4.21–5.00	Very effective	Totally agree

Table 7.2 Items means and results

Group	ITEM	Mean for Patients	Mean for Staff	Decision
AT1	I think that using social media to get health information	3.3	3.6	**Support**
AT2	I support that would be useful	3.4	3.7	**Support**
AT3	I support that would be beneficial for my health	3.4	3.6	**Support**
SN1	People that are important to me recommend that I use social media for getting health information and support	3.2	3.2	Moderately Supported
SN2	If I use social media to get health information and support, people that are important to me would approve	3.2	3.2	Moderately Supported
SN3	I think most of my acquaintances use social media for getting health information and support perceived	2.9	3.0	Moderately Supported
BC1	For me, using social media to get health information and/or support would be easy	3.3	3.6	Moderately Supported
BC2	I feel capable enough to use social media to get health information and support	3.2	3.5	Moderately Supported
BC3	I know how to use social media to get health information and support	3.0	3.7	Moderately Supported
ITU1	I plan to use social media sometime within the next week to get health information and/or support	3.1	2.9	Moderately Supported
ITU2	I plan to use social media in the next week to communicate with others about health	2.6	2.6	Moderately Supported
ITU3	I intend to use social media to post more information about my health for others to view in the next week	2.2	2.0	**Not Supported**
B1	I use social media to get health information and support	2.8	2.9	Moderately Supported
B2	I use social media to check for healthcare updates on people that are important to me	2.9	3.2	Moderately Supported
B3	I share information about my health through social media	2.3	2.1	**Not Supported**
SMP-B4	Connecting me with other patients who have the same health condition	2.4	2.3	**Not Supported**
SMP-B5	Helping me talk to my doctor	2.2	2.1	**Not Supported**
SMP-B6	Help me get health information about my illness	2.9	2.7	Moderately Supported

Table 7.2 (Continued)

Group	ITEM	Mean for Patients	Mean for Staff	Decision
T1	I think that It is reliable	2.4	2.3	**Not Supported**
T2	I think that best advices are given by SM	2.4	2.4	**Not Supported**
T3	I think that my private information are protected	2.3	2.3	**Not Supported**
T4	I think that my shares and photos are protected	2.3	2.1	**Not Supported**
T5	I think that SM is trustable	2.3	2.3	**Not Supported**
T6	I think that I trust shares and photos on SM	2.3	2.3	**Not Supported**

Summary of frequency tables of patients' survey from doctors 2.0 (2015) questions:

- 70.6% of respondents stated that there must always have been an assigned healthcare professional to ensure the quality of information at all times in a patient forum/community while 18.3% of them stated that there may be one and 13% of them do not want any healthcare professional as a moderator.
- 73.8% of respondents want that real identity must be used by a healthcare professional when communicating on the internet while just 4.8% of them support a pseudonym all the time and 15.1% do not care about it.
- 48.4% of respondents want their friends to be in contact with their doctor and 12.7% of them suggest other healthcare professionals to friends on Facebook or Twitter while 28.6% of them do not support any communication with any of their healthcare staffs.
- 82.5% of respondents want the real identity of a healthcare staff in exchanging information on a forum like Facebook or Twitter while 11.1% of them agree with real identity or a pseudonym and just 5% support a pseudonym account.
- 55.6% of the patients do not want a health professional to share any information with another health professional on public social media (Facebook, Twitter) and 30.2% of them agree as if not any patient identified while 14.3% of them agree with sharing information to other health staff.
- 66.7 and 11.9% support the use of real name, photo and pseudonym, respectively for a patient participating in an online forum or community, while 21.4% stated "it doesn't matter".
- 55.6% of them found social media not trustable

Summary of frequency tables of staff survey from doctors 2.0 (2015) questions:

- 69% of them prefer healthcare staff to control the quality of blogs and forms,
- 73% stated that the healthcare professional has to use his/her real name or information,
- 51% can be in communication with patients and 23% prefer SM to be in communication.
- 87% prefer to use real identity in SM,

- 58% are against sharing information of patients with other healthcare staff and 37% stated that if a patient allows, data can be shared.
- 62% are in support of using real name and photo and for 27% of them, it does not matter.
- 53% agree that using SM in healthcare is safe.

Both results are compared in Table 7.3. Main concerns are the same: lack of trust, privacy of patients and staffs and share of data.

WhatsApp is the most frequently used type of social media. First group respondents are using it 5.7 times per week, for staffs it is 16 times per week. Facebook and SMS communications are also widely used by respondents. Moreover, Instagram, YouTube and Twitter are other famous types of widely used social media in health. Facebook, Google+ and WhatsApp are the most widely used types of social media in exchanging healthcare data. 54 and 58% of the respondents are members of Facebook and WhatsApp, respectively, but not using it for health information exchange. LinkedIn is the lowest used social media type by 95% not being the member of it as seen in Table 7.4. Staffs use between two-three times more WhatsApp, Facebook, SMS, Instagram, CellApp and YouTube than patients.

In open questions, respondents agree that SM is useful and is a suitable communication method. 60% trust social media, while 40% find it untreatable. Security, bad usage like downloading unsuitable videos, making asocial and privacy are main concerns of respondents limiting the usage of SM. Moreover, staffs stated that bad usages like giving wrong information have to be forbidden and it should be used for beneficial purpose such as communicating with pharmacy or doctors. Security and decreasing socializations are other major problems of staff. Trust factor has the lowest mean with 2.3 and patient so-

Table 7.3 Comparing summary of both surveys

Item	Hypothesis result for patient survey	Hypothesis result staff survey
Managing SM-H Group	There is a need of healthcare staff as moderator	There is a need of healthcare staff as moderator
Using identify information by doctors or professionals	Can use real name or alias	Must use real name or alias
Being in Communication	Being in communication with doctor and pharmacist	Being in communication with healthcare staffs
As patient, using alias by healthcare staff	Staffs are to use real name	Should use real identify information
Sharing patient information	If patients not known, it can be shared	If patients not known, it can be shared or not
Shares by patient/Shares of patient data	Patients are to use alias	Should use alias
Trust	44% trust in SM of healthcare	45% trust in SM of healthcare

Table 7.4 Social Media sites used in healthcare in percentage

SM Type	I am not a member (%)		I am a member but I do not exchange information about health (%)		I am a member and I exchange information about health (%)	
SM-Used	Patients	Staff	Patients	Staff	Patients	Staff
Facebook	28.6	44	54.0	44	17.5	12
Twitter	69.8	68	23.8	28	6.3	4
Google+	62.7	32	19.0	32	18.3	36
LinkedIn	95.2	88	4.0	12	0.8	0
WhatsApp	27.8	0	57.9	72	14.3	28
Instagram	53.2	48	38.1	40	7.9	12

Table 7.5 Pearson correlation of groups

Group	At	SN	BC	ITU	BE	PSMP	TRUST
At(Item1–3)	1	0.577^{**}	0.697^{**}	0.317^{**}	0.238^{**}	0.201^{*}	0.178^{*}
SN	0.577^{**}	1	0.586^{**}	0.497^{**}	0.489^{**}	0.371^{**}	0.352^{**}
BC	0.697^{**}	0.586^{**}	1	0.540^{**}	0.413^{**}	0.375^{**}	0.274^{**}
ITU	0.317^{**}	0.497^{**}	0.540^{**}	1	0.553^{**}	0.544^{**}	0.285^{**}
BE	0.238^{**}	0.489^{**}	0.413^{**}	0.553^{**}	1	0.677^{**}	0.285^{**}
PSMP	0.201^{*}	0.371^{**}	0.375^{**}	0.544^{**}	0.677^{**}	1	0.459^{**}
Trust	0.178^{*}	0.352^{**}	0.274^{**}	0.285^{**}	0.285^{**}	0.459^{**}	1

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

cial media use preferences group has 2.53 mean while attitude has 3.37 mean. It is clear that people do not trust social media channels. Correlations for each groups are shown in Table 7.5. There is a 0.697 positive correlation significant at the 0.01 level (2-tailed) between Attitude (At) and Behavioural control (BC). The weakest correlation is between Trust group and Attitude significant at the 0.05 level (2-tailed).

7.3.2 Structural Equation Modelling (SEM)

The survey items are used to check the Hanson et al. (2014) model and add trust factor to check hypothesis and factor analysis by using AMOS program is carried out to check the validity of model based on CMIN/DF (<5) with 1.95, CFI (>0.9) with 0.922 and RMSEA (<0.08) with 0.068 and items below with variables below are decided to be in the model. Patients' preferences items are categorized under behaviour variable while they also measure future behaviour to use SM in healthcare. Factor analysing is made to increase the model validity parameters as shown in Fig. 7.4.

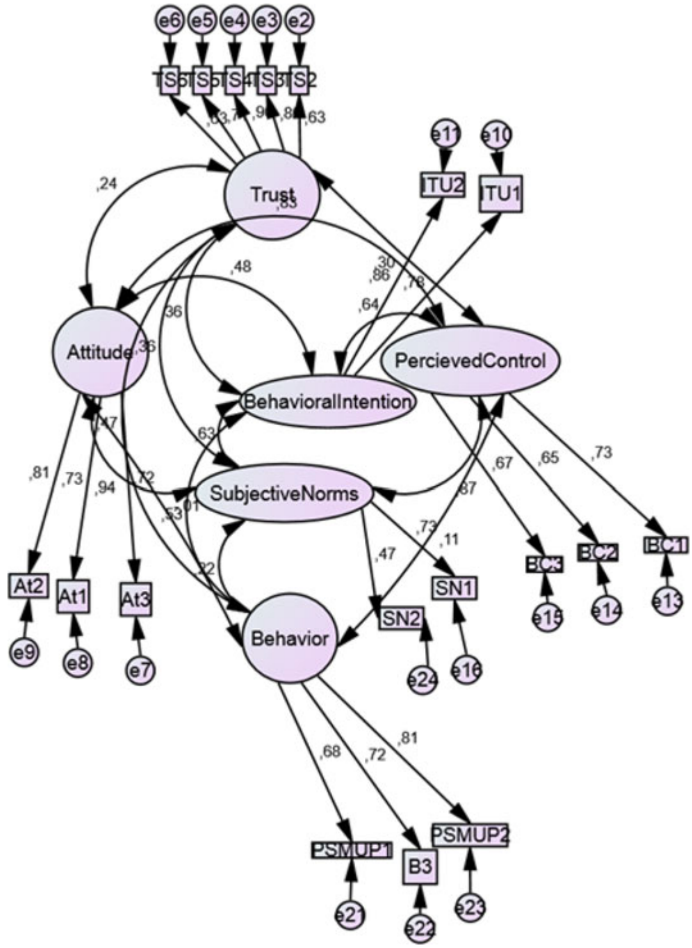

Fig. 7.4 Factor analysing

When a line from PC to Behaviour is drawn, PC and Behaviour and SN to Behaviour hypotheses are rejected by using 205 sample size. When Trust factor is added to the model, there are significant relationships between Trust and ITU and Trust and Behaviour while SN and Trust do not have any relationship with each other as shown in Table 7.6.

When, 19 respondents not filling trust items are excluded and Trust is connected to just behaviour, results in Table 7.7 are found from 186 sample size.

Table 7.6 Summary of Hypotheses

			Estimate	S.E.	C.R.	P	Decision
Subjective Norms	←	Attitude	0.743	0.235	3.161	0.002	Supported
Subjective Norms	←	Behavioural Intention	0.266	0.115	2.315	0.021	Supported
Subjective Norms	←	Perceived Control	0.135	0.272	0.495	0.621	Not-Supported
Behaviour	←	Subjective Norms	0.175	0.077	2.253	0.024	Supported

Table 7.7 Excluding 19 respondents

			Estimate	S.E.	C.R.	P	Label
Subjective Norms	←	Behavioural Intention	0.309	0.145	2.133	0.033	Supported
Subjective Norms	←	Perceived Control	−0.224	0.365	−0.614	0.539	Not Supported
Subjective Norms	←	Attitude	1.063	0.306	3.478	***	Supported
Behaviour	←	Subjective Norms	0.029	0.090	0.319	0.750	Not Supported
Behaviour	←	Trust	0.581	0.123	4.710	***	Supported

7.4 Discussion and Future Searches

Situated learning theory ubiquitous can help patients to organize and learn from their daily activities by controlling critical body signs and being able to communicate with doctors or other experienced patients to improve their life quality. As in CKF Facebook group in Turkey, patients make suggestions to other group members about diet, sport, blood pressure, diabetic and share their test results. Many patients feel loneliness due to their illnesses and have depression due to heavy load of illnesses as happened to CKF patients by visiting hospital three–four times per week and constraints of not eating what they want, drinking limited amount of water. Moreover, blood pressure, debility, diabetic, depression can be developed during treatment, making them more hopeless. Moreover, language barriers like not being able to use Turkish fluently in East of Turkey can be decreased by using Kurdish knowing doctors to make suggestions in blogs or forums as videos.

The social networking platform PatientsLikeMe.com and Microsoft HealthVault (HV) are the most famous web pages to bring patients together to share their experiences. 4.5% of all searches were found to be health related from 2001 to 2013 and recently 50–60% of people from various countries look for health related information especially young and female users. More hospitals are using SM mainly for education. Social networking is bringing together many people in similar fields like PatientsLikeMe.com, participation of patients and health care professionals with accessing personal health records like HealthVault, collaboration editing content of knowledge, openness connecting third-party databases, and to the transparency of records and Apo mediation named as a "cloud of patients" seeking advices from peers are main parameters of these SMs. In Microsoft HealthVault, patients can allow access of hospitals or healthcare staff for patients' records. Moreover, patients can download some data like laboratory results. HV providers, insurance companies or employers are met at HV web page. Main competitors are the US-based Dossia and the Norwegian World Medical Card (WMC). Patientslikeme (PLK) helps similar patients to meet at the same platform. In this way, healthcare costs can be decreased and more benefits can be gotten from the patients' perspective and provider perspective (Gurtner and Soyez 2015; HV 2015; Dossia 2015; PLM 2015; WMC 2015). As from survey, it is seen that patients are not very eager to use social media and not good at using SM technologies. For that aim, a country wide social media can be managed by governments for each illness and a healthcare expert moderator can control shares and answer questions. New developments like a new treatment methods, advices about medicines, diet, sport can be done patients with their benefits and advise them in case any patient needs helps.

To clarify the topic, SMs web pages in healthcare can be analysed and patients can be surveyed to improve the usages and benefits in Turkey with larger sample size. Moreover, healthcare staffs using SM for patients can be interviewed or surveyed in that study. This study was carried out in Bingöl and people there have lower education level when compared with west cities in Turkey. Thus, this study cannot be generalized for Turkey. TPB Model showed that there are some problems related to subjective norms and trust factor is to be included in the model. Thus, this model with larger sample size can be applied to other cities. Many people use SM to chat or for entertainment, e-business, e-government etc. and the usage of social media in healthcare is low in Turkey. More awareness can be created by governments with promotions and supports like giving each patients a SM device with internet connection.

Conclusion

The Hypothesis between PC and SN is rejected and this hypothesis was accepted in literature by Hanson et al. (2014). Respondents are in support of the benefits of SM in healthcare, however, many patients are not well educated and thus the knowledge about social media usage is low. Patients and staffs can be taught how to use SM and some devices can be given by Turkish governments to poor patients with free internet connections. Another factor added the model is trust. Trust has direct effect on intention to use and behaviour in models. The respondents do not trust the social media from descriptive statistics. Hence, the usage of real names and photos of doctors, a healthcare moderator for SM healthcare web pages, not sharing patients with third parties are suggested by them and staffs support to share the data of patients with third parties with their permissions. When any SM web page is designed, factors of TPB with trust have to be considered to increase the usage of SM in healthcare. One drawback is that

SM and behaviour hypothesis are rejected in the second sample size, thus the sample size is to be large enough to get more accurate results.

WhatsApp, Facebook, Instagram and Google+ are the most used types of SM web pages in healthcare. Increasing usage of these SMs can be used for beneficial ways in healthcare. Almost every kinds of information transfer can be done by these famous SM channels. Photos, chats, business, e-videos etc. are kinds of activities almost done by every mobile and internet user. As a result, promotions and supports have to be done by governments to help patients and impose preventive measures to people. To increase the intention to use SM and actual usages in healthcare and, privacy of patients can be improved against any misuses. Doctors have to encourage patients to talk with them by SM and patients can communicate with other patients. Almost all trusts items have low mean in the survey and they are not supported. Respondents agree that it is beneficial to use SM in healthcare.

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The Analysis of Factors that Affect Innovation Performance of Logistics Enterprises in Turkey

8

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Contents

8.1 Introduction

Services have become a compulsory factor that assists primary industries to accomplish global competitiveness (Chapman et al. 2003). There is a common consensus that eco-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_8

nomic growth, higher incomes, and technological advances have played a part to the economic growth of service-sector enterprises (Patterson 1995).

The scope of innovation attempts are revealed with Oslo Manual as follows: “Innovation comprises a number of activities that are not included in R&D, such as later phases of development for preproduction, production and distribution, development activities with a lesser degree of novelty, support activities such as training and market preparation, and development and implementation activities for innovations such as new marketing methods or new organizational methods which are not product and process innovations”. Innovation activities may also include acquisition of external knowledge or capital goods that is not part of R&D (OECD 2005).

Enterprises can employ innovation for several reasons. According to the Oslo Manual, “Their objectives may involve products, markets, efficiency, quality or the ability to learn and to implement changes. Identifying enterprises’ motives for innovating and their importance is of help in examining the forces that drive innovation activities, such as competition and opportunities for entering new markets” (OECD 2005).

Almost every manufacturing enterprises have to be aware of the service aspects of their product-service mix, due to the service component of their services offers the best chance of gaining sustainable competitive advantage. Today business enterprises have to constantly seek for innovative strategies to enhance their competitiveness in global marketplace.

Innovation in services is a value-creating function that drives market orientation and operational performance and efficiency, to benefit both service providers and consumer (Slater and Narver 1995; Hackbarth and Kettinger 2000; Garicano and Kaplan 2001).

In general, innovations can be seen as a vital factor for economic growth and competitiveness. Therefore, the competitiveness of logistics enterprises is quite related to their ability to be innovative and their characteristics such as quality, speed and flexibility (Wagner 2008).

Logistics industry seems, by all accounts, to be an industry which requires both innovative and non-technological innovations. The Logistics industry is affected by diverse factors like government policies, legislations, the natural/technological environments, changing consumer perceptions, therefore, enterprises working in this industry should quick respond to changes.

There are many ways to solve multi-criteria decision-making (MCDM) managerial problems, like Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Vise Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR), Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), Decision-making Trial and Evaluation Laboratory (DEMATEL), Data Envelop Analysis (DEA), Elimination and Choice Expressing Reality (ELECTRE), etc. When decisions are made by comparing and ranking over all the criteria, they all involve uncertainty and imperfect information processing to some extent, like randomicity, fuzzy, roughness. Zadeh (1965) presented the concept of fuzzy sets, Bellman and Zadeh (1970) presented together with the basic model of fuzzy decision.

In this study, we proposed a comparative analysis that exploits fuzzy DEMATEL technique and the Turkish Innovation Survey for determining the importance of factors that affect innovation performance of logistics enterprises in Turkey. The obtained results of fuzzy DEMATEL are compared to Turkish Innovation Survey that has been carried out by Turkish Statistical Institute (TurkStat) using Community Innovation Survey model questionnaire, which is based on the Oslo Manual with the three year observation period on a two-yearly basis (Turkstat 2013).

In this survey, results are given according to the Statistical Classification of Economic Activities in the European Community (NACE Rev.2.). Oslo Manual presents guidelines for collecting data on the general process of innovation (for example, innovation activities, expenditures and linkages), the implementation of significant changes in the firm (i.e. innovations), the factors that influence innovation activities, and the outcomes of innovation (OECD 2005). According to NACE (Rev.2) coding, logistics activities are gathered under the group of Transportation and Storage (NACE-H: 49–53).

The proposed fuzzy DEMATEL method uses fuzzy sets in describing uncertainties in the different factors. Just because some uncertainties involved in the decision process, each associated factor is represented by a linguistic variable.

Our main contribution is to provide a comparative fuzzy multi-criteria assessment to the problem of determining the importance of factors that affect innovation performance of logistics enterprises in Turkey.

The rest of this study is organized as follows: In Sect. 8.2, the logistics innovation and related literature, moreover factors influencing innovation performance are briefly introduced. In Sect. 8.3, an overview of the methods, used in this study, is given. The application of the analysis is handled in Sect. 8.4. In Sect. 8.5, a comparative assessment is discussed. Finally, the conclusion is given at the end of the chapter.

8.2 Logistics Innovation and Related Literature

Logistics management essentially interests in the physical distribution of raw materials and, at long last, finished products. Logistics are seen in all enterprises to some degree, depending on the nature of the business and the industry (Slack et al. 1999).

The scope and role of logistics functions have changed significantly over the past years. Logistics are used to have a supportive role to primary functions, for instance, marketing and manufacturing. But today they have expanded to cover warehousing and transportation activities, purchasing, distribution, inventory management, packaging, manufacturing, and even customer service.

All the more critically, logistics management has evolved from an inactive, cost-absorbing function to that of a key element that provides a unique competitive advantage in today's competitive market environment (Bowersox and Closs 1996).

Numerous logistics enterprises attempt to enhance their competitiveness by offering more comprehensive service packages (Hong and Liu 2007). Further, logistics enterprises attempt to distinguish themselves in the marketplace through innovation (Cui et al. 2009).

Some recent logistics researches have largely ignored innovation (Flint et al. 2005; Wagner 2008) and innovation research commonly concentrates on product or/and process innovation (Evangelista et al. 2008), and this moderate advance in service innovation was introduced as "laggard" by Miles (1993). According to Oke (2004, 2008), there is not a common and consistent understanding of the meaning of logistics innovation across the enterprise.

One of the earliest contributions that relates logistics to competitive strategy is revealed by Christopher (1993). He represents a reference point for the literature on logistics innovation.

While there is a rich literature discussing business and product innovation (Drucker 1985; Tidd et al. 2001; Chesbrough 2003; Huston and Sakkab 2006), limited literature covering both logistics innovation and its processes can be found (Flint et al. 2002; Roy et al. 2004; Flint et al. 2005, 2008; Busse and Wagner 2008; Wallenburg 2009).

As one can see the authors indicate the lack of researches regarding to logistics innovation generally, Grawe (2009) also describes the inadequate research about logistics innovation as: "The literature does address logistics technologies (Electronic Data Interchange (EDI), Radio Frequency Identification (RFID)) and logistics programs (vendor-managed inventory, cross-docking, etc.) and their roles in logistics operations and relationships, but there remains a significant gap in terms of research aimed at understanding drivers of logistics innovation and the specific benefits of this type of innovation".

The definition of the concept of logistics innovation was made by Flint et al. (2005) who also have introduced the logistics innovation theory. They define logistics innovation as "any logistics related service from the basic to the complex that is seen as new and helpful to a particular focal audience". In brief, logistics innovations are value added logistics activities that include improvements, developments, and novelties for customers.

Logistics innovation has a close relationship with various types of innovation such as service innovation, process innovation or organizational innovation. Logistics innovation deals with administrative and technological innovations. With regard to this situation, Wagner (2008) introduces product/service innovations, process innovations, market novelties, product range novelties and product imitations. On the other hand, Mena et al. (2007) divide logistics innovations as non-technological and technological innovations. Wallenburg (2009) analyzes the types of logistics innovations and divides these into internal and customer-oriented innovations. Besides, three different typologies of logistics innovation have also been identified: process, product/service offering and network/relationships innovation by Lin and Wu (2008) and Panayides (2006).

According to Flint et al. (2005), logistics innovation is organized from trend, scenario, and product analysis, brainstorming or costumer inputs. What's more, there is a close transaction between customer value, market orientation, organizational learning in the way of initiating logistics innovation. In addition, they assess logistics innovation as activities taken by managers to satisfy unmet customer demands.

Then again, Flint et al. (2005) demonstrate that for logistics innovation, intelligence and knowledge about customer can be accumulated from various ways. As such, a higher level of learning capability empowers enterprises to produce more alternatives for customer in the means of logistics activities and make organizations more effective in understanding customer insight.

Wagner (2008) builds a conceptual framework for logistics enterprises concerning that he examines the current status quo of German industry on innovation activities, innovation generation and innovation results. About innovation activities, he considers the innovation generation component with the elements of internal and external (R&D), knowledge acquisition, training, investment in infrastructure and capital goods. Nonetheless, although internal and external R&D exists, they can't be developed, this is why innovations in logistics industry often occur through the incremental innovation type.

Likewise, investments in infrastructure and capital goods will lead enterprises to build product/service innovations. Wagner (2008) reprimands knowledge acquisition in its many aspects and demonstrates that it may not be compelling in light of the fact that the vital customer knowledge for improvements and innovations may not be far reaching about processes, challenges and problems. Besides, he divides the innovation generation component into product/service and process innovation, market novelties, ad-hoc and planned innovations.

Other parts discussed in innovation generation component are market novelties, product range novelties and product imitations. Wagner (2008) sees market novelties as improved products or introduced services prior to competitors by enterprises. In addition, he analyzes innovation activities in terms of macro-sectoral and micro-firm level perspectives and found out that the logistics industry had the lowest percentage and came in the last place among other manufacturing and service industries. He demonstrates the reason of this as insufficient strategies, organizational structures, processes and human resources in innovation. The other reason is that logistics enterprises have largely ignored innovation activities. From the micro-firm perspective, the realization of innovation-induced revenue growth and cost reduction are essential for logistics enterprises to stay competitive.

A comprehensive review related to logistics innovation was carried out by Grawe (2009). A literature based conceptual framework was created and the antecedents, outcomes and diffusion of logistics innovation are analyzed. Grawe (2009) developed a model including environmental factors, organizational factors and these factors are related to logistics innovation. The relative competitive advantage may be revealed as an output for logistics innovation. The propositions regarding to these factors are: (i) Knowledge, Technology, Relationship network, Financial, Managerial resources and Competition, Capital scarcity are positively related to logistics innovation, (ii) Organization of labor is negatively related to logistics innovation (Grawe 2009).

Customer-centric innovations have an immense potential to create value for the customer and provide customer loyalty and, concurrently, support logistics enterprises differentiate themselves from their competitors. But then, logistics enterprises exhibit remarkable shortcomings concerning customer-centric innovations (Wallenburg 2009) and the failure rate in logistics innovation is still high (Shen et al. 2009).

As indicated by Matos and Hall (2007), radical innovation is required so as to overcome ambiguities that describe the innovation process for sustainability once conflicting pressures that are difficult to compromise are involved.

Researchers have additionally analyzed the effects and outcomes of logistics innovation under many contexts. Richey et al. (2005) introduce the positive interaction between logistics innovation and operational service quality. Panayides and So (2005) indicate that logistics innovation is positively related to logistics enterprises' effectiveness. Further, according to Wallenburg (2009), innovation can assist logistics enterprises to increase customer loyalty.

8.2.1 Factors Influencing Innovation Performance

For the analysis of determining the importance of factors that affect innovation performance of logistics enterprises in Turkey, the criteria described below are used. The criteria are defined according to the innovation indicators used in Turkish Innovation Survey which were conducted between years 2010–2012 by TurkStat for comparing this results of the study.

C_1-Research and development (R&D) R&D is defined in the Frascati Manual (OECD 2002) and includes the following: i) the firm can engage in basic and applied research to acquire new knowledge and direct research towards specific inventions or modifications of existing techniques. ii) It can develop new product or process concepts or other new methods to assess whether they are feasible and viable, a stage which may involve: a) development and testing; and b) further research to modify designs or technical functions. R&D can be classified in two categories; (i) Intramural (in-house) R&D: Creative work undertaken on a systematic basis within the enterprise in order to increase the stock of knowledge and use it to devise new applications. This comprises all R&D conducted by the enterprise, including basic research. (ii) Extramural (External) R&D: Same activities as intramural R&D, but purchased from public or private research organizations or from other enterprises (including other enterprises within the group (OECD 2005).

C_2-Expenditures An alternative would be to collect information on total expenditures on activities related to individual innovations (Oslo Manual 2005). Innovation activities, including capital purchases, R&D and other current expenditures related to innovations, can be characterized as investments in that they may yield returns in the future. Quantitative measures of expenditures on each innovation activity provide an important measure of the level of innovation activity at enterprise, industry and national levels. Innovation expenditures can be considered under four categories; (i) R&D (include both Intramural and Extramural R&D) in total product and/or process innovation expenditure, (ii) acquisition of machinery, equipment and software in total product and/or process innovation expenditure, (iii) acquisition of other external knowledge (know-how etc.) in total product and/or process innovation expenditure, (iv) all other innovation activities including design, training, marketing and other relevant activities in total product and/or process innovation expenditure.

C_3- Financial findings As one of the fundamental components, finance acts as a stimulator of innovation within enterprises. Finance is very important for all organizations. Innovation investments usually install a huge cost to the enterprises. The enterprises are needed to have strong financial resources for innovation (Mena et al. 2007). According to Oslo Manual (OECD 2005), enterprises can be provided financial findings from; (i) central government, (ii) local or regional authorities, and (iii) international organizations.

C_4- Knowledge sources A firm's dedication to yield contemporary knowledge by being a "learning" and "teaching" organization is indispensable if a firm requires to maintain and enrich the value of its knowledge resource (Chapman et al. 2003). Moreover, Flint et al. (2005), argues that learning enables the inclusion of additional ways of understanding the customer desires and sharing them through the organization. Knowledge sources have to be used so as to understand and gather associated information from market and sector environment. Knowledge becomes one of the unique sources for competence. In this sense, according to Chapman et al. (2003), a worker with high knowledge has a high status and plays a leading role, because the knowledge of their employees is the single greatest asset possessed by firms today. Besides, knowledge resources are mostly related to learning and teaching within companies. Establishing effective networks with technological and scientific knowledge sources refer to the information channels and they may be accomplished both in-house and outside of the organization.

C_5- Co-operation arrangements Co-operation arrangements are defined in the Oslo Manual (OECD 2005) as: (i) Innovation co-operation involves powerful participation in joint innovation projects with the others. These may either be other enterprises or non-commercial organizations. The partners need not derive immediate commercial benefit from the venture. Pure contracting out of work, where there is no active collaboration, is not regarded as co-operation. Co-operation is distinct from open knowledge sources and acquisition of knowledge and technology in that all parties take an active part in the work. (ii) Innovation co-operation provides enterprises to access knowledge and technology that they would be unable to utilize on their own. There is also great potential for synergies in co-operation as partners learn from each other. (iii) Innovation co-operation may take place along supply chains and involve customers and suppliers in the joint development of new products, processes or other innovations. Innovation co-operation can also involve horizontal collaboration, with enterprises working jointly with other enterprises or public research institutions.

8.3 Methods

8.3.1 Fuzzy Sets and Triangular Fuzzy Numbers

Fuzzy set theory, a mathematical theory, is first introduced by Zadeh (1965), designed to model the vagueness or imprecision of human cognitive processes. In this study, we used triangular fuzzy number (TFNs) because of ease using a TFN for the decision-makers to calculate (Giachetti and Young 1997; Moon and Kang 2001) and TFNs are useful in promoting representation and information processing in a fuzzy environment (Liang and Wang 1993; Tang 2009). Moreover, it has verified that modeling with TFNs is an efficient way for formulating decision problems where the information available is subjective and inaccurate (Kahraman et al. 2004; Chang et al. 2007). Furthermore, the TFNs best suits the nature of linguistic assessments of experts, and they are the most utilized in fuzzy MCDM studies (e.g., Ayag and Ozdemir 2012; Liu et al. 2013; Patil and Kant 2014; Guzel and Erdal 2015).

Fundamental definitions of fuzzy set, fuzzy numbers and linguistic variables are reviewed from Chen (1996), Cheng and Lin (2002), Amiri (2010), and Guzel and Erdal (2015) and given below:

Definition 1 A TFN $\tilde{a}$ can be defined by a triplet (a_1, a_2, a_3). The membership function $\mu_{\tilde{a}}(x)$ defined as:

$$\mu_{\tilde{a}}(x) = \begin{cases} 0 & x < a_1 \\ \frac{x-a_1}{a_2-a_1} & a_1 < x < a_2 \\ \frac{x-a_3}{a_2-a_3} & a_2 < x < a_3 \\ 0 & x > a_3 \end{cases}$$

Definition 2 If $\tilde{a}$ and $\tilde{b}$ were two TFNs, which have been illustrated by the triplet (a_1, a_2, a_3) and (b_1, b_2, b_3), respectively, and then the operational laws of these two TFNs are as below:

$$\tilde{a} + \tilde{b} = (a_1, a_2, a_3)(+)(b_1, b_2, b_3) = (a_1 + b_1, a_2 + b_2, a_3 + b_3) \tag{8.1}$$

$$\tilde{a} - \tilde{b} = (a_1, a_2, a_3)(-)(b_1, b_2, b_3) = (a_1 - b_1, a_2 - b_2, a_3 - b_3) \tag{8.2}$$

$$\tilde{a} \times \tilde{b} = (a_1, a_2, a_3)(\times)(b_1, b_2, b_3) = (a_1 \times b_1, a_2 \times b_2, a_3 \times b_3) \tag{8.3}$$

$$\tilde{a}/\tilde{b} = (a_1, a_2, a_3)(/)(b_1, b_2, b_3) = (a_1/b_1, a_2/b_2, a_3/b_3) \tag{8.4}$$

$$\tilde{a} = (ka_1, ka_2, ka_3) \tag{8.5}$$

Definition 3 A linguistic variable that illustrate by terms as very low, low, etc. use to describe complex condition (Zadeh 1974). These linguistic values may also be demonstrated by fuzzy numbers (Amiri 2010).

Fuzzy aggregation processes have to embody a defuzzification procedure that considers the spread, height and shape of a TFN as essential characteristics of the fuzzy number. The centroid (Center-of-gravity, COA) method is widely-used in defuzzification. However, it cannot differ two fuzzy numbers with the same crisp value, if they have different shapes. The CFCS (Converting Fuzzy data into Crisp Scores) defuzzification method (Opricovic and Tzeng 2003) is widely-used and suitable for the fuzzy aggregation process. The CFCS method obtains more appropriate crisp value (Opricovic and Tzeng 2003; Wu and Lee 2007).

The CFCS method is based on determining the fuzzy maximum and minimum of the fuzzy number range. According to membership functions, the overall score can be computed as a weighted average (Opricovic and Tzeng 2003). Let $\tilde{z}_{ij}^n = \left(l_{ij}^n, m_{ij}^n, r_{ij}^n\right)$, mean the degree of criterion i that affects criterion j and fuzzy questionnaires n ($n = 1, 2, 3, \ldots, h$). The CFCS method contains a five-step computational procedure presented below:

Step 1. Normalization

$$xr_{ij}^n = \left(r_{ij}^n - \min l_{ij}^n\right) / \Delta_{\min}^{\max} \tag{8.6}$$

$$xm_{ij}^n = \left(m_{ij}^n - \min l_{ij}^n\right) / \Delta_{\min}^{\max} \tag{8.7}$$

$$xl_{ij}^n = \left(l_{ij}^n - \min l_{ij}^n\right) / \Delta_{\min}^{\max} \tag{8.8}$$

$$\text{where} \quad \Delta_{\min}^{\max} = \max r_{ij}^n - \min l_{ij}^n \tag{8.9}$$

Step 2. Calculate Right (rs) and Left (ls) Normalized Values

$$xrs_{ij}^n = xr_{ij}^n / \left(1 + xr_{ij}^n - xm_{ij}^n\right) \tag{8.10}$$

$$xls_{ij}^n = xm_{ij}^n / \left(1 + xm_{ij}^n - xl_{ij}^n\right) \tag{8.11}$$

Step 3. Calculate Total Normalized Crisp Values

$$x_{ij}^n = \left[xls_{ij}^n \left(1 - xls_{ij}^n\right) + xrs_{ij}^n \times xrs_{ij}^n\right] / \left[1 - xls_{ij}^n + xrs_{ij}^n\right] \tag{8.12}$$

Step 4. Calculate Crisp Values

$$z_{ij}^n = \min l_{ij}^n + x_{ij}^n \Delta_{\min}^{\max} \tag{8.13}$$

Step 5. Combine Crisp Values

$$z_{ij} = 1/h \left(z_{ij}^1 + z_{ij}^2 + \ldots + z_{ij}^h\right) \tag{8.14}$$

8.3.2 The Fuzzy DEMATEL Method

The DEMATEL method, first presented by the Geneva Research Centre of the Battelle Memorial Institute (Gabus and Fontela 1973), is a comprehensive method for building and analyzing a structural model consisting causal relationships between complex factors. It is particularly practical and useful for visualizing the structure of complicated causal relationships with matrices or digraphs (Wu and Lee 2007). The digraphs depict a contextual relation between the elements of the system, in which a numeral represents the importance of influence. Therefore, the DEMATEL method can convert the relationships between the causes and effects of factors into an intelligible structural model of the system.

However, in the real-world situations, the relationships of causes and effects are often complex and subtle. In addition, the judgements and preferences of decision-makers/experts are often difficult to quantify in exact numerical values because of the inherent vagueness of human language. Because of this, fuzzy set theory was applied to DEMATEL for dealing problems characterized by vagueness and imprecision.

Suppose a system involves a set of elements $S = \{s_1, s_2, \ldots, s_n\}$, and particular pairwise relations are determined for modeling with respect to a mathematical relation R. Following, to present the relation R as a direct-influence matrix that is indexed equally on both dimensions by elements from the set S. Then, except the case, that the number is 0 appearing in the cell (i, j), if the entry is a positive integral that has the meaning of (1) the ordered pair (s_i, s_j) is in the relation R, and (2) there has the sort of relation regarding that element s_i causes element s_j. The computational steps of the fuzzy DEMATEL method can be briefly described as follows (Lin and Wu 2004, 2008):

Step 1. Create the Fuzzy Direct-Influence Matrix

$$\tilde{Z} = \begin{bmatrix} 0 & \tilde{z}_{12} & \cdots & \tilde{z}_{1n} \\ \tilde{z}_{21} & 0 & \cdots & \tilde{z}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{z}_{n1} & \tilde{z}_{n2} & \cdots & 0 \end{bmatrix} \tag{8.15}$$

Where $\tilde{z}_{ij} = (z_{ij1}, z_{ij2}, z_{ij3}$ are TFNs and $z_{ii}, i = 1, 2, \ldots, n)$, will be regarded as TFN $(0, 0, 0)$ whenever necessary.

Step 2. Normalize the Fuzzy Direct-Influence Matrix

$$\tilde{X} = \frac{\tilde{Z}}{r}, \tag{8.16}$$

where

$$\tilde{X} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{z}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{n1} & \tilde{x}_{n2} & \cdots & \tilde{x}_{nn} \end{bmatrix} \tag{8.17}$$

and

$$r = \max_{1 \le i \le n} \left(\sum_{j=1}^{n} z_{ij3} \right) \tag{8.18}$$

It is assumed at least one i such that

$$\sum_{j=1}^{n} z_{ij3} < r.$$

Step 3. Obtain the Fuzzy Total-Influence Matrix

$$\tilde{T} = \lim_{n \to \infty} (\tilde{X}^1 + \tilde{X}^2 + \ldots + \tilde{X}^n) = \tilde{X}(1 - \tilde{X})^{-1}, \text{when } \lim_{n \to \infty} \tilde{X}^n = 0. \tag{8.19}$$

Then

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{t}_{n1} & \tilde{t}_{n2} & \cdots & \tilde{t}_{nn} \end{bmatrix} \quad \text{where} \quad \tilde{t}_{ij} = (t_{ij1}, t_{ij2}, t_{ij3}) \tag{8.20}$$

and

$$\begin{aligned} T_1 &= [t_{ij1}]_{n \times n} = X_1(I - X_1)^{-1}, \\ T_2 &= [t_{ij2}]_{n \times n} = X_2(I - X_2)^{-1}, \\ T_3 &= [t_{ij3}]_{n \times n} = X_3(I - X_3)^{-1}, \end{aligned} \tag{8.21}$$

in which $X_1 = [t_{ij1}]_{n \times n}$, $X_2 = [t_{ij2}]_{n \times n}$, $X_3 = [t_{ij3}]_{n \times n}$, and I is designated as the identity matrix. The elements of TFNs in the fuzzy total-influence matrix $\tilde{T}$ are divided into T_1, T_2 and T_3, and $T_1 < T_2 < T_3$, when $x_{ij1} < x_{ij2} < x_{ij3}$ for any $i, j \in \{1, 2, \ldots, n\}$.

Step 4. Construct the Causal Diagram

By obtaining the fuzzy total-influence matrix $\tilde{T}$, then it is calculated $\tilde{D}_i + \tilde{R}_i$ and $\tilde{D}_i - \tilde{R}_i$ in which $\tilde{D}_i$ and $\tilde{R}_i$ are the sum of rows and the sum of columns of $\tilde{T}$, respectively. Then, the fuzzy numbers of $\tilde{D}_i + \tilde{R}_i$ and $\tilde{D}_i - \tilde{R}_i$ should be converted to crisp values by using Eqs. (8.8)–(8.16). A causal diagram can be constructed by mapping the dataset of $(\tilde{D}_i + \tilde{R}_i, \tilde{D}_i - \tilde{R}_i)$, where the horizontal axis $\tilde{D}_i + \tilde{R}_i$ is made by adding $\tilde{D}_i$ to $\tilde{R}_i$, and the vertical axis $(\tilde{D}_i - \tilde{R}_i)$ is made by subtracting $\tilde{D}_i$ from $\tilde{R}_i$. Thus, causal diagram can visualize the complex causal relationships between elements into a visible structural model and will provide valuable insights for problem solving.

8.4 The Fuzzy DEMATEL Calculations

The fuzzy DEMATEL method is used to determine the importance of factors that affect innovation performance of logistics enterprises in Turkey. This study uses an expert interview method. The 2 objects are professional experts working in innovation departments of logistics enterprises. The other 7 are academicians works on logistics and innovation. The major steps of method are conducted as follows:

Step 1. Developing Evaluation Factors and Designing the Fuzzy Linguistic Scale
In this step, it is necessary to establish sets of significant factors for evaluation. However, evaluation factors have the nature of causal relationships and are usually comprised of many complex aspects. The evaluation factors symbols in this study are as follows: R&D (C_1), Expenditures (C_2), Financial finding (C_3), Knowledge sources (C_4), and Co-operation arrangements (C_5). To gain a structural model dividing consisting factors into cause and effect groups, the DEMATEL method is used in this study. For handling with the ambiguities of human assessments, the linguistic variable "influence" is used with five linguistic terms (Li 1999) as (Very high, High, Low, Very low, No) that are expressed in positive TFNs (l_{ij}, m_{ij}, r_{ij}) as presented in Table 8.1.

Step 2. Acquiring and Aggregating the Experts' Judgements
In this step, the relationships between the factors are measured by experts through the use of the fuzzy linguistic scale, the data from each individual assessment is obtained, first. For example, the assessments of one of the academician are shown in Table 8.2. Then, aggregating the expert assessments, the fuzzy direct-influence matrix is produced as shown in Table 8.3.

Step 3. Establishing and Analyzing the Structural Model
In this step, based on the fuzzy direct-influence matrix, the normalized fuzzy direct-influence matrix (Table 8.4) is obtained by Eqs. (8.16)–(8.18).

Table 8.1 The fuzzy linguistic scale

Linguistic terms	Influence score	Triangular fuzzy number
No influence (No)	0	(0, 0, 0.25)
Very low (VL)	1	(0, 0.25, 0.50)
Low (L)	2	(0.25, 0.50, 0.75)
High (H)	3	(0.50, 0.75, 1.00)
Very high (VH)	4	(0.75, 1.00, 1.00)

Table 8.2 The assessments of one of the academician

Z	C_1	C_2	C_3	C_4	C_5
C_1	0	VH	VH	H	H
C_2	H	0	VH	VL	L
C_3	L	VH	0	H	L
C_4	L	L	VL	0	H
C_5	H	VL	L	VH	0

Table 8.3 The fuzzy direct-influence matrix

	C_1	C_2	C_3	C_4	C_5
C_1	(0.000, 0.000, 0.000)	(0.639, 0.889, 1.000)	(0.750, 1.000, 1.000)	(0.611, 0.861, 1.000)	(0.500, 0.750, 1.000)
C_2	(0.444, 0.694, 0.944)	(0.000, 0.000, 0.000)	(0.306, 0.556, 0.806)	(0.056, 0.278, 0.528)	(0.167, 0.417, 0.667)
C_3	(0.444, 0.694, 0.944)	(0.639, 0.889, 1.000)	(0.000, 0.000, 0.000)	(0.500, 0.750, 0.972)	(0.333, 0.583, 0.833)
C_4	(0.639, 0.889, 1.000)	(0.556, 0.806, 1.000)	(0.694, 0.944, 1.000)	(0.000, 0.000, 0.000)	(0.583, 0.833, 0.972)
C_5	(0.306, 0.556, 0.806)	(0.056, 0.278, 0.528)	(0.083, 0.306, 0.556)	(0.139, 0.333, 0.583)	(0.000, 0.000, 0.000)

Table 8.4 The normalized fuzzy direct-influence matrix

	C_1	C_2	C_3	C_4	C_5
C_1	(0.000, 0.338, 0.397)	(0.324, 0.265, 0.000)	(0.338, 0.397, 0.324)	(0.265, 0.000, 0.338)	(0.397, 0.324, 0.265)
C_2	(0.235, 0.000, 0.162)	(0.029, 0.088, 0.235)	(0.000, 0.162, 0.029)	(0.088, 0.235, 0.000)	(0.162, 0.029, 0.088)
C_3	(0.235, 0.338, 0.000)	(0.265, 0.176, 0.235)	(0.338, 0.000, 0.265)	(0.176, 0.235, 0.338)	(0.000, 0.265, 0.176)
C_4	(0.338, 0.294, 0.368)	(0.000, 0.309, 0.338)	(0.294, 0.368, 0.000)	(0.309, 0.338, 0.294)	(0.368, 0.000, 0.309)
C_5	(0.162, 0.029, 0.044)	(0.074, 0.000, 0.162)	(0.029, 0.044, 0.074)	(0.000, 0.162, 0.029)	(0.044, 0.074, 0.000)

Table 8.5 The fuzzy total-influence matrix

	C_1	C_2	C_3	C_4	C_5
C_1	(2.120, 2.485, 2.420)	(1.874, 2.051, 2.120)	(2.485, 2.420, 1.874)	(2.051, 2.120, 2.485)	(2.420, 1.874, 2.051)
C_2	(1.180, 1.052, 1.141)	(0.814, 0.946, 1.180)	(1.052, 1.141, 0.814)	(0.946, 1.180, 1.052)	(1.141, 0.814, 0.946)
C_3	(1.894, 2.049, 1.710)	(1.510, 1.627, 1.894)	(2.049, 1.710, 1.510)	(1.627, 1.894, 2.049)	(1.710, 1.510, 1.627)
C_4	(2.344, 2.423, 2.373)	(1.609, 2.059, 2.344)	(2.423, 2.373, 1.609)	(2.059, 2.344, 2.423)	(2.373, 1.609, 2.059)
C_5	(0.795, 0.731, 0.719)	(0.586, 0.583, 0.795)	(0.731, 0.719, 0.586)	(0.583, 0.795, 0.731)	(0.719, 0.586, 0.583)

Next, the fuzzy total-influence matrix (Table 8.5) is acquired by using Eqs (8.19)–(8.21). from the normalized fuzzy direct-influence matrix.

Next, the CFCS method, described in Eqs (8.6)–(8.14). , is used to aggregate the fuzzy data. The defuzzied influence of concern factors in criteria level are presented in Table 8.6. The threshold value calculated as 1.564.

Table 8.6 The defuzzied influence of concern factors in criteria level

Criteria	$\tilde{D}_i$	$\tilde{R}_i$	$\tilde{D}_i + \tilde{R}_i$	$\tilde{D}_i - \tilde{R}_i$
C_1	10.950	8.333	19.283	2.618
C_2	5.132	8.741	13.873	−3.609
C_3	8.790	8.364	17.154	0.427
C_4	10.808	6.392	17.200	4.416
C_5	3.414	7.265	10.679	−3.852

Finally, the influence values and priority rankings of factors are demonstrated in Table 8.7.

Based on the above analysis, the causal diagram (Fig. 8.1) is acquired by mapping a dataset of $(\tilde{D}_i + \tilde{R}_i, \tilde{D}_i - \tilde{R}_i)$. Looking at the causal diagram, it is clear that evaluation factors are visually divided into the cause group, including C_1, C_3 and C_4 while the effect group was composed of such factors as C_2 and C_5. Therefore, according to the causal diagram, the cause-and-effect relations among the factors are generated in Table 8.8.

From Tables 8.6 and 8.7, and Fig. 8.1, it can be observed that R&D (C_1) apparently has the most influence on logistics innovation performance. The ranking order of importance of factors is obtained as R&D (C_1) > Knowledge sources (C_4) > Financial funding (C_3) > Expenditures (C_2) > Co-operation arrangements (C_5).

Table 8.7 The influence values and priority rankings of factors

Criteria	Influence value	Ranking
C_1	0.24	1
C_2	0.18	4
C_3	0.21	3
C_4	0.22	2
C_5	0.14	5

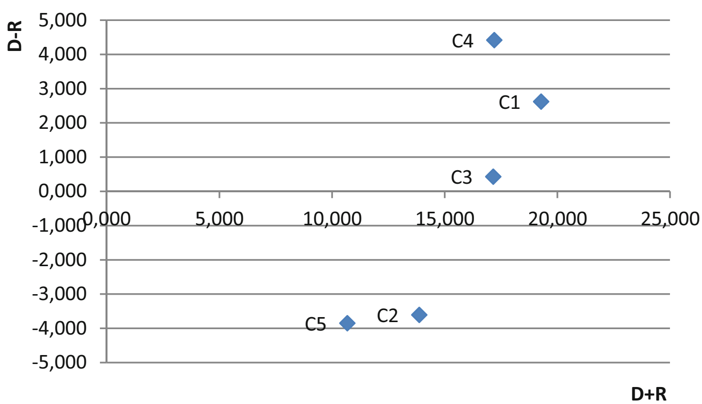

Fig. 8.1 Causal diagram

Table 8.8 The causal relationship

Cause factors	Effect factors
R&D (C_1)	Expenditures (C_2)
Financial funding (C_3)	Co-operation arrangements (C_5)
Knowledge sources (C_4)	

8.5 Discussion and Comparing the Obtain Result to Turkey Innovation Survey

In this study, we have fuzzy DEMATEL for determining the importance of factors that affect innovation performance of logistics enterprises in Turkey. We conducted five factor that thought to influence the firm's innovation performance. There are many factors that nurture the growth of services and drive innovation. Since, through the evaluation process of Turkish Innovation Survey, the five factor used in this study are conducted. Therefore, it is decided to evaluate the same criteria for a comparative study.

In the three-year period of 2010–2012, among the logistics enterprises were innovative, which participate in the survey, vital information have been gathered. Per cent of logistics enterprises conducted In-house R&D is 22 while the per cent of logistics enterprises conducted External R&D is 15, 56. Similar to our results R&D is assessed to the most important factor for innovation performance. In literature, many research discusses innovation in the context of R&D and also indicates the positive impact of R&D in the innovation process (Mena et al. 2007; Holtzman 2008; Greenhalgh and Rogers 2010; Arlbjørn et al. 2011). Also, the Oslo Manual and Cainelli et al. (2004) indicate that R&D plays a vital role in the innovation process (OECD 2005). Lin (2006) determined the percent of logistics enterprises have an R&D department is 35. However, Wagner (2008) have determined that limited transportation firms conducts R&D activities.

Product and/or process innovative logistics enterprises reported suppliers of equipment, materials, components as the most important knowledge source with 31.2%. This was followed by internal sources with 28.3%, and the clients with 27.6% according to medium degree of importance. Because of the survey report, the knowledge sources have been depicted as the second most important factor affecting innovation performance like our study.

In literature, knowledge source component of logistics innovation and its importance has been discussed and highlighted by many authors and they indicate a positive relationship between knowledge and logistics innovation performance (Chapman et al. 2003; Flint et al. 2005; Wagner 2008; Grawe 2009).

Financial findings are determined as the third important factor that affects the innovation performance in our study. Similarly, during the period of 2010–2012, 16.4% of logistics innovative enterprises received public funds. While 13.1% of them received funds from central government, 3.0% of them from local and regional authorities. 0.3% of them was supported by institutions from the European Union.

However, in literature, there is no consensus on effects of financial findings. It can be observed that the effect of financial findings are vary from country to country. Although Lin (2006) determined the financial findings as the most important innovation factor in case of Taiwan, Caniels et al. (2008) indicated the financial findings have limited influence on innovation for German firms.

Mena et al. (2007) allocated a wide place in their study to government funding for logistics innovation. According to the authors, governments can play a supporting role to create the appropriate environment for innovation. It is also important to support innovation activities with overall government policies and regulations at national and local levels. They figured out that the reluctance to innovation of logistics enterprises is originated from the high R&D expenditures.

When we evaluate the effect group, it is obviously seen that Expenditures (C2) and Co-operation arrangements (C5) factors have been influenced from the R&D (C1) and Knowledge sources (C4) most.

Looking at the findings of Turkish Innovation Survey, proportion of product and/or process innovation expenditure of enterprises in total expenditures. Acquisition of machinery, equipment and software in total product and/or process innovation expenditure as the highest expenditure proportion with 50.4%. This was followed by intramural R&D expenditures with 22.1%, all other innovation activities including design, training, marketing and other relevant activities with 16.5%, Extramural R&D expenditures with 10.6% and acquisition of other external knowledge (know-how etc.) with 0.4%.

In terms of Co-operation factor, 14.2% of product and/or process innovators cooperated with other enterprises and institutions. 71.1% of them cooperated with other enterprises within the same the enterprise group and 75.5% of them with suppliers of equipment, materials, components, or software.

With respect to countries of these enterprises and institutions, national was the most common with 98.8%. This was followed by the European Union and other European countries with 18.3%, China and India with 5.9% and other countries with 6.2%.

According to the evaluation results, we can derive several implications about logistics management as follows: Firstly, valuable cues can be obtained for making profound decisions from the causal diagram (Fig. 8.1). For instance, if we wanted to obtain high performances in terms of the effect group factors, it would be compulsory to manage and pay a great deal of attention to the cause group factors first. This is why the cause group factors imply the meaning of the influencing factors, whereas the effect group factors denote the meaning of the influenced factors (Fontela and Gabus 1976). Namely, the cause group factors are difficult to move, while the effect group factors are easily moved (Hori and Shimizu 1999). Thus, among the five factor considered in this study, R&D (C1) is the most important factor because it has the highest intensity of relation to other factors; moreover, the expenditures (C_2) is the most influencing factor, but it is quite difficult to move. Secondly, in real-world situations, the independence of the dimensions and criteria does not exist. It is essential to find not only the key performance factors but also to evaluate the relationships among these factors.

These results give a strong visualization to support managers for allocating limited resources for innovation and therefore, valuable cues can be obtained for identifying the most critical factors that affect the innovation performance.

Conclusion

Innovation capabilities are important for an enterprise's success but are often neglected especially from companies in logistics markets. Thus, this study investigated the influencing factor that affect the innovation performance of the logistics enterprises in Turkey.

The innovation decision-making problem, handled in this study, is a complex multi-criteria problem including both quantitative and qualitative factors which may be in conflict and may also be uncertain. Fuzzy methods can handle with ambiguities, uncertainties, and vagueness that cannot be deleted by crisp values. In other words, using linguistic preferences can be very useful for uncertain situations. Besides, causal analysis largely influences the effectiveness of decision-making. For this reasons, we used Fuzzy DEMATEL technique. The Fuzzy DEMATEL approach is not only found as an efficient, complementary, and effective approach for examining causal relationships, but also a useful or effective assessment for logistics enterprises to allocate limited resources for innovation.

In this study, fuzzy weights of the 5 criteria and fuzzy judgments of 9 experts are employed to compute influence values and rankings. Based on the evaluation factors, R&D (C_1) apparently has the most influence on logistics innovation performance. The ranking order of influence value of criteria is obtained as R&D (C_1) > Knowledge sources (C_4) > Financial funding (C_3) > Expenditures (C_2) > Co-operation arrangements (C_5). The obtained results show parallelism with the results of Turkey Innovation Survey and literature.

In sum, the initial insights on logistics innovation have emerged in recent years. Researchers have shed light on driving forces, barriers, and effects of logistics innovation in different contexts. However, a little research investigates the drivers, barriers, outcomes of logistics innovation and performance in a holistic way. Therefore, this research tries to fill the one of this gap by determining the influencing factors that affect the logistics innovation performance.

For further research, different hierarchical and detailed objectives can be incorporated into the study. Also, mathematical models or meta-heuristics can be combined with the MCDM methods. This study can be extended with more comprehensive factor and the obtained results can be compared to similar studies.

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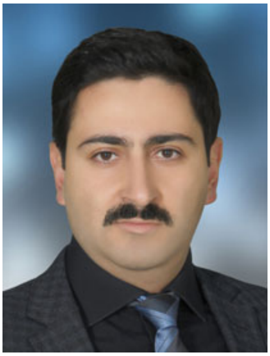

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Corporate Evaluation as an Instrument of Innovation Management in Turkey

9

Sven Lauterjung and Alessandra Bugla

Contents

9.1 Introduction

The economic development of Turkey changed quite significantly in the last years. After several years of boom a downturn set in recently. GDP growth amounted to just 3% in 2014 while it averaged around 5% in the last ten years. In conjunction with the economic slump, the Lira depreciated by 10% against the US-Dollar. This occurs in an uncertain economic environment which is quite visible along the high rate of interest for Turkish government bonds. The interest for government bonds with a maturity of 10 years amounts to almost 10%.[1]

[1] See http://de.statista.com/statistik/daten/studie/14556/umfrage/wachstum-des-bruttoinlandsprodukts-in-der-tuerkei/.

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_9

Companies now have to consider the question of how to deal with innovation in this market. For people, innovation plays an important role in their lives. Be it as a modernization through new ideas, inventions, technological, or even artistic advancements that ought to regularly improve our existence. This progress is visible in new products, services, or a simplification of everyone's life (see Welsch and Johann 2015, p. 31).

Joseph Schumpeter centered his theories on innovation. It is understood as a conscious and deliberate process of a company to order the existing production factors in a new and improved fashion. Companies must take conscious decisions on the way to the introduction of an innovation on the market which is almost always depending on investment (see Schumpeter 1912, p. 157).

These decisions are regarded as investment under uncertainty because incomplete information allows for a variety of future developments. The value of an innovation project in such scenarios is not only determined by the expected cash flows, but also by the given latitude for the innovation venture which is dependent on the development of the national economic region (see Perridon et al. 2012, p. 108).

The following choices of action are possible in the current market situation in Turkey from the perspective of the management: If the project is considered cost-effective, it can be put into effect immediately. If an investment is not considered cost-effective due to the current attainable prices, a postponement can be suggested. This gives the management the opportunity to come to a decision in the future in dependence of the current market developments.

9.2 Assessment of Innovation Ventures

An investment in a dynamic economic environment like the Turkish market demands a clear understanding of the risk-return ratio of an innovation. If the innovation is implemented, the management will try to recognize and influence positive and negative developments of the project during the whole process (see Ford et al. 2002, p. 343). This is actually the clearly defined task of a management. At the same time, it is required that the management continuously monitors the endeavor and implements modifications where necessary (see Dangl and Kopel 2003, p. 38).

The leeway of the management is the value of the innovation in comparison to alternative investments due to the fact that it is the prime task of a businessman to guide the production factor to the location of the highest yield. In order to achieve this goal, a method of valuation must be provided that can take dynamic control procedures and the changes of value of a project into account which can follow from commercial flexibility (see Kuper and van Soest 2006, p. 56).

The established method of an assessment is the discounted cash flow (DCF) (see Deter et al. 2010, p. 44). There are several approaches in the DCF analysis. Because of its regular usage in business practice, this paper uses the model of weighted average cost of capital (WACC) (see Sabal 2007, p. 5).

The DCF analysis is based upon the corporate finance publications of F. Modigliani and M. H. Miller whose research shows that it is irrelevant for the value of a firm if it is financed by equity or debt in the absence of taxes (see Miller and Modigliani 1958, p. 261 ff.).

The present value calculation is the basis for the DCF analysis. A project's present value is the sum of the expected cash flows. They are discounted against the yield of an alternative investment on the validation date. The discount factor is composed of the risk-free interest rate and a risk premium. As such, it comprises the time value of money and the future expectations of the risk-averse investor. If the so discounted value of the present period is subtracted from the investment costs, a firm can calculate the net present value of an innovation (see Barquín et al. 2013, p. 650).

The value of an innovation on its validation date depends on the generated cash flows of the project over the next years (see Mandl, Rabel 2012, p. 53). The net present value of an investment is given by:

$$\mathrm{NPV} = -A_0 \sum_{t=1}^{T} \frac{\mathrm{FCF}_t}{(1 + \mathrm{WACC})^t} \tag{9.1}$$

The discounting of the free cash flow is an integral part of the WACC method. They represent the investment neutral overpayments which are available for the settlement of outside creditors' claims as well as investors' claims (see Ballwieser 2012, p. 503).

This paper does not provide a thorough analysis of the complex risks for outside creditors. Instead, it focuses on the general risk assessment of investors.

The possible deviation of a quantity from an expected value is commonly understood as risk. The order of magnitude of this deviation depends upon the occurrence of varying, future states whose probabilities can be considered as certain and known. In a broader sense, risk denominates positive and negative divergences. Risk results from uncertainty about future developments whose occurrences cannot immediately be quantified due to limited information. Although uncertainty can be reduced by a broader planning horizon, risk may remain constant over the whole life span of a project (see Bamberg et al. 2012, p. 109).

Positive deviations are considered as opportunities. In the eyes of the market participant, the concept of risk usually entails only negative deviations from the expected value (see Hill et al. 2011, p. 60). Investments in a growth market are considered to carry more risk than investments in a developed economy due to the fact that market fluctuations occur in a lesser severance. Because of this, the risk assessment in developed economies is less complicated. This is observable by the lower margin of error of DCF analyses in such countries than in comparison to its application in Turkey.

The WACC method measures the expected risk in the denominator. In order to calculate the cost of equity capital, WACC uses the capital asset pricing model (CAPM). The basic principle of CAPM was laid down in Harry M. Markowitz's portfolio theory. This framework describes how assets with certain risks can be optimally combined. The CAPM was built on this foundation and attempts to determine the price of risk carrying assets by employing restricted assumptions (see Husmann, Kruschwitz 2012, p. 187 f.).

The CAPM differentiates between two kinds of risk: unsystematic and systematic risk. Unsystematic risk measures yield fluctuations which apply only to a single asset. For example, errors of the management may lead to a loss in value of a firm without having an influence on the general rate of return of a market. An investor can safeguard against such risks by diversification. CAPM does not evaluate unsystematic risk (see Hill et al. 2011, p. 32).

The systematic risk, also known as market risk, is based upon macroeconomic factors. They cannot be diversified and have an effect on the rate of return of all securities, stocks, and bonds. Examples are fluctuations in economic activity, policy changes, or natural disasters. For the willingness to accept such risks, the investor receives a risk premium (see Brösel, Matschke 2013, p. 702). Systematic risks are typical for emerging markets (see Hesse and Andrei 2015, p. 97–107, 131–133).

The reward-to-risk ratio of CAPM is used to calculate the WACC's discounting factor. If the risk of an investment in an innovation increases, the expected return on the capital asset increases as well as the discounted interest rate. This lowers the value of the project. Because the WACC focuses solely on the loss risk of an investment, opportunities for appreciation are disregarded. Therefore, opportunities and risks are differently weighted. The equally existent possibilities for yields in high volatility are neglected. Due to the uncertainty of the market development, the application of the WACC method in Turkey will lead to a systematic undervaluation of innovation (see Ford et al. 2002, p. 344).

9.2.1 Consideration of Flexibility Using the WACC Method

Entrepreneurial flexibility specifies the possibility to manage a project along the market development and adapt it to changed conditions. Such latitude allows for the realistic assessment of the project value. The WACC approach, however, assumes that cash flows are predictable and not susceptible to change. As a consequence, the project value does not fluctuate. Once made, decisions are considered final. In theory, the management determines all activities for the coming years until the validation date in a sense of "now or never" (see Fleten and Siddiqui 2010, p. 817 f.).

This is a problematic assumption in an emerging market. Especially considering that the management in such a market will adapt its plans along the dynamism of the economic environment. As a matter of fact, the calculated present value can only be considered significant if the management remains consequently passive (see Humphreys and Germain 2002, p. 307).

Decisions become only relevant when new knowledge clears up previous uncertainty during the course of a project. Else information, that was not available during the first calculated present value, but, nonetheless, influence the future value of the innovation, would have to be disregarded (see Guthrie 2009, p. 5).

Latitude has a direct effect on the project value. However, the WACC method cannot reproduce it. Supplemental methods, like simulation, sensitivity, and scenario analyses, ought to rectify this shortcoming. Yet, even these techniques are only able to assess isolated expected values for a singular development path. Other factors of uncertainty are assumed as ceteris paribus. A key figure, that would integrate performance opportunities, cannot be determined (see Humphreys and Germain St. 2002, p. 314).

The shortcomings of the WACC method in a dynamic economic environment result in the implementation of investments, despite a negative assessment, on the grounds of a "gut feeling". This is due to evaluators' intuitive decision to include the influence of value of latitude in their decision (see Vollrath 2003, p. 341).

A "management by gut" is typical for an entrepreneur, but it is not a feasible management style for large companies.

9.2.2 Using Real Options Valuation for Uncertain Investments

Being able to do something without coercion creates an option. The flexibility of the management can be considered as a real option. Such latitude allows for the absorption of opportune profit chances and the safeguarding against negative developments. The real options valuation can represent this value of flexibility monetarily. Due to resemblance with financial options, the underlying option price theory can be carried over to the assessment of real capital projects (see Ernst et al. 2012, p. 267).

9.2.2.1 Analogies to Financial Options

The buyer of a financial option acquires the right, but not the obligation, to call or put the contractually agreed upon underlying through a strike price. The option may be exercised at a previously agreed upon point of time (European option) or at any point during a predefined period (American option). The long position has to pay a fee for this right to the short position in order to being able to exercise it (see Becker 2013, p. 311).

In the context of a real economy call option, the buyer acquires the right to for a first-time or additional investment in a commodity (physical underlying). As this applies to the real economy investments at hand, the further focus of this paper is the analysis of the properties of the call option. A put option comprises the possibility of a sale, a constraint on capacity, or the abandonment of the project (see Copeland et al. 2008, p. 406 f.).

Opportunities and risks are distributed asymmetrically among the contractual partners. As such, the buyer of the option can limit his/her losses on the payment of the option fee respectively on the previous transaction of the investment. At the same time, the buyer can benefit from a theoretically unlimited profit chance (see Kuhner and Maltry 2006, p. 284).

The fee for the real option consists of an advanced payment which was provided by the option holder in order to create the option. In the context of an innovation project, this applies to all investments until the decision point, be it the creation of a feasibility study, authorization processes, or the expenditures for research and development.

Although the buyer of a financial option contractually obliges to provide the underlying at maturity or to purchase, no such physical counterpart exists with real options (see Volkart 2011, p. 461).

The value of an option consists of an intrinsic and a time value. The intrinsic value of a call is composed of the difference between the base value and the strike price at the time of the exercise. The time value quantifies the value of the flexibility as the difference between the value of the option and the intrinsic value. For example, if a management decision is postponed, an intrinsic value can be generated or increased (see Hampton 2005, p. 52).

There are six general factors that determine the value of an option. The Table 9.1 provides an overview:

The way the value driver works as follows. This depiction is ceteris paribus. The value of the host instrument of financial options corresponds with the price of a share that the option correlates to. If the underlying is traded at the stock market, its value can be determined reliably. A real option has the problem that the base object is not permanently traded or does not even exist and can thus not reliably assessed. An assessment on the basis of market prices is therefore not possible (see Ernst et al. 2012, p. 273 f.).

The basic or strike price of a call option for shares is the price that has to be paid on the maturity of the investment. It is determined upon the purchase of the option. The fee for the exercise on a real option corresponds with the present value of the necessary investment at maturity. Higher investment costs increase and lower costs decrease the net present value, hence the value of an option (see Lee 2011, p. 4448).

The maturity until the expiry date respectively of an exercise of a financial option is determined contractually. Real options are not limited in such a way. The reason for that is, for example, that the actions of the competition, technological innovation, or the general development of the market could have an influence on the profitability of an endeavor (see Ernst et al. 2012, p. 275).

Table 9.1 Analogies between financial and real options. (Own depiction after: Beckmann and Peemöller 2012, p. 189)

Value driver	Call option (financial instrument)	Call option (commodity)
Base value	Share price	Present value of future cash flows
Strike price	Certain price of an underlying	Present value of investment amount paid out
Maturity	Contractually determined	Period, during which the option may be exercised
Opportunity costs	Lost dividend payments	Missed cash flow through postponement
Interest rate	Risk free interest rate	Risk free interest rate
Volatility	Fluctuations of the share price	Uncertainty over gross value of the expected in payment

A longer remaining maturity increases the value of an option. That is due to the longer time the value of an option has to develop into the desired direction (see Dragulescu et al. 2002, p. 224).

The value of a financial option decreases on the day of dividend distribution by the amount of the dividends paid to the shareholders. The reason for this decrease is that only they profit from the distributions. Analogously, the value of real call options decreases if the management forfeits payments surpluses that would have been available at the decision point. The higher the sum of those missed payments the lower the value of an option (see Volkart 2011, p. 468).

The option price theory is based upon the principle of a perfect and arbitrage free market. This allows for the discounting of the option on the basis of the risk-free interest rate. Under the assumption that increasing interest rates correlate with a decrease of value of the underlying the value of an option can decrease as well. Yet, their value can increase if the value of an underlying increases due to a decrease of the interest rate (see Harris 2002, p. 533).

The higher the uncertainty in regards to expected return on investment the stronger the real performance of the innovation can diverge from the expected value. The volatility can measure such changes for the value of an option. These changes have a tendency to balance themselves out for the shareholders of an underlying. This is the result of the asymmetrical reward-to-risk ratio. Consequently, an option in a secure market environment has a rather low value (see Allen et al. 2011, p. 546).

9.2.2.2 Characteristics of Real Options

The purchase of a timing option enables the management to postpone the introduction of an innovation. The capital spending decision is made when the innovation is sufficiently profitable in the context of developments on the market and the competition. A postponement may also have the goal to wait and learn from the experience of the competitors. The timing option can therefore also be called a learning option. This option is used for the assessment of innovation (see Schulmerich 2003, p. 65 f.).

The path from the first consideration of an innovation until, for example, its approval and implementation over to a roll out can be understood as a series of several phases. The purchase of a growth option enables the management to decide about a further investment, abandonment, or sale of the endeavor after the completion of each milestone (see Goyanes et al. 2009, p. 5).

If an innovation is more profitable than expected after its completion, the project can be expanded via the purchase of an option to expand. An option to contract enables the management to shut down all or just parts of an operation. This allows for a reaction to a decrease in demand or prices (see Copeland et al. 2008, p. 406).

If an implementation develops unfavorably, the exercise of an option to abandon allows the cancelation or sale of a project. While a growth option aims to defer future payments, an option to abandon intents to salvage already invested capital (see Beckmann and Peemöller 2012, p. 1184).

A project is not limited to a single option but may entail several, interacting options. The exercise of an option can influence the value of the other options at the same time. In such a case an isolated assessment of a single option becomes impossible. Although such constructs are very complex, they are the most proliferated ones.

There are several approaches for an assessment of real options. The following will use the binomial options pricing model. This method was developed by John C. Cox, Stephen A. Ross, and Mark Rubinstein in 1979. The binomial options pricing model has succeeded as the most feasible method to valuate real options (see Gibner et al. 2005, p. 100).

9.2.2.3 The Binomial Options Pricing Model for the Valuation of Real Options

The binomial model is based upon the idea that the value of an investment increases or decreases over a period by a fixed factor. The time until maturity of an option is divided into even, discrete nodes. With each step towards a new node an additional scenario of future states is modeled. Fig. 9.1 shows the possible development paths of the project value in a binomial model with three periods (see Hull 2012, p. 326).

In order to calculate the option value the replicating portfolio method and the risk-neutral measure are two mathematically equivalent approaches. The method of risk-neutral measure is easier to use, however. Because of this, the formulas for the assessment of the wind park project are developed by this method (see Mun 2006, p. 127 f.).

The extent of the change of and investment value is depicted in the binomial tree through movements up and down. The ratio of value change is calculated through the volatility of the underlying and kept constant through the maturity (see Beckmann and

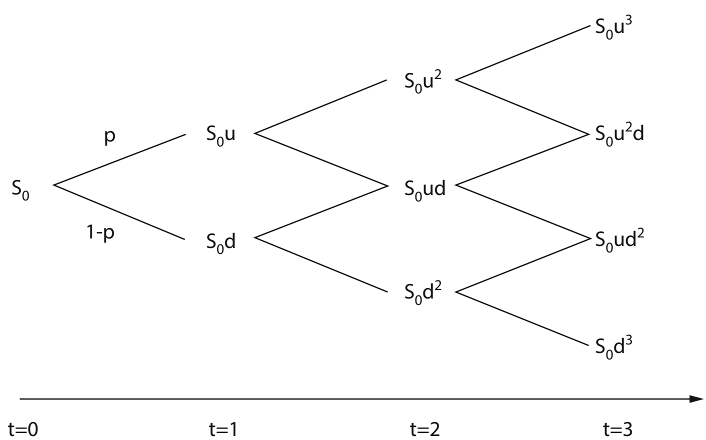

Fig. 9.1 Schematic depiction of the binomial model. (Source: after Husmann, Krischwitz 2012, p. 284)

Peemöller 2012, p. 1192). The calculation was computed through the following formulas.

$$u = e^{\sigma\sqrt{\Delta t}} \tag{9.2}$$

respectively

$$d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u}$$

For d is the factor of the downtrend and u the factor of uptrend, while σ is the volatility of the base objective.

At the end of the observed period the call for the underlying has the following value with a probability p:

$$C_A^u = \max\{S_u - X; 0\} \tag{9.3}$$

respectively with a probability of $1 - p$

$$C_A^d = \max\{S_d - X; 0\}, \tag{9.4}$$

in which C_A^u equals the option value by an exersice at a negative development and C_A^d equals the option value at a positive development. X equals the strike price and d the factor of the uptrend and u the factor for the downtrend. S equals the present value of the project.

The option value is represented by the development of the underlying instrument in the binomial model. In a first step the option values are calculated through the difference of the expected project value of the innovation and the strike price at maturity. The call value at the decision point is determined retrogradely. For the moment the option values of possible states are weighted with their probability and aggregated. In the next step the result is discounted with the risk-free interest rate of the previous period (see Ernst et al. 2012, p. 290).

In case of a single period the option formula is as follows:

$$C_0 = \frac{p \cdot C_u + (1 - p) \cdot C_d}{1 + r_f} \tag{9.5}$$

Where $1 - p$ is the probability for a downtrend and q the probability for an uptrend. The factor for the uptrend is d and the factor for the downtrend is u, rf is the risk-free interest rate for the calculation of the option value C_0 of the period t_0.

The probabilities used in this case are no based on realistic estimations. Instead, they depict the probability how risk-neutral market participants would assess them. These so-called risk-neutral probabilities are calculated through the formula below. The probability for an uptrend is depicted through p. The difference of $1 - p$ is the probability of a downtrend:

$$p = \frac{(1 - r_f) \cdot d}{u - d} \tag{9.6}$$

The value of the call option can be calculated in the binomial model with the help of these formulas.

9.2.3 Evaluation of an Innovation on the Basis of the Real Option Valuation

Up to this point this paper showed how the effects of a volatile environment affect an investment value through the real option valuation in that it includes the change in value through the calculation of the option value. The real option valuation appears to be a feasible instrument for the assessment of an innovation in an emerging market with a dynamic market environment. This method, however, is only useful, if certain criteria are met:

The real option valuation requires a decision problem, which is characterized through uncertainty, flexibility, and irreversibility. Uncertainty exists for the profitability and thus the real value of an innovation, as neither the future payments nor the market developments are foreseeable (see Blyth and Yang 2007, p. 3).

The possibility to postpone investment creates flexibility. Depending on new information, opportunities can arise for a decision about the ideal exercise, a further postponement, or full abandonment of the project.

The irreversibility of a decision is given by the sunk costs. The purchase of an option creates sunk costs in the amount of the option fee. At the time of exercise further investment costs are due. These are in parts irreversible. Furthermore, it is to be expected that they are adapted to the specific demands of the Turkish location. Whereas costs for installations may be salvaged with some losses in liquidity, costs for planning, site development, and transports are effectively lost (see Copeland et al. 2008, p. 399).

The real option value improves upon the shown shortcomings of the WACC method. In an emerging market the risk of an investment in an innovation are not considered solely as a possible loss but also considered as an opportunity. Furthermore, the latitude of the management is added to the assessment of the project value. This value of flexibility is depicted through the option value, which could not be computed with the WACC net present value.

The management is involved in the project evaluation and hence in the decision making. As the real option analysis showed, it can be a contributing factor for the project value. The real option valuation enables the arrangement of corporate finance and the theory of the firm (see Fernández 2002, p. 516).

As a prerequisite the management must be able to recognize changes in the economic environment and, just as well, be able to take advantage of arising opportunities to increase profitability (see Goedhart et al. 2010, p. 687).

The creation of a binomial tree creates the possibility for transparency of risks, the enabling of identification of value drivers, and to depict possible value developments clearly and in a structured manner. The analysis in not limited to the mere application of formulas. Rather, a detailed analysis of factors that can influence the project value is necessary. As such, the project is no longer considered a "black box" where only the results but not the development processes are disclosed (see Deter et al. 2010, p. 52).

The fluctuations in turnover and revenue of the Turkish market can be taken into consideration through the depiction of the different project developments in the binomial model.

The displayed uncertainty t_0 for future developments is resolved over time through the influx of new information.

Starting with t_0 the real option valuation enables a better estimation of opportunities and risks. The actual future development remains uncertain, though. Each postponement should hence include a renewed analysis of the current situation. Furthermore, an extension of the original time horizon is necessary. If a decision is, for example, postponed for ten years, further development opportunities are relevant in the subsequent years. The latter are not considered in $t_{0.}$

In the case that the expected fluctuation margin of the payments does not correspond with the expected volume, the binomial model allows for a relatively fast adaption of the evaluation parameters to the new situation. Furthermore, the changes of the states and their effects on the project value can be reviewed at each node (see Himpler and Madlener 2011, p. 11).

In the context of an active involvement in the project management the real option valuation allows for relatively practical conditions. Also in reality the management is expected to wait, if there is insufficient information until a change of state and decide upon the basis of recent developments about future developments of the project. Planned strategies can thus be reviewed again at each node and modified in the case of unexpected events.

Despite of this advantage, the assessment is executed with numerous restricted and rather unrealistic assumptions. Yet, investment decisions in a dynamic environment are very complex. The accessibility of an assessment needs a reduction in complexity (see Beckmann and Peemöller 2012, p. 1202 f.).

This paper presented the real option analysis with significantly simplified assumptions. When it comes to a practical application, a detailed description of the decision situation, the room for maneuver, the latitude, as well as the respective effects on the expected payments is mandatory. An insufficient database can impair the explanation power of the real option valuation (see Perridon et al. 2012, p. 110).

It is therefore feasible to apply the real option valuation on decision problems where the object of investment can be depicted transparently and in a structured manner. Insufficient information or negligent application of the model can lead to faulty assessments, however. The application of the real option valuation demands a detailed database, whose creation requires a significant effort.

In practice there is still the problem of exclusivity. Under real conditions the same option is available for several investors. If, for example, an option for the creation of an industry service is purchased but not the affected building, a competitor could destroy this option through the execution of an equal call (see Witt 2003, p. 135).

If such factors are considered, the complexity of the previously kept simple method increases continuously. The same is true when several available options and their interactions are put up to consideration.

By using yearly intervals between each step of the valuation model rather large periods had been chosen. But already then it was observable that the binomial method becomes increasingly unclear with each added decision node. As each evaluator creates the option valuation formula by himself, the resulting latitudes may be influenced by subjective distortions. This effectively means that the result of the assessment can only attain an approximation value. Hence, the quality of the results of the real option valuation depends on the skill and intentions of the evaluator (see Schäfer, Schässburger 2001, p. 101).

The real option valuation and the WACC method include risk in differing ways for an assessment. The possible undervaluation of risk-carrying projects on the basis of the WACC method was already shown. On the other hand, the real option valuation includes possible revenue opportunities. If the real option valuation shows a higher yield than the WACC method, a decision should not be made solely on the grounds of the former. Instead, an analysis of the composition of the strategic net present value and what consequences could follow from a change of single parameters.

Despite these shortcomings, the real option valuation can be considered as a feasible method for an assessment of an innovation in an emerging market. The binominal model supplements the decision process. It models the different states and developments of the market as well as the possible ramifications of management decisions on the expected payments. Furthermore, recommendations for the ideal time for the exercise of the options can be deduced. The binomial tree may therefore serve as a guideline for the management in regards to the control of a project (see Ford et al. 2002, p. 346).

The real option valuation has to be understood rather as an upgrade or extension of the WACC method and not as a replacement. It includes all those factors for the assessment that the WACC analysis cannot show respectively that would show only through further research. A sole assessment via the WACC method would have led to the rejection of an innovation proposal, which carries risk but also opportunity for revenue.

These arguments lead to the conclusion that the advantage of the real option valuation lies less in the precise determination of the realistic net present value. But more in its effectiveness to structure uncertainty and provide the management with opportunities for further degrees of latitude and potentials in the context of a business plan of an investment (see Allen et al. 2011, p. 582).

The real option valuation can therefore be relevant in all situations of decision making where the static net present value is close to zero and no clear recommended course of action can be deduced (see Fackler, Schacht 2009, p. 375).

Conclusion

This paper researched to what extend the real option valuation is superior to the WACC method in the context of an uncertain investment environment of an emerging market. This analysis is based upon the theory that the WACC method is not feasible for a dynamic market environment. It cannot show the advantages of an investment in an innovation under such circumstances. Instead, the real option valuation should be preferred.

The statement from the beginning of this paper that the WACC primarily shows the risk of an uncertain investment is reflected in the results of this analysis. While risks of an investment are depicted in the discounting factor, opportunities for an increment of value are not registered. Additionally, there are no starting points for other, alternative decisions.

It is therefore foreseeable that a project under assessment by the WACC method will be valued lower than by an evaluation through real object valuation.

Higher evaluation results by the real option valuation are attributed to the improved depiction of opportunities for revenue of risk-carrying projects in its methodology.

The application of this method must be exercised with caution. As this paper shows, a lack of precision in the data or misconception can lead to a distortion of results. This danger increases even further with additional complexity of the method in dependence of the assessment focus.

The real option valuation should therefore not be considered or understood as a replacement of traditional evaluations. It is rather an indicator for potentials of a risk-carrying investment, which would have been disregarded with a sole utilization of the WACC method.

The situation on the energy markets shows retrospectively that the application of the real option valuation can be helpful in order to calculate the value of a risk-carrying investment. If the necessary effort is in proportion to the probable profit, remains a decision of the evaluator.

Finally, and that is common with the WACC method, the explanatory power and benefit of this method depends on the skill and knowledge of the user.

The considerations of this paper provide opportunity for further research. A first starting point should be the inclusion of several uncertainties into the binomial model. The excluding interactions of several options and their impact on the option value can be a further point of interest.

Another aspect could be how the behavior of the competitors has an effect on the attractively of one's own endeavor and the significance of the excluding problem of exclusivity on the method.

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An Assessment on Innovative Activity and Performance of Turkish Logistics Sector

10

Osman Demirdöğen and Hamit Erdal

Contents

10.1 Introduction

Logistics management is seem in all enterprises to some degree, depending on the nature of the business and the industry, basically interests in the physical distribution of raw materials and, at long last, finished products (Slack et al. 2009).

The role of logistics functions have changed significantly over the past years. Logistics were used to have a supportive role to primary business disciplines, for instance, manufacturing and marketing. But today logistics have expanded to cover purchasing, warehousing and transportation activities, distribution, inventory management, packaging, and even customer service. Besides, logistics have evolved from a cost-absorbing function to that of a pivotal element that enables a unique competitive advantage in today's competitive market environment (Demirdogen et al. 2015). Therefore, logistics enterprises

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_10

try to strengthen their competitiveness by providing/offering more comprehensive service packages (Hong and Liu 2007).

Aforementioned complex and competitive market/competition conditions lead the logistics enterprises to distinguish themselves in the marketplace through innovation (Cui et al. 2009).

In general, innovation in services is a value-creating function that drives market orientation and operational performance and efficiency, to benefit both service providers and consumer (Garicano and Kaplan 2001). Likewise, the competitiveness of logistics enterprises is noticeably related to their ability to be innovative and their characteristics such as quality, speed and flexibility (Wagner 2008).

Oslo Manual (A joint publication of OECD and Eurostat-Guidelines for collecting and interpreting innovation data) revealed the scope of innovation attempts as follows: “Innovation comprises a number of activities that are not included in R&D, such as later phases of development for preproduction, production and distribution, development activities with a lesser degree of novelty, support activities such as training and market preparation, and development and implementation activities for innovations such as new marketing methods or new organizational methods, which are not product and process innovations. Innovation activities may also include acquisition of external knowledge or capital goods that is not part of R&D” (OECD 2005).

Enterprises can conduct innovation for several reasons. According to the Oslo Manual “Their objectives may involve products, markets, efficiency, quality or the ability to learn and to implement changes. Identifying enterprises’ motives for innovating and their importance is of help in examining the forces that drive innovation activities, such as competition and opportunities for entering new markets” (OECD 2005).

In this study, the Turkish Innovation Surveys, which were conducted from 2010–2012, were utilized to identify the innovative activity and performance of the Turkish logistics sector.

The Turkish Innovation Survey has been carried out by the Turkish Statistical Institute (TurkStat) using the Community Innovation Survey model questionnaire, which is based on the Oslo Manual with the three-year observation period on a two-yearly basis (TurkStat 2013).

In this survey, results are given according to the Statistical Classification of Economic Activities in the European Community (NACE Rev.2.). The Oslo Manual presents guidelines for collecting data on the general process of innovation (i.e., innovation activities, expenditures and knowledge sources), the implementation of significant changes in the enterprises, the factors that influence innovation activities, and the outcomes of innovation (OECD 2005). According to NACE (Rev.2) coding, logistics activities are gathered under the group of Transportation and Storage (NACE-H: 49–53).

The rest of this study is organized as follows: In Sect. 10.2, the logistics innovation and related literature, in addition the barriers and the basic indicators of logistics innovation are briefly introduced. An assessment of innovativeness of the Turkish logistics sector is handled in Sect. 10.3. Finally the conclusion is given at the end of this chapter.

10.2 The Concept of Logistics Innovation and Related Literature

The Council of Supply Chain Management Professionals defines logistics as follows: "the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements".

It is understood from the above description, logistics can provide a competitive advantage for an enterprise and increase an enterprise's market share (Mentzer et al. 2004).

While the opportunity to gain a competitive advantage through logistics has inspired decision-makers and authors to consider various factors leading to higher levels of logistics performance, the broader concept of innovation has not been addressed in literature.

In this context, some recent logistics researches have largely ignored innovation (Flint et al. 2005; Wagner 2008) and innovation research commonly concentrates on product or/and process innovation and this moderate advance in service innovation was introduced as "laggard" by Miles (1993). According to Oke (2004, 2008), there is not a common and consistent understanding of the meaning of logistics innovation across the enterprises.

One of the earliest contributions, represents a reference point for the literature on logistics innovation, relates logistics to competitive strategy is revealed by Christopher (1993).

While there is a rich literature on business and product/process innovation (Tidd et al. 2001; Chesbrough 2006; Huston and Sakkab 2006), limited literature covering both logistics innovation and its processes can be observed (Roy et al. 2004; Flint et al. 2005; 2008; Wagner and Busse 2008; Wallenburg 2009).

Grawe (2009) indicates the lack of researches related to logistics innovation as follows: "The literature does address logistics technologies (Electronic Data Interchange (EDI), Radio Frequency Identification (RFID)) and logistics programs (vendor-managed inventory, cross-docking, etc.) and their roles in logistics operations and relationships, but there remains a significant gap in terms of research aimed at understanding drivers of logistics innovation and the specific benefits of this type of innovation" as well.

Flint et al. (2005) who also have introduced the logistics innovation theory, have defined the concept of logistics innovation as: "any logistics related service from the basic to the complex that is seen as new and helpful to a particular focal audience". In brief, logistics innovations are value-created logistics activities that cover improvements, developments, novelties for customers. They proposed an iterative process for managing logistics innovation that is comprised of four key activities (Oke 2008):

I. Setting the stage: Creating and modifying environments and training people to foster innovation activities.
II. Customer clue gathering: engaging with customers to search for clues for changing needs and to identify unmet needs.
III. Negotiating clarifying and reflecting: a continuous improvement approach to interpret, clarifying and negotiating customer needs.

IV. Inter-organizational learning: engaging in joint learning and open innovation with customers.

Bajec (2011) defines the logistics innovation as follows: "logistics innovation represents any logistical related service, process or product from the basic to the complex that is new and helpful to a particular client or focal audience".

Logistics innovation can be classified as the types of innovation that are such as service innovation, process innovation, organizational innovation or marketing innovation (OECD 2005).

- **A product innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
- **A process innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- **A marketing innovation** is the implementation of a new marketing method by involving significant changes in product design or packaging, product placement, product promotion or pricing.
- **An organizational innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

Wagner (2008) introduces the types of logistics innovation as product/service innovations, process innovations, market novelties, product range novelties and product imitations. On the other hand, Mena et al. (2007) and Lin and Jung (2006) divide logistics innovations in two categories as technical and technological innovations. Wallenburg (2009) analyzes the types of logistics innovations and divides these into internal and customer-oriented innovations. Besides, three different typologies of logistics innovation have also been identified: process, product/service offering and network/relationships innovation by Panayides (2006).

Another way to classify logistics innovations is to consider them as either **radical**, that result in new products or services and business processes**, semi-radical,** that can provide significant change to either the business model or technology of an organization, or **incremental,** that leads to small improvements in existing products and business processes (Oke et al. 2007).

Flint et al. (2005) considers that the logistics innovation is organized from trend, scenario, and product analysis, brainstorming or costumer inputs. According to them, there is a close transaction between customer value, market orientation, organizational learning in the way of initiating logistics innovation. In addition, they assess logistics innovation as activities taken by managers to satisfy unmet customer demands. Intelligence and knowledge about customer can be accumulated from various ways. As such, a higher level of learning capability empowers enterprises to produce more alternatives for customer in the means of logistics activities and make organizations more effective in understanding customer insight.

Wagner (2008) draws a conceptual framework for logistics enterprises on innovation activities, innovation generation and innovation results. He considers the innovation generation component with the elements of internal and external R&D, knowledge acquisition, training, investment in infrastructure and capital goods. According to him, the investments in infrastructure and capital goods will lead enterprises to build product/service innovations. Wagner (2008) reprimands knowledge acquisition in its many aspects and demonstrates that it may not be compelling in light of the fact that the vital customer knowledge for improvements and innovations may not be far reaching about processes, challenges and problems. Besides, he divides the innovation generation component as product/service and process innovation, market novelties, ad-hoc and planned innovations. He analyzes innovation activities in terms of macro-sectoral and micro-enterprise level perspectives and found out that the logistics industry had the lowest percentage and came in the last place among other manufacturing and service sectors. He demonstrates the reason of this as insufficient strategies, organizational structures, processes and human resources in innovation. The other reason is that the logistics enterprises have largely ignored innovation activities.

A comprehensive review, a literature based conceptual framework was created and the antecedents, outcomes and diffusion of logistics innovation are analyzed, related to logistics innovation was handled by Grawe (2009). He proposed a model including environmental and organizational factors related to logistics innovation.

Researchers have additionally analyzed the effects and outcomes of logistics innovation under many contexts. Glenn Richey et al. (2005) introduce the positive interaction between logistics innovation and operational service quality. Panayides and So (2005) indicate that logistics innovation is positively related to logistics enterprises' effectiveness. According to Wallenburg (2009), innovation can assist logistics enterprises to increase customer loyalty. Grawe (2009) revealed that the factors; knowledge, technology, relationship network, financial, managerial resources and competition, capital scarcity are positively, and organization of labor factor is negatively related to logistics innovation.

Logistics sector seems, by all accounts, to be a sector, which requires product, process, organization and marketing innovations. Logistics sector is affected by diverse factors such as government policies, legislations, the technological/technical environments, changing consumer perceptions, therefore, enterprises working in this sector should quickly respond to changes.

10.2.1 Barriers of Logistics Innovation

Conducting logistics innovation requires an introduction of the barriers of logistics innovation. Oke (2008) and Lendel and Varmus (2010) consider the lack of clear definition of innovation and innovation strategy as a challenging barrier. Gammelgaard (2008) defines four pitfalls in logistics innovation process according to the experiences of Maersk Logistics:

I. lack of long-term dedication,
II. lack of information sharing and mutual openness,
III. lack of support from the customer's organization, and
IV. lack of openness towards the environment.

Hoecht and Trott (2006) asses the outsourcing as a barrier of innovation of logistics enterprises. They emphases that the innovative capability of an enterprise is largely dependent on cumulative knowledge built up over many years of experience. Hence, the need to remind senior managers of the unwitting harm that may be inflicted on the ability of the organization to survive in the long term if its core competencies are slowly eroded through outsourcing. Oke (2008) defines four pitfalls in logistics innovation

I. lack of clear definition of innovation,
II. reactive vs. proactive innovations,
III. peculiar customers,
IV. ineffective transfer of knowledge,
V. inability to protect innovations with patents,
VI. technology as a major source of innovation,
VII. lack of effective development of process,
VIII. difficulty in concept testing.

Flint et al. (2005) considers the lack of process as a thought-provoking barrier. The Oslo Manual defines obstacles of innovations including logistics innovation as:

I. strong price competition,
II. strong competition on product quality, reputation or brand,
III. lack of demand,
IV. innovations by competitors,
V. dominant market share held by competitors,
VI. lack of qualified personnel,
VII. lack of adequate finance,
VIII. high cost of access to new markets,
IX. high cost of meeting government regulations or legal requirements.

In order to avoid the pitfalls/barriers high level of collaboration and open culture, trust, strong leadership, long-term focus, financial resources, people and skills, effective transfer of knowledge, right metrics and rewards for innovation, process and tools and performance measures, should be ensured (Bajec 2011).

10.2.2 Basic Innovation Indicators

There is an increasing need to measure and assess innovation to increase our knowledge about driving forces behind innovation and socio-economic consequences of innovation. In the past, publicly available, internationally comparable and reliable data on innovation have been extremely sparse. Since the beginning of the 1990s, especially since the 1992 pilot round of the Community Innovation Survey (CIS), some progress has been made in collecting micro-data on innovation. The CIS undertook a more elaborate measurement of innovation inputs, as well as an attempt to measure newly developed indicators of the output side of the innovation process (Kleinknecht et al. 2002). The basic innovation indicators that have been utilized by CIS are defined below:

Research and Development (R&D)
R&D is defined in the Frascati Manual (OECD 2002) and consists of following:

I. The enterprise can engage in basic and applied research to acquire new knowledge and direct research towards specific inventions or modifications of existing techniques.
II. It can develop new product or process concepts or other new methods to assess whether they are feasible and viable, a stage which may involve:
   a. development and testing; and
   b. further research to modify designs or technical functions.

R&D can be classified in two categories:

I. Intramural (in-house) R&D: Creative work undertaken on a systematic basis within the enterprise in order to increase the stock of knowledge and use it to devise new applications. Intramural R&D comprises all R&D activities conducted by the enterprise, including basic research.
II. Extramural (External) R&D: Same activities as intramural R&D, but purchased from public or private research organizations or from other enterprises (including other enterprises within the group) (OECD 2005).

In literature, many research discusses innovation in the context of R&D and also indicates the positive impact of R&D in the innovation process (Mena et al. 2007; Holtzman 2008; Greenhalgh and Rogers 2010; Arlbjørn et al. 2011). In addition, The Oslo Manual (OECD 2005) indicates that R&D plays a vital role in the innovation process. Lin and Jung (2006) determined that 35% of the logistics enterprises dispose of an R&D department. However, Wagner (2008) determined that limited transportation enterprises conduct R&D activities.

Expenditures
Expenditure for innovation activities may also be broken down into current and capital expenditure (OECD 2005). Among the categories of innovation activities, capital expendi-

tures for innovation are included in *intramural R&D*, *acquisition of machinery, equipment and other capital goods,* and potentially also in *preparations for marketing innovations* and *preparation for organizational innovations*. All other categories consist only of current expenditures. Current innovation expenditures are composed of *labor costs* and *other current costs*:

I. *Labor costs* comprise annual wages and salaries and all associated costs of fringe benefits such as bonus payments, holiday pay, contributions to pension funds and other social security payments and payroll taxes. The labor costs of persons not involved in innovation activities (such as security personnel and maintenance staff) should be excluded here and included under other current costs.
II. *Other current costs* comprise non-capital purchases of materials, supplies, services and equipment to support innovation activities performed by the firm in a given year.

As a general agreement in literature, high innovation expenditures is the most common obstacle that put the enterprises off engaging innovation (Lin and Jung 2006; Mena et al. 2007; Wagner 2008)

Financial Funding
As one of the fundamental components, finance acts as a stimulator of innovation within enterprises. Finance is very important for all organizations. Innovation investments usually install a huge cost to the enterprises. The enterprises are needed to have strong financial resources for innovation (Mena et al. 2007). According to the Oslo Manual (OECD 2005), enterprises can get financial funding from;

I. central government,
II. local or regional authorities,
III. international organizations.

However, in literature, there is no consensus on effects of financial funding. It can be observed that the effect of financial funding can differ from country to country. Although Lin and Jung (2006) determined the financial funding as the most important innovation factor in case of Taiwan, Caniels et al. (2008) indicated that the financial funding have a limited influence on innovation for German firms.

Mena et al. (2007) allocated a wide place in their study to government funding for logistics innovation. According to the authors, governments can play a supporting role to create the appropriate environment for innovation. It is also important to support innovation activities with overall government policies and regulations at national and local levels. They figured out that the reluctance to innovation of logistics enterprises is originated from the high R&D expenditures.

Knowledge Sources

Knowledge sources have to be used to understand and gather associated information from market and sector environment. Knowledge becomes one of the unique sources for competence. Knowledge sources consists of following:

I. internal sources which involve: the enterprise or enterprise group;
II. market sources which involve:
    a. suppliers of equipment, materials, components, or software,
    b. clients or customers from the private sector,
    c. clients or customers from the public sector,
    d. competitors or other enterprises in your industry,
    e. consultants and commercial labs;
III. education and research institutes which involve:
    a. universities or other higher educational institutions,
    b. government, public or private research institutes;
IV. other sources which involve:
    a. conferences, trade fairs, exhibitions,
    b. scientific journals and trade/technical publications,
    c. professional and industry associations (OECD 2005).

In literature, knowledge source component of logistics innovation and its importance has been discussed and highlighted by many authors and they indicate a positive relationship between knowledge and logistics innovation performance (Chapman et al. 2003; Flint et al. 2005; Wagner 2008; Grawe 2009).

Co-operation Arrangements

Co-operation arrangements are defined in the Oslo Manual (OECD 2005) as:

I. Innovation co-operation involves powerful participation in joint innovation projects with the others. These may either be other enterprises or non-commercial organizations. The partners do not need to derive immediate commercial benefit from the venture. Pure contracting out of work, where there is no active collaboration, is not regarded as co-operation. Co-operation is different from open knowledge sources and acquisition of knowledge and technology in that all parties take an active part in the work.
II. Innovation co-operation provides enterprises access to knowledge and technology that they would be unable to utilize on their own. There is also great potential for synergies in co-operation as partners learn from each other.
III. Innovation co-operation may take place along supply chains and involve customers and suppliers in the joint development of new products, processes or other innovations. Innovation co-operation can also involve horizontal collaboration, with enterprises working jointly with other enterprises or public research institutions.

According to Chapman et al. (2003) logistics enterprise's innovation capabilities are dependent on its knowledge base, realized through the effective use of internal and external partnerships, utilizing technology to extend its product mix and increase the speed and efficiency of its delivery. Mena et al. (2007) indicates that cooperative agreements tend to focus on customers and suppliers and that cooperation with universities and government or public research institutes is limited. They also indicates the use of information and communication technology can drive innovation by enhancing communication, processing information and improving cooperation.

10.3 Assessment of Innovativeness of Turkish Logistics Sector

In this study, the Turkish Innovation Surveys, conducted from 2010–2012, were utilized to identify the innovative activity and performance of the Turkish logistics sector.

First of all, we assessed the descriptive statistics of the Turkish logistics sector upon innovativeness. After that, we discussed the innovativeness of the logistics sector and proposed some advices about strategies on conducting innovation to Turkish logistics enterprises by comparing with literature. We shared the survey data of logistics sector with general (all sectors), industry and service sectors together within all tables for a comparative assessment for anyone who is interested in that. Table 10.1 demonstrates the percentage of innovative enterprises and types of innovation (product, process, organization and marketing) according to the Turkish Innovation Survey.

In the three-year period of 2010–2012, among the logistics enterprises were innovative, which participate in the survey, vital information have been gathered. 48.5% of enterprises were classed as being innovative in Turkey. The Percent of innovative enterprises in industry was 49.8 and 47 in services sector. As seen in Table 10.1 the logistics sector have been an innovation performance that should not be underestimated with a percentage of 40.1 close to average by comparing to others. Organizational innovation was the most engaged innovation activity with a 27.4% within the logistics sector. While 19.2% of logistics en-

Table 10.1 Innovative enterprises and types of innovation activities

	General (%)	Industry (%)	Service (%)	Logistics (%)
Innovative enterprises	48.5	49.8	47	**40.1**
Product and/or process innovative enterprises	27	29.5	23.9	**21**
Product innovative enterprises	17.7	19.2	15.8	**12.5**
Process innovative enterprises	20.4	21.9	18.6	**17.2**
Organization and/or marketing innovative enterprises	43.7	44.4	42.9	**33.6**
Organization innovative enterprises	31.7	31.2	32.3	**27.4**
Marketing innovative enterprises	34.7	37.1	31.6	**19.2**

terprises engaged in marketing innovation, 17.2% of them engaged in process innovation. Finally, 12.5% of them engaged in product innovation activities.

With a general perspective, one can see that the innovativeness of logistics enterprises reflects the general innovativeness. Turkish logistics sector was relatively innovative according to organizational and marketing innovation activities but a little bit more effort is necessary with process, especially with product innovation activities.

Until today, because of the fact that the enterprises handled the product and process innovations mainly, the acquisitions of these types of innovations, derived from the past years, reached a great degree of satisfaction. Besides, it is assessed that the organization and marketing innovations, relatively new adopted and not dwelled on recently, is considered to provide more opportunities for innovation activities. Table 10.2 demonstrates the percent of innovative enterprises conducted R&D activities.

In the three-year period of 2010–2012, the percent of logistics enterprises conducted In-house R&D is 22 while the percent of logistics enterprises conducted external R&D is 15.6. These percentages pictures that the enterprises are still willing to utilize their own organizational R&D potentials and hesitates to outsource R&D activities. While the external R&D percentage of logistics enterprises was relatively acceptable, the In-house R&D activities were observed to be insufficient. We assessed a general approach with caution to external R&D and inadequate coordination and communication among the enterprises and R&D institutions. Table 10.3 demonstrates the percentage of total product and/or process innovation expenditures.

Looking at the findings of the Turkish Innovation Survey, the proportion of product and/or process innovation expenditure of enterprises in total expenditures, expenditures of logistics innovation were remarkably satisfying. Acquisition of machinery, equipment and software in total product and/or process innovation expenditure as the highest expenditure proportion with 50.4%. This was followed by all other innovation activities including design, training, marketing and other relevant activities with 16.5%. Similarly as mentioned above in R&D activities, In-house R&D expenditures were about two times more from external R&D expenditures. Table 10.4 demonstrates the proportion of product or process innovative enterprises that received public funding.

During the period of 2010–2012, 16.4% of logistics innovative enterprises received public funds. While 13.1% of them received funds from central government, 3.0% of them from local and regional authorities. 0.3% of them were supported by institutions from the European Union. The survey data pictures that the logistics sector received almost all funding from Central Government as well as the others. Enterprises should show

Table 10.2 Demonstration of R&D activities

	General (%)	Industry (%)	Service (%)	Logistics (%)
In-house R&D	40.5	44	35.3	**22**
External R&D	17.8	18.4	16.9	**15.6**

Table 10.3 The percentage of total product and/or process innovation expenditures

	General (%)	Industry (%)	Service (%)	Logistics (%)
In-house R&D in total product and/or process innovation expenditure	23.3	44.3	13.2	**22.1**
External R&D in total product and/or process innovation expenditure	9.8	16.4	6.6	**10.6**
Acquisition of machinery, equipment and software in total product and/or process innovation expenditure	56.7	31.4	68.9	**50.4**
Acquisition of other external knowledge (know-how etc.) in total product and/or process innovation expenditure	1.2	0.9	1.4	**0.4**
All other innovation activities including design, training, marketing and other relevant activities in total product and/or process innovation expenditure	9.0	7.0	9.9	**16.5**

Table 10.4 The proportion of product or process innovative enterprises that received public funding

<table>
<tr><th colspan="2"></th><th>General (%)</th><th>Industry (%)</th><th>Service (%)</th><th>Logistics (%)</th></tr>
<tr><td colspan="2">Enterprises that received any public funding</td><td>24.1</td><td>26.0</td><td>21.2</td><td>16.4</td></tr>
<tr><td rowspan="3">Institutions received funding from</td><td>Central Government</td><td>22.0</td><td>24.0</td><td>19.0</td><td>13.1</td></tr>
<tr><td>Local or regional authorities</td><td>3.6</td><td>3.2</td><td>4.1</td><td>3.0</td></tr>
<tr><td>The European Union</td><td>1.8</td><td>1.6</td><td>1.9</td><td>0.3</td></tr>
</table>

more effort to receive funding from local/regional authorities and the European Union. Table 10.5 demonstrates the proportion of knowledge sources.

Product and/or process innovative logistics enterprises reported clients or customers from the private sector as the most important knowledge source with 33.4%. This was followed by suppliers of equipment, materials, components, or software internal sources with 32.1%, and the internal sources with 26.5%. While the internal and market sources reported more important knowledge sources, the education and research institutes and other sources reported to be insignificant. One can see that the logistics enterprises tend to focus on customers and suppliers as main knowledge source and that the cooperation with universities and government or public research institutes is limited. Especially the universities should make a deduction with these reports. Table 10.6 demonstrates the co-operation on innovation activities in product or process innovative enterprises.

In terms of Co-operation factor, 14.2% of product and/or process innovators cooperated with other enterprises and institutions within the logistics sector. 71.1% of them cooperated with other enterprises within the same enterprise group and 75.5% of them

Table 10.5 The proportion of knowledge sources

		General (%)	Industry (%)	Service (%)	Logistics (%)
Internal sources	Within the enterprise or enterprise group	28.9	29.1	28.5	**26.5**
Market sources	Suppliers of equipment, materials, components, or software	26.0	26.9	24.8	**32.1**
	Clients or customers from the private sector	30.3	30.9	29.4	**33.4**
	Clients or customers from the public sector	10.2	9.1	11.8	**15.2**
	Competitors or other enterprises in your industry	14.0	14.8	12.8	**14.2**
	Consultants and commercial labs	6.2	5.6	7.0	**6.3**
Education and research institutes	Universities or other higher education institutions	4.3	4.2	4.4	**2.2**
	Government, public or private research institutes	2.7	2.8	2.4	**0.2**
Other sources	Conferences, trade fairs, exhibitions	16.3	18.0	13.8	**5.9**
	Scientific journals and trade/technical publications	8.2	7.6	9.1	**4.9**
	Professional and industry associations	6.9	6.5	9.1	4.9

with suppliers of equipment, materials, components, or software, were the most two co-operated participant.

With respect to countries of these enterprises and institutions, national was the most common with 98.8%. This was followed by the European countries with 18.3%. Table 10.7 demonstrates the barriers that the innovative enterprises faced.

Logistics enterprises reported strong price competition as the most challenging barrier with 53.5%. This was followed by the high cost of meeting government regulations or legal requirements with 40.3%, and high cost of access to new markets with 33.35%.

Table 10.6 The co-operation on innovation activities in product or process innovative enterprises

		General (%)	Industry (%)	Service (%)	Logistics (%)
Any types of co-operation		17.2	15.7	19.6	**14.2**
Types of co-operation partner	Other enterprises within the enterprise group	65.5	60.1	72	**71.1**
	Suppliers of equipment, materials, components, or software	62.0	54.2	71.5	**75.5**
	Clients or customers from the private sector	53.3	49.9	57.5	**60.3**
	Clients or customers from the public sector	36.2	31.2	42.2	**70.7**
	Competitors or other enterprises in the sector	41.6	37.4	46.6	**64.6**
	Consultants and commercial labs	44.0	40.3	48.6	**52.1**
	Universities or other higher educational institutions	39.3	36.4	42.7	**39.3**
	Government, public or private research institutes	31.3	26.5	37.1	**50.7**
Co-operation partner by location	National	94.0	95.6	92.2	**98.8**
	Europe	29.5	30.3	28.5	**18.3**
	China or India	8.5	10.8	5.6	**5.9**
	All other countries	13.6	15.7	11.0	**6.2**

Table 10.7 The barriers that the innovative enterprises faced

	General (%)	Industry (%)	Service (%)	Logistics (%)
Strong price competition	49.5	50.5	48.1	**53.5**
Strong competition on product quality, reputation or brand	29.8	31.7	27.3	**24.6**
Lack of demand	24.3	24.9	23.4	**29**
Innovations by competitors	14.9	15.3	14.4	**17.3**
Dominant market share held by competitors	23.5	24.1	22.8	**26.1**
Lack of qualified personnel	26.2	27.8	24.1	**26.2**
Lack of adequate finance	29.1	30.6	27.1	**32.8**
High cost of access to new markets	32.6	34.2	30.5	**33.3**
High cost of meeting government regulations or legal requirements	34.4	35.6	32.8	**40.3**

Conclusion

Innovation capabilities are vital for an enterprise's success but are often neglected from enterprises in the logistics sector. The increased worldwide competition with its consequent downward pressure on prices and margins, several authors and researchers argue that innovation in logistics could be an effective way to assure a sustainable competitive advantage for logistics enterprises (Esper et al. 2007; Flint et al. 2008; Wagner 2008). Thus, this study investigated the descriptive statistics of the Turkish logistics sector upon innovativeness.

The survey data, utilized in this study, give a strong visualization to support managers for allocating limited resources for innovation and therefore, valuable cues can be obtained to identify the most critical factors that affect the innovation performance.

In conclusion, the initial insights on logistics innovation have emerged in recent years. Researchers have shed light on driving forces, barriers, and effects of logistics innovation in different contexts. However, there is a little research that investigates the indicators and barriers of logistics innovation in a holistic way. Therefore, this research tries to fill this gap.

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Determining Performances of Innovation and Exports in Turkey and Selected Countries via Malmquist Index for the Period of 1996–2012

11

Aziz Kutlar, Yusuf Bayraktutan, and Hanife Bıdırdı

Contents

11.1 Introduction

Innovation, as a means of improving new product and process, is able to transform the quality of tradable goods at the context of international trade relations. Developments in educational level of labour force, vocational technical capacity and capability configure product range like research and development (R&D) activities in such a way that it contains further technologies. R&D expenditures and increasing schooling rates enable to use and reach advanced technology by increasing the quality of labour force. This situation develops not only general export volume but also the technology contents of exports. In-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_11

creasing advanced technology exports increases welfare gains through foreign trade. On the other hand, fixed capital investments and foreign direct investments are in the basic inputs of innovativeness capacity.

Turkish economy has experienced important economical and technological transformations since the midst of 1990s. Economic growth of the country has been recorded regularly except for 2001 and 2009. GDP value per capita has three-folded since the beginning of 2000s until today.

Percentage of R&D expenditures to GDP in Turkey was 0.24% at the beginning of 1990s, and remained at the level of 0.5% and below for years, it reached at 0.95% by 2013. When taken as absolute numbers, R&D expenditures which were 14.13 dollars per person at the beginning of 1990s reached at 176 dollars by 2013, but it remained under the average of OECD (908 dollars) and EU countries (676 dollars) (OECD 2015). Schooling rate in higher education was 20% in 1996, and it increased 60% in 2012. Patents which are an output of R&D and innovation process contribute to the increases in manufacturing and export of advanced technology products by enabling innovation to transform into a commercial product. When patent applications of residents with respect to years are considered, patent applications which were 189 in 1996 reached at 4434 by 2012 (World Bank 2016). On the other hand, it is seen that high technology content of Turkish exports were about 2.25% in 1995, and 3.10% in 2013, which is still very low (OECD 2015). Under the lights of all these indicators, Turkey displays a weak appearance in terms of innovative capacity.

In this study, the impacts of innovative capacity inputs (R&D expenditures, schooling rate in higher education, fixed capital investments, foreign direct investments) on the number of patents and performance of high technology exports (outputs) were examined in the sample of Turkey, which has headed to join international markets dating from 1980s, and Bulgaria, Hungary, Lithuania, Poland, Romania, Russia all of whose market experience has been supported by EU after the dissolution of Soviet Union, and China which has been performing a successful economic growth in the last few decades. Therefore, Turkey's relative situation is revealed against China and selected Eastern European countries.

This study aims to measure the advanced technology use of People's Republic of China and six former Eastern Bloc countries and Turkey, and export of advanced technology products and performance in patent manufacturing. The reason why this study which covers 1996–2012 didn't include closer years is that related data haven't been published yet. Variables related to advanced technology use and manufacturing are determined as; total land phone membership (TELP), schooling rate in higher education (ENROL_HIGH), total domestic patent number (PATENT), high technology export (HTEXP), percentage of high technology in manufacturing industry (HTEXP), R&D expenditures (thousand dollars) (R&D), fixed capital investments (thousand dollars) (GFC), foreign direct investment inflow (thousand dollars) FDI. Advanced technology export of countries and the number of patents which is a type of output of high technology are accepted as output of that country. On the other hand, schooling rate in higher education, R&D expenditures, foreign direct capital investments and fixed capital investments are used as input.

In this study, Malmquist index is used to see the dynamic performance of countries in addition to Data Envelopment Analysis. Efficiency values which are obtained in consequence of dynamic analysis and Total Factor Productivity values and countries' activities related to high technology in given term are evaluated.

In Fig. 11.1, existence of correlation among 17-year high technology values of eight countries, which are six former Eastern Bloc countries, China and Turkey, has been dealt. Seven variables have been used in correlation table. There is a positive meaningful correlation among all the variations except for one in the table. However, there is a negative correlation between the number of registered students in higher education and all the variables. This situation can be perceived as an unexpected situation in terms of manufacturing and use of high technology. One of the expected results in the table is that there is a high incidence of correlation between R&D expenditures and the number of patents. Hence, as it can be seen in the table, there is a positive correlation up to %97 between R&D expenditures and the number of patents.

Correlation t-Statistic Probability	R&D	ENROL_HIGH	FDI	GFC	HTEXP1	HTEXP2	PATENT
R&D	1.000000 ----- -----						
ENROL_HIGH	-0.282524 -3.409351 0.0009	1.000000 ----- -----					
FDI	0.849334 18.62579 0.0000	-0.035930 -0.416192 0.6779	1.000000 ----- -----				
GFC	0.993524 101.2178 0.0000	-0.311031 -3.788344 0.0002	0.826143 16.97245 0.0000	1.000000 ----- -----			
HTEX	0.965645 43.01528 0.0000	-0.347487 -4.289771 0.0000	0.745144 12.93390 0.0000	0.966335 43.47715 0.0000	1.000000 ----- -----		
HTEXP	0.486616 6.447907 0.0000	-0.276759 -3.333943 0.0011	0.377681 4.721676 0.0000	0.487373 6.461052 0.0000	0.590124 8.461632 0.0000	1.000000 ----- -----	
PATENT	0.978082 54.37516 0.0000	-0.262319 -3.146756 0.0020	0.785518 14.69368 0.0000	0.984844 65.72914 0.0000	0.946906 34.09296 0.0000	0.446669 5.779115 0.0000	1.000000 ----- -----

Fig. 11.1 Correlation Analysis

11.2 An Overview of the Related Literature

By using the 2 year data covering 1981–1999 period, Braunerhjelm and Thulin (2008) inferred that 1% increase in R&D expenditures increased high technology export at the rate of 3%. In a study in which fixed effect multiple regression models were used, they analysed the effects of R&D expenditures and market size on high technology export. They found out that market size is not effective while R&D expenditures are important determinant of high technology export. By using multiple regression model for 28 countries, Vogiatzoglou (2009), in ICT (Information and Communication) specialising, the share of R&D expenditures in GDP, R&D staff per million persons (human capital), real effective exchange rate index, information-communication expenditures, manufacturing industry added value, index of openness telephone line number per 100 persons, DYY entry/GDP's effect have all been searched. Statistically important effects of R&D and human capital have been found out. Özçelik and Taymaz (2004) tested whether innovations in 2200 companies in Turkey manufacturing industry are important in terms of competition with the help of Tobit model. In the study which includes 1995–1997 period, export intensity (the share of export in total sales) is used for export performance which is dependant variable, technology relevant factors as independent variable (product and process innovations, innovative firm shadow variable, as independent variable, R&D intensity, technology transfer shadow variable, regional innovation intensity) capital intensity, real wage rate and variables related to firms state, private or foreign ownership are used. In addition, paradigm is dealt in three groups; all of the firms, innovative firms and non-innovative firms and 5 different models are predicted and made comparison in terms of the results. Findings show that innovations and R&D activities which firms in manufacturing industry in Turkey increased international competition.

Karaöz et al. (2008) searched the effects of technological level real exchange rate and labour costs on Turkish manufacturing export for 1999–2004 periods. Patent applications which were made by domestic and foreign firms in economy were used for technological level; shadow variable has been added to control structural changes that flexible exchange rate made in economy from 2001. The model that was created in this study in which monthly data was used in socialized level was predicted with common EKK method. It was determined that country's innovation ability and efforts have a positive and meaningful effect on national export performance. It was found out that the effect of industry-specific wage level on competitiveness is negative; the effect of exchange rate is positive, contrary to expectations.

11.3 Methodology

Efficiency can be defined as the success of ability to get probably highest output by preferring the method that uses input compound most productively. This expression means that it is impossible to increase outturn from other output without decreasing one of outputs by changing input distribution economically.

In Koopman's (1951) definition, if manufacturing limit is defined as $f(x_t, y_t) = 0$, it technically expresses non-operative manufacturing limits as, $f(x_t, y_t) < 0$.

$f(x_t, y_t) > 0$ gives input-output compounds that are impossible to be manufactured by using a certain manufacturing technique (Kumbhakar and Lovell 2000). There are two different sides of Koopmans' definition; input oriented and output oriented.

I. A functional input oriented technique efficiency:

$$TE_1 = (y, x) = \min\{\theta : \theta x \in (y)\} \tag{11.1}$$

II. A functional output oriented technique efficiency:

$$TE_0(x, y) = [\min\{\varphi : \varphi y \in P(x)\}]^{-1} \tag{11.2}$$

Studies related to allocative efficiency under DEA frame goes back to Farrell (1957) and Debreu (1951). Fig. 11.2 (x_1, x_2) shows single output co-product segments which probable input compounds create. P point in the figure shows the same output level which is manufactured with more input and which is located in the production possibilities set of a DMU.

To show the performance in P point, Farrell's radial measure of effectiveness can be expressed as:

$$0 \leq \frac{d(0D_{ts})}{d(0D)} \leq 1 \tag{11.3}$$

Here, the division of the distance from origin to D point into the distance from origin to D point is expressed, and this result is known as technical efficiency. For allocative efficiency, a $c_1x_1 + c_2x_2 = k_1$ budget line is passed from D point in the same figure. This budget line can be drawn down leftward touching B point which is on isoquant curve.

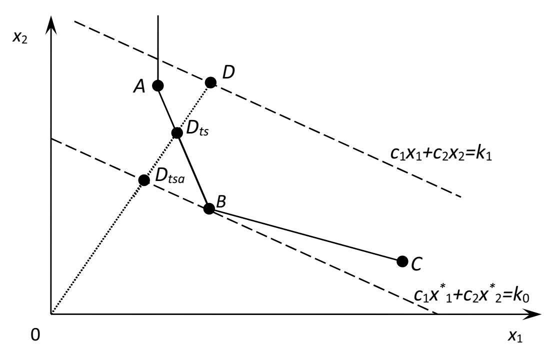

Fig. 11.2 Input Oriented Allocative Efficiency

For x and c, new budget becomes $c_1x_1^* + c_2x_2^* = k_0$ ($k_1 > k_0$) on B point. The total cost declined.

For C point, optimal x^* solution is as follows:

$$cx^* = \min cx \quad (c = 1, 2, \ldots, m) \tag{11.4}$$

Similarly, rate of D_{tsa}'s relative difference on D_{ts}:

$$0 \leq \frac{d(0D_{\text{tsa}})}{d(0D_{\text{ts}})} \leq 1 \tag{11.5}$$

According to Farrell, it gives the measeure of allocative efficiency, DEA depends on the use of a lot of input and output which is weighted linear programme method and is developed by adopting relative technique efficiency approach that Farrell suggested in eficiency measurement. DEA is a technique which is based on performance concept. The first studies related to performance measure were done relying on measurable rates such as cost per unit, profit pet unit etc. There rates are simply defined as output/input. Because DEA uses "Mathematical Programming" techniques in which a lot of variables can be evaluated together under certain restrictions, it enables researchers to work more comfortably compared to other techniques which are more restrictive, and a lot of input and output cannot be evaluated together.

If it is supposed that a DMU produces y_i, ($i = 1, 2, \ldots, t$) outputs from x_k, ($k = 1, 2, \ldots, m$) inputs, with the help of appropriate weights on variables ($v_i = 1, 2, \ldots, t; w_k = 1, 2, \ldots, m$), equation can be written as follows:

$$\frac{\sum_{i=1}^{t} v_i, y_i}{\sum_{k=1}^{m} w_k, x_k} \tag{11.6}$$

Fractional programme benefits from total factor efficiency rate. In one sense, it should be thought as DEA's conceptional model, linear model should be thought as a practical method in efficiency calculations. For each input and output in DEA, weights that belong to DMU are determined. There are two restrictions in determining these weights by which linear programming; the first one is that weights must be positive, second one is that the rate of weighted outputs on weighted inputs must be bigger than one for DMU which is included in the model. In literature, these weight values are called "virtual input-output" or "virtual weights". DEA takes the inputs (x_k) and outputs (y_i) in the equation given above as data and chooses weights that maximize "p" decision making unit's performance for these inputs and outputs according to other units' performances.

$$\text{Max. } v_i w_k \frac{\sum_{i=1}^{t} v_i, y_{ip}}{\sum_{k=1}^{m} w_k, x_{kp}} \tag{11.7}$$

Here, efficiency value that belongs to a number of Z decision unit under the restriction of ≤ 1:

$$0 \leq \sum_{i=1}^{t} v_i y_{ic} / \sum_{k=1}^{m} w_k x_{kc} \leq 1 \quad (c = 1, 2, \ldots, p, \ldots, Z) \tag{11.8}$$

and

$$v_i, w_k > 0 \quad (v_i = 1, 2, \ldots, t; \quad w_k = 1, 2, \ldots, m) \tag{11.9}$$

"v" and "w" in the model forms the variables in equation and weights on inputs and outputs. The solution of the model "p" gives an efficiency value for DMU and the necessary weights cluster to reach this value.

Efficiency measure model which is not parametric in fractional programming form that was a developed by Charnes et al. (1978, 1979) was turned into linear programming model whose solution is easier. Weight cluster is obtained in the number of Z as much as DMU by this equation being calculated for each DMU seperately. Weights in objective function maximizes unit's efficiency value under the restriction of (≤ 1).

That performance calculated with the help of this equation equals to 1 means that observed performance and potential performance equal to each other. In this case, it is decided that DMU is the best observation.

11.3.1 Malmquist Index

Malmquist Productivity Index (MI) is one of the indices that address the change in production (Malmquist 1953). This index was used by Caves et al. (1982) in the data envelopment analysis. This index consists of difference functions representing multiple output and multiple input technologies sited on the input and output quantities. Malmquist Index is superior to the other indices in that there is no need for prices in this index as well as the assumptions about the nature of the technology. Because of these properties, MI can be used as a convenient tool to measure productivity in the public sector where prices cannot be very clearly defined. Unlike other indices, MI can determine the cost of production limits or the limits of manufacturing technology. Another advantage of the index is that production efficiency and technical efficiency can be shown separately through this index (Estache et al. 2004).

The index may be calculated through parametric methods and linear programming methods.. Two functions are achieved using DEA. One of these functions represents technical change, and the other symbolizes the change in the technical events (Liu and Wang 2008).

According to Färe et al. (1994a,1994b) in S^t production technology, $t = 1 \ldots T$ for each period, output based Malmquist Index that show efficiency/productivity change models the transformation of inputs, $x^t \in R_+^N$, into outputs, $y^t \in R_+^M$. It is described as $S^t = [(x^t, y^t) : x^t \text{ can produce } y^t]$ in brief. Färe (1988) output distance function defined during

"t" period is formulated as follows:

$$D_o(x^t, y^t) = \inf\left[\theta : (x^t, y^t/\theta) \in S^t\right] \tag{11.10}$$

This function describes x^t entries and the maximum output y^t vector. This function is a first degree homogeneous function, and it takes a value of one and less than one. If (x^t,y^t) is on the technological frontier, D_o, $(x^t,y^t) = 1$, equals 1. According to Farrell (1957), this refers to the technical efficiency. A similar definition is made for $t+1$ term. Outcome-oriented CCR type Malmquist index of productivity change is the geometric means of Malmquist productivity index:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\frac{D_o^t(x^{t+1}, y^{y+1})}{D_o^t(x^t, y^t)} \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^t, y^t)}\right]^{0.5}$$

This index can be written by two ways as follows:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}\left[\left(\frac{D_o^t(x^{t+1}, y^{y+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})}\right)\left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)}\right)\right]^{0.5} \tag{11.11}$$

In the above equation, the part of the index outside the braces gives the relative efficiency change between the two periods while the part inside the braces represents technical efficiency change. This equation can be described in two parts as follows:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \overbrace{\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}}^{EC}\overbrace{\left[\left(\frac{D_o^t(x^{t+1}, y^{y+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})}\right)\left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)}\right)\right]^{0.5}}^{TC}$$

If it is desired to be expressed more intensely:

$$M_o^{t,t+1} = EC^{t,t+1}\, TC^{t,t+1} \quad \text{MI index is described.}$$

In this study, for each t period (here $t = 1996 \ldots 2012$), each $k = 1 \ldots$ for K countries.

11.4 Empirical Findings

Total fixed telephony membership (TELP), total workforce (LABOR), the total number of domestic patent (PATENT), high-tech export (HTEX), the share of high-tech export in manufacturing export (%) (HTEXP), R&D expenditure (at current prices) (thousand dollars) R&D, fixed capital investments (in thousand dollar) GFC, direct foreign investment inflows (thousands of dollars) FDI.

As stated at the beginning of the study, efficiency of the number of patents of Turkey, which is an indication of high-tech exports and technological innovation success, is evaluated in comparison with six former Eastern Bloc countries and China. To do this, developments were identified using Data Envelopment Analysis (DEA) for a period of 17 years. Analysis of the results is given in Table 11.1 and following tables. While determining efficiency scores in DEA analysis, excess of inputs or lack of outputs has been determined as different using input-oriented or output-oriented models.

In this study, CCR model referring to as the constant returns to scale and BCC model referring to as the variable returns to scale were used to conduct the efficiency analysis and the results were evaluated. For these two different approaches, CCR and BCC models, which can carry out an analysis on the basis of constant and variable returns to scale, are used.

As the second step, Output Oriented Malmquist Index Total Factor Productivity and the efficiency scores and the average of the countries were handled separately. Malmquist Index tries to demonstrate the efficiency of the country as a dynamic process.

There are seven variables used in input oriented DEA models. Table 11.1 shows the inputs and outputs used in DEA models. Four inputs (X_1, X_2, X_3, X_4) and tree outputs (Y_1, Y_2, Y_3) were used in basic models.

Fixed-income technical efficiency scores based on input-oriented scale model made with CCR are shown in Table 11.2. While R&D expenditures, foreign direct investment, the higher education schooling rate and fixed capital investments were taken as inputs; exports of high-tech products, the share of high-tech exports and the number of domestic patent are used as output for fixed-income technical efficiency scores based on input-oriented scale model made with CCR. As can be seen in Table 11.2, China, Hungary and Lithuania had all the efficiency score throughout the period. Russia, Romania and Bulgaria as having partially full efficiency scores followed these countries. The lowest efficiency

Table 11.1 Variables of the Model

Inputs (X)	
X_1: ENROL_HIGH X_2: FDI	Higher education schooling rate Foreign direct investment inflow (thousand dollar)
X_3: R&D	R&D expenditure (at current prices) (thousand dollars)
X_4: GFC	Fixed capital investment (thousand dollars)
Outputs (Y)	
Y_1: HTEX	High-tech export (HTEX) (thousand dollars)
Y_2: HTEXP Y_3: PATENT	The share of high-tech export in manufacturing export (%) The total number of resident patent applications
Dependent Variables	
TE_{CCRt}	CCR Technical Efficiency
TE_{BCCt}	BCC Technical Efficiency
*($t = 96.04, \ldots\ 12$)	

Table 11.2 Input Oriented technical activities based on CCR model

	Bulgaria	China	Hungary	Lithuania	Poland	Romania	Russian F.	Turkey	Ortalama (CCR)
1996	1	1	1	1	0.637	0.972	1	0.346	0.869
1997	1	1	1	1	0.597	1	1	0.276	0.859
1998	1	1	1	1	0.589	1	1	0.328	0.865
1999	0.745	1	1	1	0.416	1	1	0.353	0.814
2000	0.633	1	1	1	0.457	1	1	0.37	0.808
2001	0.863	1	1	1	0.491	1	1	0.341	0.837
2002	0.923	1	1	1	0.562	1	1	0.403	0.861
2003	0.995	1	1	1	0.701	1	1	0.34	0.879
2004	0.86	1	1	1	0.698	1	1	0.358	0.865
2005	0.968	1	1	1	0.578	0.97	1	0.332	0.856
2006	0.941	1	1	1	0.568	0.683	1	0.3	0.812
2007	0.936	1	1	1	0.538	0.502	0.9	0.242	0.765
2008	0.966	1	1	1	0.502	0.518	0.709	0.195	0.736
2009	1	1	1	1	0.564	0.824	0.953	0.262	0.825
2010	0.966	1	1	1	0.51	1	0.806	0.223	0.813
2011	1	1	1	1	0.455	0.929	0.518	0.194	0.762
2012	1	1	1	1	0.43	0.743	0.466	0.211	0.731

scores in the table belong to Turkey and Poland. However, Turkey's technical scores are located under the technical scores of Poland. While Poland's efficiency scores vary in the range of 0.7–0.3, Turkey's range of efficiency scores was situated between 0.4–0.2. Moreover, these figures are in a downward trend. That is to say, one of the negativity seen on Turkey is that the efficiency values that declined in 17 years show tendency to decline increasingly. Turkey is lagging behind the covered countries in terms of high-tech exports and the number of patents. The minimum value of the average efficiency score located in the last row of the table is even higher than the efficiency value of Turkey.

Obtained scores based on the CCR model in Table 11.2 was recalculated with BCC model in Table 11.3. It can be said that the efficiency scores obtained from analyses using the same data set is better to a certain extent. Bulgaria, China, Hungary and Lithuania are countries which were fully efficient for seventeen years. Bulgaria, Romania, Russia and Turkey are among the group of countries that were partly effective. Although Turkey had full efficient scores between 2001 and 2009, it couldn't catch these scores in the last three years of the period covered. However, based on the analysis of BCC variable return to scale, Poland had the worst efficiency scores. Poland was not able to catch the full effectiveness scores any time during the covered period. Given the efficiency scores for all countries, Turkey, after Poland, had the lowest efficiency scores. While Turkey ranks last in the efficiency ranking based on CCR model, it is located on the second last in the ranking in the BCC model. Average efficiency scores are listed in the last column. These average values are better when compared to average score values in the CCR model.

Table 11.3 Technical Efficiency based on Input Oriented BCC Model

	Bulgaria	China	Hungary	Lithuania	Poland	Romania	Russian Federation	Turkey	Ortalama (VCR)
1996	1	1	1	1	0.666	1	1	0.881	0.943
1997	1	1	1	1	0.597	1	1	0.827	0.928
1998	1	1	1	1	0.725	1	1	0.921	0.956
1999	1	1	1	1	0.527	1	1	0.939	0.933
2000	1	1	1	1	0.517	1	1	0.968	0.936
2001	1	1	1	1	0.547	1	1	1	0.943
2002	1	1	1	1	0.573	1	1	1	0.947
2003	1	1	1	1	0.702	1	1	1	0.963
2004	1	1	1	1	0.7	1	1	1	0.963
2005	1	1	1	1	0.688	1	1	1	0.961
2006	1	1	1	1	0.71	0.905	1	1	0.952
2007	1	1	1	1	0.748	0.899	0.931	1	0.947
2008	1	1	1	1	0.766	0.849	0.741	1	0.919
2009	1	1	1	1	0.785	0.89	0.971	1	0.956
2010	1	1	1	1	0.78	1	0.824	0.994	0.95
2011	1	1	1	1	0.723	1	0.65	0.838	0.901
2012	1	1	1	1	0.754	1	0.673	0.756	0.898

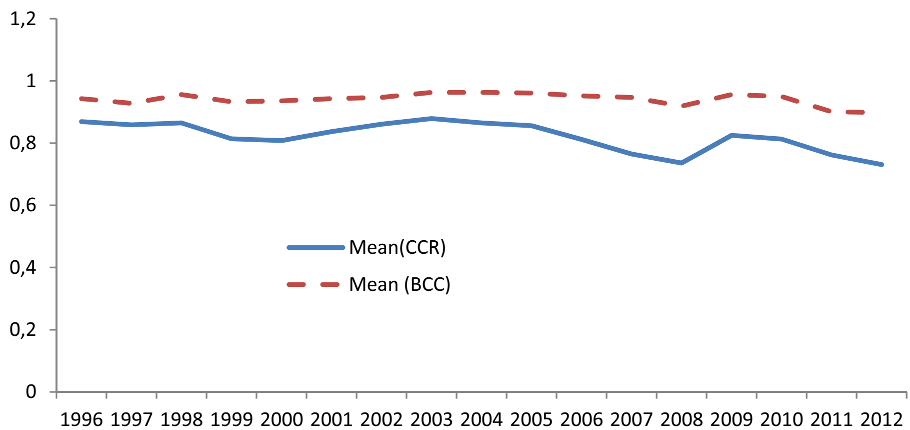

Fig. 11.3 The Means of Efficiency scores of CCR and BCC Models

The means of efficiency scores based on CCR and BCC models are given in Fig. 11.3. Efficiency scores range between 0.7–0.88 in CCR model, and between 0.9–0.98 in the BCC model. However, efficiency scores in both models decreases more when compared to baseline values.

Total Factor Productivity Analysis with Malquist Index and the Findings

DEAP Version 2.1 program was used for Malmquist index analysis. Output oriented Malmquist Index Total Factor Productivity and the efficiency scores and the average of countries were discussed separately. The efficiency values to be estimated for each country can be listed as follows:

- Total Factor Productivity (TFP), (tfpch),
- Technical Change (techch)
- Efficiency Change (effch)
- Pure Efficiency Change (pech)
- Scale Change (sech)

The findings relating to fixed income and input-oriented Total Factor Productivity was calculated through Malquilm Index, and are shown in Table 11.4. As seen in the table, in the covered period, total factor productivity for all the years except six years is below one (1). Initially tfpch increased by 4.1%, but this figure has decreased to minus 5.3% at the end of the term. TFP (Total Factor Productivity) and other efficiency changes of banks within the given period are illustrated through Malmquist Index in Table 11.4. Referring to the efficiency of all the countries during the period, it is seen that average pech value, techch and sech value, effch value, and tfpch value decreased by 0.6%; 1%; 1.6%; 2.6% respectively.

Table 11.4 Malmquist Index: Annual Average Efficiency

Countries	effch	techch	pecch	secch	tfpch
1996/97	0.914	1.139	0.964	0.948	1.041
1998	1.007	0.971	1.009	0.998	0.978
1999	0.954	1.087	0.999	0.955	1.037
2000	0.975	1.057	1	0.975	1.031
2001	1.039	0.883	0.996	1.043	0.917
2002	1.051	0.94	1.003	1.048	0.988
2003	1.011	0.858	1.012	1	0.868
2004	0.988	0.957	1.006	0.982	0.945
2005	0.983	0.916	0.999	0.985	0.901
2006	0.944	0.941	0.99	0.954	0.889
2007	0.963	0.944	1.004	0.959	0.909
2008	0.992	1.058	0.991	1	1.05
2009	1.085	1.005	1.007	1.077	1.091
2010	1.009	1.053	1.015	0.995	1.063
2011	0.909	1.065	0.929	0.978	0.968
2012	0.934	1.014	0.986	0.947	0.947
Mean	0.984	0.99	0.994	0.99	0.974

The table shows that the most productive year was 2009. None of the efficiency values of this year is below one (1). 8.1% efficiency increased in the value of Effch and 9.1% increase in techch value represent a record level increase. Among all efficiency values, Scale Change (sech) variable carries the lowest one. However, when considered as an average value of 17-year efficiencies, Total Factor Productivity (TFPCH) variable seems to have lost more efficiency than any other variables.

Some results which cannot be seen in Table 11.4 can be monitored more easily in the graph below. Fig. 11.4 shows the overall efficiency values of all eight countries. During the period, all other variables except *pech* variable located in the second row of the graph show a decreasing trend towards the middle of the period. Later, it appears that these values increased and then fall again. However, 2009 draws attention as a peak year for all variables.

Table 11.5 gives the means of efficiency scores of each country, and the last row of the table shows all countries' efficiency scores. The average factor productivity of all countries is consistent with the values in the previous table. When looked at the total factor productivity values, it is seen that this value is above one (1) for China, Hungary, Poland and Turkey. This means that total factor productivity increased in these countries. The factor causing the increase in total factor productivity of Turkey is Technical Efficiency Change coefficient. The coefficient of this variable indicates an increase of 8.5%. The country whose total factor productivity is the lowest is Lithuania. Total factor productivity of this country during the covered term shows a decline of 12.7%. Hungary, with an increase of 5.4%, represents the highest increase in total factor productivity. The sole country in which all efficiency values are under one (1) is Russia. If dynamic efficiency process is followed, it appears that Russian Federation exhibits the poorest performance while Hungary displays the best performance.

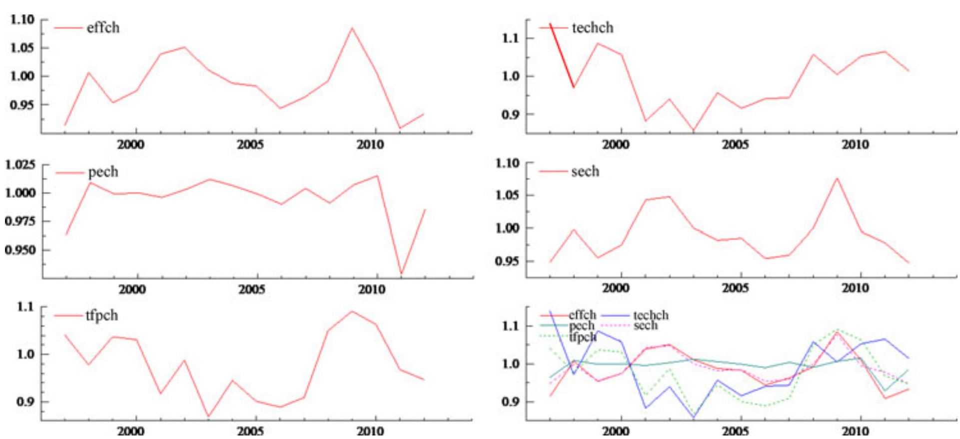

Fig. 11.4 Variables of Total Factor Productivity Analysis

Table 11.5 Malmquist Index: Countries' Average Efficiency

Countries	effch	techch	pecch	secch	tfpch
Bulgaria	1	0.912	1	1	0.912
China	1	1.053	1	1	1.053
Hungary	1	1.054	1	1	1.054
Lithuania	1	0.873	1	1	0.873
Poland	0.958	1.048	0.989	0.969	1.004
Romania	0.983	0.937	1	0.983	0.921
Russian Federation	0.964	0.981	0.976	0.987	0.945
Turkey	0.967	1.085	0.988	0.978	1.048
Mean	0.984	0.99	0.994	0.99	0.974

Conclusion

R&D expenditures, foreign direct investment, the higher education schooling rate and fixed capital investments were taken as inputs; and exports of high-tech products, the share of high-tech products in exports, the number of patents were taken as output for fixed-income technical efficiency scores based on input-oriented scale model made with CCR. While China, Hungary and Lithuania had full efficient scores throughout the period; Russia, Romania and Bulgaria had partially full efficiency scores. The lowest efficiency scores of the table belong to Turkey and Poland. Even the minimum value of the average efficiency score is higher than the efficiency score of Turkey.

Bulgaria, China, Hungary and Lithuania were fully efficient; Bulgaria, Romania, Russia and Turkey are the countries which were partially efficient for seventeen years in BCC model. Based on the analysis of BCC variable return to scale, Poland had the worst efficiency scores, and it wasn't able to catch full efficiency scores anytime in the covered period. Turkey ranks second to last row according to BCC model.

Total factor productivity value for all the years except six years is below one (1) in fixed income and input-oriented analysis carried out through Malmquist Index. The most productive year was 2009, and none of the efficiency values of this year is below one (1). Among all efficiency values, Scale Change (sech) variable carries the lowest one. However, when considered as an average value of 17-year efficiencies, Total Factor Productivity (TFPCH) variable seems to have lost more efficiency than any other variables. The factor causing the increase in total factor productivity of Turkey is Technical Efficiency Change coefficient. The coefficient of this variable indicates an increase of 8.5%. When all efficiency values are evaluated; it is seen that Russia and Hungary exhibited the lowest and the highest performance respectively.

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Structure Genesis as a Factor of Success of Interorganisational Innovation Networks

12

Axel Müller and Silvia Pick Vidal

Contents

12.1 Introduction

Small and medium-sized companies (SMEs) fall – measured on the investment for innovations – behind large-scale companies: "Small and medium-sized companies with up to 249 employees held in year 2011 a share of 10.2% of the entire research and development expenses and a share of 17.8% of research and development workforce. Larger companies with 250 to 499 employees represent a share of 4.8% of the research and development expenses and 7.0% of the research and development workforce. Measured on the share of these group companies to the net value-added and to total employment (54.8% respectively 59.4%) the research and development stake is small in comparison to large-scale companies with at least 500 employees." (IfM Bonn).

However, this declaration deforms the picture. SMEs spend relatively less for R&D, but they are not necessarily less innovative since they concentrate on other forms of in-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_12

novation. A popular model is the interorganisational cooperation in innovation networks. The following explanations aim to examine the goal, the development and structure genesis of innovation networks. With the help of the case study of the "Fördergesellschaft Erneuerbare Energien e. V." (Promotional Organisation for Renewable Energies), which is an in Germany active innovation network under significant participation of SMEs, an exemplary model will be described.

12.2 Heterogeneous Stakeholders as Interorganisational Innovation Partners

Innovation networks depict a special form of association of organisations. The most outstanding characteristic is the heterogeneity of the participants. Gläser et al. deviate heterogeneity from diverse languages, knowledge foundations, interests and institutional integration of stakeholders (Gläser et al. 2004, p. 7). With a sight on innovation projects, Hahn (2013, p. 48 ff.) defines heterogeneity as categorical differences regarding the dimensions:

- Sector (producing or consulting companies, universities, non-universal research institutions, public authorities and associations)
- Form of organisation (minor establishments, SMEs, large companies, corporation of public law, private person) and
- Persons (experts (commercial, technical), managers, representatives, interest persons or specialised persons).

Out of heterogeneity, chances and difficulties evoke. Depending on the characteristic of one of the three dimensions of heterogeneity (sector, form of organisation and persons), the business culture (Coxon and Davies 1986; Huber 1989, 2011) and specific interests, work experience and the decision-making power have to be considered. Heterogeneous actors possess heterogeneous relevance structures at goals and in the problem solving behaviour (Hahn 2013, p. 57).

This can promote creativity, but also complexity. In heterogeneous cooperation's, the probability of structural instability, tensions and incompatibility are given. Therefore, it has to be achieved to establish common perspectives and solution routines in interorganisational innovation networks.

12.3 Success Factor Structure Genesis

Some defining groundwork is necessary. It is helpful to treat the system type "organisation" at first, since the other types (networks, network organisations and project organisations) compound out of organisations resp. the members of organisations.

12.3.1 Participants in Interorganisational Innovation Networks

Organisations

An organisation is a permanent, methodical classification of persons and material expenses in order to achieve an optimal cooperation to reach the specified goals with best conditions. Through division of labour the entities specialize internally. With which specialised entities a company participates in innovation networks depends on its special core competence. The goal of realisation of specific purposes is significant.

Networks

A social network can be defined as a through relationships related type of connected crowd of social entities such as persons, positions, organisations and so on (Pappi 1987). Mitchell defines a social network as a "specific set of linkages among a defined set of actors, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the actors involved" (Mitchell 1969, p. 2). Barnes discovered early the special characteristic of social networks: They can interfuse limits and organisations (Barnes 1979).

Regarding to Weyer networks can be defined as "1) a relatively permanent, informal, 2) personal, trustful, 3) reciprocal, exclusive interaction relation 4) heterogeneous, autonomous, 5) strategy cabale, 6) but independent actor [. . .]" (Weyer 1997, p. 64).

Network Organisations

Networks and network organisations are two different forms of social systems: Networks of organisation are latent structures. A network organisation evolves when the latent structures are mobilised, formalised and managed. Networks can be permanent whilst network organisations are usually terminated. While the focus in networks often only is on the maintenance of good relationships to old friends, the network organisations concentrates on reaching specific goals together.

Networks are the requirements for network organisations. This means: "A network is not a static event or a static entity. A network is a permanent process of the activities of integrated participants. Networks are a possibility to generate cooperation through the setting of network organisations. The medium of cooperation serves as a pool of potential to be produced services" (Aderhold et al. 2001, p. 154). Network organisations are formed to lower the effects of competition as well as to use the potentials of cooperation.

Organisations are found permanently corresponding to their purpose and in networks a temporal limit is usually not given, too. In case of network organisations, the situation is not clear. They are often found as non-profit associations without a temporal limit – just as the Fördergesellschaft Erneuerbare Energien e. V. – but they are terminated to their purpose. The promotion of renewable energies makes itself in the ideal case dispensable. If the promotion was successful, it will not be necessary anymore. Network organisations with the expression of the existing potentials in the network are temporarily limited.

Project Organisations

Networks form a pool of potential network organisation members and network organisations are an enabling instance for thematically specific projects.

Every of the resulting projects will be executed in a separate project organisation. The subsystems of the network organisations are the project organisations which do not include all members of the network organisation, but rather those who are relevant for the project.

For network and project organisations the following characteristics are given: 1) orientation to a specific goal (innovation intents resp. derived projects), 2) formation specially for the purpose to achieve the goal (functional focus through thematic orientation), 3) formal structure, 4) work division through integration and coordination of core competences of the members organisations, 5) temporary continuance until the achievement of purpose/attainment of goal, 6) cooperation (instead hierarchical control), 7) rational coordination of action, supplemented by trust as well as 8) exact determinable members (through recognition of member rules).

Coming to the model of structure genesis of innovation networks – the emergence of formal structures out of an informal network. Based on informal acquaintance networks, in which an idea circulates, form formal structures. Depending on this formal network organisation, an internal differentiation in several project organisations takes place. This process of structure genesis can be a decisive success factor for innovation networks in case of ideally planned courses and purposeful implementation. Trigger for such a structure genesis, in cases of innovation networks, is the existence of an idea.

12.3.2 The Process of Structure Genesis

Step 1: Idea

It does not matter if an idea is an actual invention or if it is an idea to apply such an innovation in a new context. Therefore, the term idea should not be interpreted literally but rather as a collecting category to clarify the existence of a beginning step. The idea in this phase is not yet (regional and social) communicated broadly. It is only common to the inventor or discoverer, maybe a team of scientists, a department resp. company internal. The communication between known employees of different departments takes place in intra-firm networks (Brass and Burkhardt 1992). Interpersonal and local communication channels are used.

Step 2: Circulation

If in the idea based discussion process and decision process, it turns out that the idea is worth implementing, but it is not expected to succeed alone, partners have to be identified.

The search for partners orientates on a raster with the characteristic values of compatible resp. necessary core competences, possibility of risk distribution and possibility out of the resulting division of labour. The search is characterised through the acquaintance of the participants (know about each other), the knowledge of core competences (know each other), eventual already commonly executed projects (experiences) or recommendations of others.

Whilst the idea until now had to prove oneself intraorganisational, the communication in the circulation phase exceeds the organisation boarders. The respective communication channels just as in the phase "idea" are interpersonal and local, even if now interorganisational. The communication is informal. The content of the exchange is the idea, but surely not in all its aspects and the presentation of the overall potential. After all, it is not foreseeable which communication partner will become a cooperation partner.

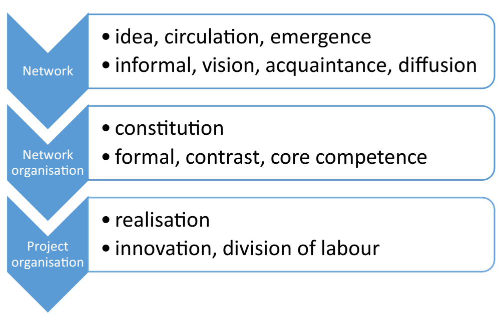
Step 3: Emergence

The third step is called emergence. Under emergence the development of structures out of a situation of an unstructured unit is meant. Therewith emergence always is the description of a process. It is not an addition of something but rather the structuring of something. In this case, emergence implies the conscious and purposeful practice of the structure of a network organisation out of the forerunner conditions of a loose acquaintance network, as depicted in the circulation phase. The arose structures are the first step of the transition from the network to a network organisation.

Emergence can be considered as a concretion step. The communication style is stronger goal and cooperation orientated than in the previous step. Decisions are taken who belongs to the exclusive circle of participants of a network organisation. The restricted publicity of the circulation is limited furthermore through the emergence. The communication only takes place within the actors whose interest and suitability for the innovation project is visible. To the restricted publicity, only the effective future partners belong from a certain point of the negotiation. This enables that the discussion of the idea takes place in more detail than it was the case during the circulation when permanent partners were not foreseeable yet. The first three phases, which are still connected with the structure format of the network, are depicted in the following Fig. 12.1.

These three phases are characterised by an informal communication, first intraorganisational and in the last two steps also interorganisational. A with the idea connected vision circulates. By vision, it is meant what could evoke out of the idea and the vision circulates in a circle of known resp. recommended persons resp. companies represented by persons.

Fig. 12.1 Modell of Structure Genesis of multi-organisational Innovation Networks. (Source: Müller 2004, p. 95)



Thus, there is diffusion process. The innovation (idea/vision) spreads in a social system (network of acquaintances, first intraorganisational, then interorganisational) through specific communication channels (interpersonal and local) in the time (three processes idea circulation and emergence) with specific consequences (structure creation, formation of partners).

Step 4: Constitution

The characteristic of the constitution phase is the legal and contractual validation of the innovation project. Through contractual obligations and fixations, a formalised organisation with an own name is found (e.g. Fördergesellschaft Erneuerbare Energien e. V.).

By creating a legal framework through cooperation, contracts commitments are established – this is a difference to loose networks. As important as trust might be, it is not enough when it comes to cooperation between legally independent partners. The process of constitution is consequent and targets the formalisation of the continuation of the emergence. The contracts are signed by the in the previous phase merged organisations. When it comes to the communication style and the content of the exchange, there are mainly judicial problems. Interests, responsibility, authority, voting ratio and so on are required in the contract form (statute).

Once, this process step is completed successfully, the operative business – the development and promotion of the innovation – can begin. If the constitution is successful, thus enough partners recognise the legal general conditions, a network organisation is formed. On this basis, task-specific subsystems are created, the project organisation.

Step 5: Realisation of Project Organisation

After capturing legally who belongs to the project organisation and who needs to execute which tasks, in the realisation the operative business begins. The operations of the topics research and development as well as product and production plans belong to the operative business. The only but decisive difference to single companies is that the work-sharing of the performed services takes place in different organisations. This process is characterised by economic resp. entrepreneurial decisions. Now it is about result-orientated work with partners.

Another aspect is worth to be mentioned: In comparison to the network (and the network organisation), the project organisation is established temporarily, as long as the project goes. Afterwards, the structure dissociates whilst the network organisation might preserve for further potential projects.

In transition from network to network organisation, the mechanism of trust is replaced by the contract. The formalisation of the communication and contract therefore have a direct correlation. Whilst in the first part of the formalisation of the innovation network some things have been handled informally as amicable associated acquaintances, now there is the situation of a cooperation between contractual partners.

Potentials in a network organisation are in a positive sense: increased flexibility, possibilities of cost reduction, dedication of market chances, realisation of time advantages, access to other resources and interorganisational learning (Aderhold et al. 2001, p. 151 ff.).

On the other hand, there are also risks that arise from cooperation: competence loss, infrastructure costs, diverse business culture, indirect dependence and the dilemma of competition and cooperation.

12.4 Case Study Fördergesellschaft Erneuerbare Energien e. V.

12.4.1 Structure Genesis

The throughout Germany acting Fördergesellschaft Erneuerbare Energien e. V. (subsequent short FEE e. V.) is a paradigm for the model of structure genesis. The FEE e. V. formulates its goals as follows:

§ 1 Name, location, goal, fiscal year
(2) Purpose of the association is the encouragement of education, science and research as well as the knowledge distribution in public through effective and economical use of energy just as about the application of energy out of renewable sources with the aim to contribute to environment protection and to conserve the natural livelihood.
(3) The registered purpose is especially realised through:

- Distribution of information through the application of renewable energies in the national and international public by lectures, seminars and workshops with public access
- Contemporary publication of all own realisations, conference materials and speeches, execution of community research whose results are published for the public promptly,
- Encouragement of effective cooperation of science and economy (http://www.fee-ev.de/verein/satzung.html)

The charter refers to the first central point of the structure genesis:

1. Purpose = idea. It is about the promotion of knowledge and science in the topic of use of energy and renewable energy sources. With the help of in passage 3 depicted measures such as the information generation and distribution through speeches and workshops, but also through own research the cooperation between economy and science is strengthened.

"Our association links innovative small and medium-sized companies, well-respected research facilities and technical experts with politic decision makers" (http://www.fee-ev.de/). Apart from that, the heterogeneity of the actors is apparent, it becomes clear that the association also aims networking: “We offer you through technology specific meetings of study groups a platform of experts on the field of renewable energies. Additionally, we support you in cases of project propositions and executions as a competent partner. On national and communal level, we appear as interests alliance. Network with us! Enrich our study groups! As a member you can discuss your idea with like-minded persons” (http://www.fee-ev.de/).

During a 2003 executed organisation analysis, it has been proved that the first contact with the FEE e. V. or members of the association takes place in acquaintance networks that emerge trade-specific (Müller 2004). An idea exists which circulates in interested spheres and has the potential to encourage organisation to a membership.

The existence of a network organisation can be proven. In a passage on the web page a membership is proclaimed:

“In the FEE you will find a sustainable innovation and information network on the field of renewable energies, realised through an intense and capable collaboration between science and economy. Become a member of our non-profit association to communicate with small and medium-sized companies, universities, Fraunhofer- and Leibniz-institutes as well as various more actives on this field about your innovation, developments and ideas. Enrich our study groups and exchange your thoughts. We are looking forward to your ideas and participation” (http://www.fee-ev.de/).

This formulation and the offensive reference to the application for admission refer to the second point of the structure genesis:

2. Network organisation = exclusive, interests orientated and competence based area. Hierarchized regarding the amount of employees resp. with private persons, the labour status an explicit declaration of intent is required for the membership which also contains costs and the recognition of the charter (contract). Only through this step of the formal constitution, the entrance to the “inner circle” is possible – consequently a preposition for the participation in the project organisation. This demarcation is the basis for the protection of the idea and promotes an open communication on the basis of trust under the effective members.

Apparently, a membership is attractive since thereby the chance evokes to participate in the project organisation. Already at the naming, it is advised that it is an innovation network. Even though the FEE e. V. names itself a network, it is a circumstance that irritates since it obviously is a network organisation (as registered association). As proven by Müller in 2004, the naming as network evokes out of the founding time (1993) when it was usual to talk about networks resp. to initiate them. Furthermore, back then no one differentiated networks and network organisations as well as that the differentiation for most members is in need of explanation and it might not have mattered back then or nowadays.

Also the third step of development, the realisation of the project organisation out of the network organisation, can be proved. The project organisation of the FEE e. V. is referred to as study groups. There exist four:

The FEE has nationwide various networks and study groups (SG)

- SG "gasification of biomass" since 1994, with international integration in projects
- SG "biogenic gas – fuel cell" since 2001, until now unique in Europe
- Biomethan-Kurastorium (BMK) since 2008, together with the Bundesverband Regenerative Mobilität e. V. (BRM, formerly BBK)
- SG "energy efficiency in buildings and residential areas" since 2008

"We welcome you kindly as contributors in the study groups and as participants of our SG meetings, for you, with you and with your ideas, organised by us" (http://www.fee-ev.de/arbeitsgruppen.html).

The third central point of the structure genesis, the development of specialised project organisations as part of the network organisation, can be confirmed:

3. Project organisation = membership area with the entrance barriers of core competence, interests, resources, willingness for active participation

Not all members of the acquaintances network in the atmosphere of the FEE e. V. are members of the innovation network FEE e. V. and in return not all members of the network organisation are members in one or several project organisation like e.g. the successful study group "biogenic gas – fuel cell".

On basis of the respective core competence, resources and interests the membership is decided. The composition of members shows on one hand the heterogeneity and on the other hand the specialisation (in terms of core competences):

"To the success more than 160 partners from 16 states have contributed until mid of 2004 thereunder 82 companies, mainly small and middle-sized, as well as 7 agrarian companies, 9 networks and competence centres, 46 research institutes, 11 authorities and ministries of the federation as well as 10 unions and associations. In the preparation phase the FEE is self-forgetful in scientific questions through the support of HMI Hahn-Meitner-Institut, Berlin" (http://www.fee-ev.de/arbeitsgruppen/biogene-gase-brennstoffzellen.html).

12.4.2 Lessons Learned

Success factors are difficult to measure in comparison to the success extent and are extremely complex and multi factorial. However, the employment with them is still advisable to determine the success factors of effective organisations. In case of multi organisational innovation networks with heterogeneous participants, we suppose that the organisational reproduction and coordination of heterogeneity works best with the phase model of the structure genesis. With increasing exclusiveness of the participants (of the acquaintances network for many up to few in project organisation), various possibilities of intense participations are permitted.

Why do we examine the above described process of structure genesis as a success factor of innovation networks?

1. From the initiators of the FEE. E. V., by name Eberhard Oettel, the foundation time has been described as a time of learning by doing, thus a time in which no experiences were available about how heterogeneous members could be integrated through their common interests. This starting problem has been solved by becoming a member in the FEE e. V. and to engage afterwards competence based and guided by the specific interest in the study groups.
2. The FEE e. V. is up to today mainly supported by the enthusiasm of its members for the same cause. Even though a working management of the association is occupied with competent members that are technically, organisationally, financially and personally able to work, the significant impulse for the content come from the members themselves.
3. An important lesson is after all that the members receive an area where a protected communication about their ideas and interests is possible (network organisation and project organisation). Here, representatives of the members organisations gather who can work on mutual trust in work division on precise projects or initiate developments. If the FEE e. V. were "only" an acquaintances network, the confidentiality would not be possible. In this confidence region which is strengthened through legal obligations, the significant success factor of innovation network lies.

Conclusion and Outlook for the Turkish Bio-Energy Market

The model of the structure genesis of innovation networks has been depicted with its main features and with the help of a case study in this short essay. It becomes clear that the illustrated phase sequence is in principle verifiable. On the basis of an informal acquaintances network a formal network organisation is found which in return serves as a starting basis for the foundation of thematic specific project organisations. The innovation network "Fördergesellschaft Erneuerbare Energien e. V." is since 1993 a throughout Germany respected institution and obtains its attractiveness for current and future members to work core competence based and trustful with heterogeneous partners.

An innovation network according to the model of the FEE e. V. has advantages which may also apply to the Turkish market for renewable energies (preferably for the gasification of biomass):

1. In turkey, the potentials for utilisation of biomass as energy source are existent, but they are only used in a low extent. The EnergieAgentur.NRW comments: "Bioenergy has a marginal status in Turkey. (. . .) Modern forms of biomass utilization like wood pellets or gasification of biomass of the forestry and agriculture do

not exist in an appreciable extent (http://www.energieagentur.nrw/international/laenderinformationen/tuerkei)". The same source estimates a potential of 100,000 GWh/a of which 70,000 GWh/a have already been realized. But there are also more optimistic perspectives: The German-Turkish chamber of commerce and industry expects 7.38% renewable energy of the energy mix in year 2016 with 5868.8 installed MW. One of the main obstacles for the development of renewable energies are the missing know-how and experienced technical personnel as well as too marginal investments in research and development (www.eclareon.com/sites/default/files/factsheet_bioenergie_2016.pdf).

The expectations until year 2023 are major: The percentage of renewable energies of the energy consumption shall rise from currently 6 to 30%. Therefore, the encouragement has been brought to a legal basis which also regulates the compensation for the supply of electricity out of renewable energies. Altogether, the following positive evaluation, especially from the view of the German industry, can be drawn for Turkey:

"The potential in this segment is high and up to now unutilized. (. . .) The biomass in Turkey is today mainly used for heat production. For the production of electricity the portion is marginal and also the current exploitation and utilization of the available potentials for extraction of biogas is not particularly high. However, these sectors offer a tremendous growth potential. Up to 12% of the consumption of electricity could be provided in Turkey through biogas" (www.eclareon.com/sites/default/files/factsheet_bioenergie_2016.pdf).

2. The role of the FEE e. V. or the (German-) Turkish pendants can also be assessed as optimistic. The main demand exists in the area of consultation, engineering companies und project planning, components for biogas, fermentation and composting facilities, components for waste separation, pre-treatment and sortation as well as other technical knowhow and facilities. The in Sect. 12.4 indicated member structure of the FEE. E. V. is predestined for the provision of (scientifically based) consultation services and the provision of technical assets on highest standard.
3. In context of the "Turkish-German biogas projects" (http://www.biyogaz.web.tr/de), a fundamental transfer and set-up of know-how shall be expected in Turkey. A participation of the FEE e. V. would be possible in order to assist Turkish KMUs and research institutions as consulting partner as well as to determine market opportunities for the FEE e. V. members.

Due to climatic, geographic/geological and infrastructural framework, Turkey is an interesting target market for companies of the renewable energy industry who want to invest in peripheral, small forms of electricity production.

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Knowledge Transfer as Driver for Innovation Culture in Heterogeneous Economic Zones

13

Winand Dittrich and Matthias Biniok

Contents

13.1 Introduction

The management of innovations is an important factor of influence for success in organizations and determines not only the sustainability of companies but also the future of whole economic zones. Due to the intensified competitive constraints, the need for a structural established innovation culture in companies and organizations increases. Knowledge transfer is considered as the central aspect of such an innovation culture. The goal of this paper is to analyze knowledge transfer in small and medium-sized enterprises and heterogeneous developing economic zones, like Turkey and Germany, especially considering the role of socio-cultural factors and degree of modernization.

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_13

This transfer of knowledge that drives innovation exists in organizations or regions, e.g. Erzurum, among different instances. The mostly established transfer is internal communication of knowledge, e.g. between two departments. A mutual exchange of experiences and establishment of knowledge transfer among organization and customer, or also educational institution and students, is another step to implement an innovation culture. It is also possible for innovation to come from outside the company – this is called open innovation. Opportunities and risks of an open innovation culture interrelated with intercultural factors will be discussed.

Processes in innovation management which build and maintain an innovation culture need to be managed to eventuate in the optimal result. The advantage of knowledge transfer and innovation culture as a strategic instrument of economic expansion for small and medium-sized enterprises and economic zones will be focused conceptually and practically. Other factors like communication, IT support and also boundaries of innovation need to be considered as well. Also, areas important to business, such as the proximity to large markets, the quality of its infrastructure services (other than those related to trading across borders and getting electricity), the security of property and people, the transparency of government procurement, macroeconomic conditions or the underlying strength of institutions—will not be studied in relation to the knowledge economy.

13.2 Knowledge Transfer – Terms and Definitions

The term "knowledge transfer" is only one of many ways describing how to deal with information and knowledge. Ian Graham of the University of Ottawa tried to list most of these different terms, resulting in a Table itemizing and defining them. The arising list contains names like "knowledge translation", "knowledge exchange", "research utilization", "implementation", "dissemination", "diffusion", "continuing education", "continuing professional development", and, of course, "knowledge transfer" (cf. Graham et al. 2006, p. 15 ff.). Each term means something similar but still varies from the other ones. Similarly, Nonaka and Takeuchi have developed a comprehensive model for knowledge management, which consists of four different modes, namely Socialization, Externalization, Combination and Internalization (see Nonaka and Takeuchi 1995). It is also known as the SECI process and is at the very heart of the knowledge-creation process. Knowledge creation takes place through the continuous transfer from one status to the other, for example from permanent interactions of implicit and explicit knowledge or from internalization to externalization. The current paper will focus on "knowledge transfer", as a comprising name for the above mentioned terms, therefore, a process taking place at different levels from pure knowledge creation.

Being aware of all these diverse terms and their meanings, it gets difficult to find an appropriate definition for knowledge transfer. Looking at each word separately, new questions come up. First of all, what is knowledge exactly, and second, what is understood by "transferring" something abstract like knowledge. The attempt to answer these questions will not be part of this paper. The distinction between types of knowledge started centuries ago, e.g. the difference between a priori and a posteriori knowledge by Kant (cf. Kant 1974, A1 ff./B7 ff.). Fortunately, Eisenhardt and Santos decided to take on a generic approach to this problem: They defined knowledge transfer as the process of "moving a piece of knowledge from one place to another" (Eisenhardt and and Santos 2002, p. 44). This definition is very clear as it takes the term "knowledge" as given fact and describes the movement and sharing of knowledge which is a critical success factor for every business.

Another definition in a university context is that knowledge transfer is "about transferring good ideas, research results and skills [. . .] to enable innovative new products and services to be developed" (cf. Gabrys et al. 2011, p. 84). When referring to innovation as process and outcome of creating something new which also needs to be something of value, the definition above assigns some new attributes to knowledge transfer. The outcome needs to be not only a new product or service but also something of value. This augmentation implies, on the one hand, that knowledge transfer is part of every innovation process (and therefore also part of an innovation culture). On the other hand, the output of a knowledge transfer process is always considered as input for a new innovation or knowledge transfer process. Thus, the evaluation of this outcome is crucial for the success of new knowledge transfer.

Knowledge transfer is not only applicable in typical fields such as enterprise business and university context or the health sector. The range of possible application domains is much wider. Tim Minshall of the University of Cambridge describes six further sectors: people, publication and events, collaborative research, consultancy, licensing, and new businesses (cf. Minshall 2016). The transfer of knowledge from people (e.g. new hires) to the company is a normal (mostly non-guided) process in enterprises. To improve this knowledge transfer, these processes must be implemented, documented, and properly applied. The outcome of publications and events needs to be documented and transformed into a format which is sufficient for working with these results. This goes hand in hand with storing the results of collaborative research or work in a convenient way. External knowledge transfer is often based on advice and experience of experts and consultants. They can introduce their intellectual property into the company, sometimes as part of a licensing process. While all of these sectors root in the university area, they can also be adopted to the business area which is described by Minshall as import into new businesses (cf. Minshall et al. 2008, p. 355 f.). Mortara and Minshall describe in their paper how "open innovation" is driven by knowledge transfer not only out of a university context (cf. Mortara and Minshall 2011, p. 591).

13.3 Knowledge Transfer in Heterogeneous Economic Zones with Focus on Turkey and Germany

For a starting point, when building a national knowledge economy, it seems essential to understand the country's strengths and weaknesses, as well as the strengths and weaknesses of actual and potential competitors. To evaluate a country's potential in this area, here, the world bank's broad measure of the overall level of preparedness for the knowledge economy is used, namely the Knowledge Economy Index (KEI) (see WBI 2008). The KEI summarizes each country's performance on 12 variables corresponding to the four knowledge economy pillars. These pillars are based on 12 indicators of knowledge, summarized in 4 groups: a) Economic and institutional regime, b) Education and skill of population, c) Information infrastructure, d) Innovation system. The KEI is constructed as the simple average of the normalized values of those indicators, from 0 to 10. A KEI score that is close to 10 implies relatively good development of the four knowledge economy pillars as compared to other countries while a score close to 0 indicates relatively poor development.

Economic development and knowledge seem closely linked together (see Fig. 13.1). It has been found that the correlation between the accumulation of knowledge (KEI) and levels of economic development is around 87%. Countries with higher KEI scores tend to have higher stages of economic development and vice versa.

Certainly, a correlational measure on its own seems insufficient to predict that building up certain forms of knowledge in a poor country will be a guarantee to produce economic growth any time soon. However, further econometric tests by the WBI (see WBI

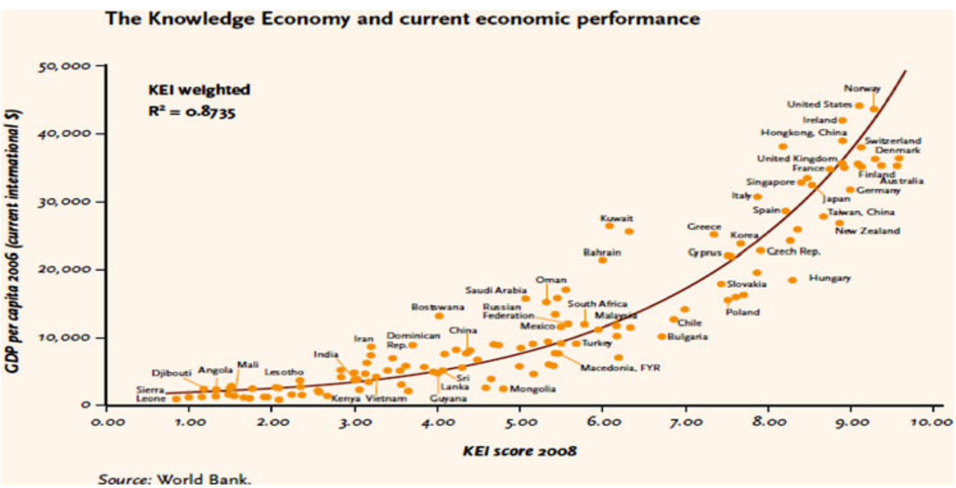

Fig. 13.1 The Knowledge Economy Index according to the world bank's Knowledge Assessment Method. (Source: WBI 2008, p. 7)

2008, p. 8) actually do reveal a statistically significant causal relationship running from the level of knowledge accumulation, as measured by the KEI, to future economic growth, the relation between countries' KEI values and their average future growth rates of output per worker. That higher KEI values are associated with higher rates of future economic growth (with other factors held constant) suggests that larger stocks of knowledge stock do indeed cause higher levels of economic growth and development. According to the WBI, a one-unit improvement in the KEI—equivalent to an increase in ranking of one decile or 13 positions—can increase economic growth by 0.49 percentage points, after accounting for initial conditions. Turkey has established herself among the top gaining countries between 1995 and 2007 with an improved score of +12. Nevertheless, in the last few years this positive development might have reached a kind of levelling with a rather constant score, however, aiming to outstretch this score again in the future. These important findings by the WBI confirm that knowledge and its applications should be attributed a major role in growth processes. Knowledge-related policies and practices belong at the top of today's agenda in low- and high-performing countries independent of the country's economic ranking.

The crucial role of knowledge and innovation becomes evident if one compares eight dimensions of economic development (see Fig. 13.2), following the European Commission's Innovation Union Scoreboard (IUS) Report (see IUS 2013, p. 17). In this report, based on 24 innovation scores, all 27 EU countries and a selected group of important associated partners of the EU, including Turkey (TR), were divided into four groups: innovation leaders, innovation followers, moderate innovators and modest innovators[1].

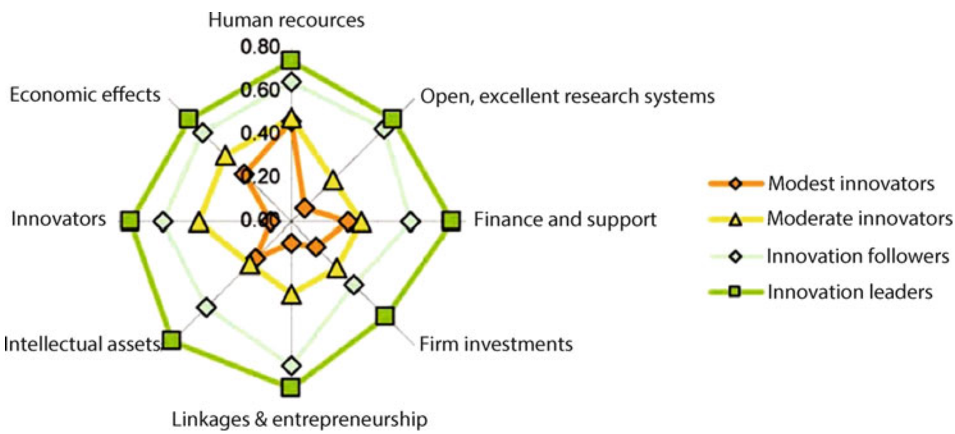

Fig. 13.2 Innovation level and performance per dimension for the four country groups. (Source: EC, 2013)

[1] For details of countries included see Fig. 13.4.

Innovation leaders, including Germany, are characterized by the smallest variation across all eight dimensions. This might point to beneficial effects of keeping a balance of all different dimensions in addition to performing best on all dimensions compared to the other three groups. Modest innovators, including Turkey, showed their best results on the dimensions Human resources, Intellectual assets and Finance and support, i.e. a considerable potential for innovation actually seems available. However, when considering the weakest innovation scores, namely on the dimensions Innovators, Open/excellent research systems and Linkages/entrepreneurship, it becomes evident that the actual potential could well be used or developed more efficiently. The overall performance of Innovation leaders is 20% or more above that of the EU27 average, and for Modest innovators it is below 50% that of the EU27 (see IUS 2013, p. 10). Therefore, introducing supportive policies for knowledge development and establishing social and economic structures for innovation and entrepreneurship is the challenge for modest-innovator countries like Turkey.

Analyzing the economic development in Turkey in relation to innovation, the overall picture regarding innovation, provided by the latest Community Innovation Score (CIS) of the Turkish Statistical Institute (see CIS 2015), seems to support the findings of the IUS Report. The types of innovation most often initiated by the different companies are summarized in Fig. 13.3.

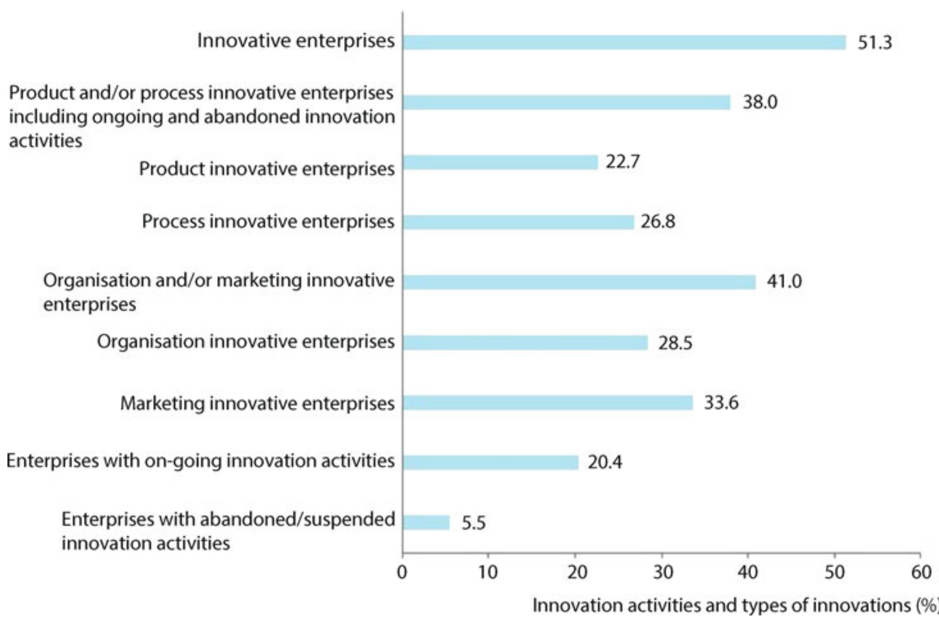

Fig. 13.3 Main Innovation Indicators 2012–2014. (Source: CIS 2015)

Interestingly, half of all enterprises see themselves as innovators. The variation of percentage (10–15%) for non-innovators in the different industries (45–60%) was quite low with two remarkable exceptions (see CIS 2015, Table 13). Only the sectors Research, development (25%), Information, and communication (35%) reported quite low percentages for non-innovators. When asking all non-innovators about the reasons for not being innovative, quite consistently about 80% in the different business branches mentioned that they could find no compelling reasons for innovation. Overall, there seems a high potential but at the same time a high demand for innovation in Turkey, even if a high percentage of companies seem to have difficulties to acknowledge the role of innovation in a modern economy. Most interestingly, only 35% of larger companies with more than 250 employees regard themselves as non-innovators compared to 49% of smaller companies. The low percentage of abandoned/suspended innovation (6%) and the international competition most likely faced by larger companies can be taken as an encouraging indicator for innovation success in this respect. For example, innovations seem to be adopted by competitive companies and if innovations are started than they most likely will be implemented successfully. The closer the economy in Turkey will be integrated with international markets the more it needs to prepare for innovation and new opportunities. The geographical situation of the country seems ideally placed to benefit from new opportunities in the world economic and trade development, particularly its potentially mediating role between Asia and Europe.

Similarly to the Former Yugoslav Republic of Macedonia, here, Turkey is seen as a Modest Innovator (see Fig. 13.4), according to the European Commission's IUS Report (see IUS 2013, p. 19). It seems not surprising that Turkey as modest innovator in relation to EU comparison has shown a below average performance overall. Although, by comparing most indicators, both countries seem to perform below average, one might point to some particular strengths.

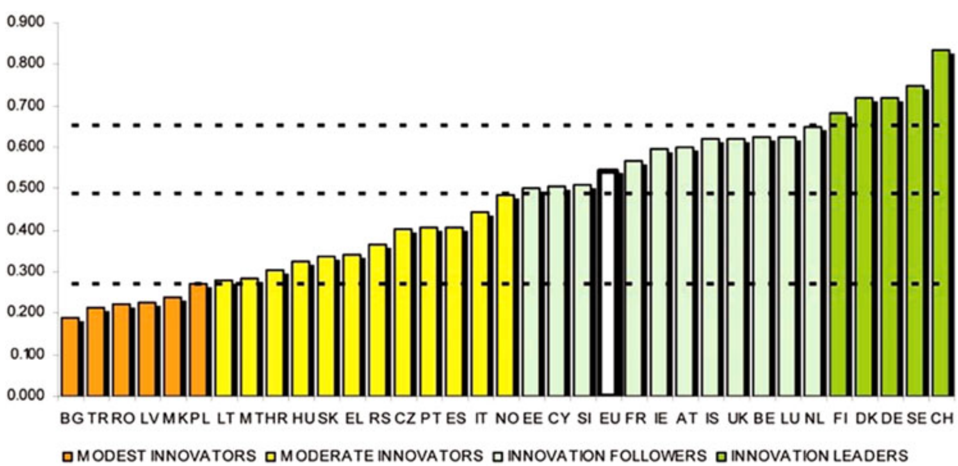

Fig. 13.4 European countries' innovation performance. (Source: IUS 2013, p. 19)

For example, as shown in Fig. 13.5, Turkey can be found in the top-5 positions for SMEs introducing marketing or organizational innovations and for co-publications, Public R&D expenditures and Public private co-publications. Both countries have improved their innovation performance at a rate above that of the EU27 average: Macedonia (2.6%) and Turkey (3.6%). Relative strengths are in Innovators and Economic effects, as shown in Fig. 13.6. Relative weaknesses are in Human resources and Firm investments. High growth is observed for new doctorate graduates and Community trademarks. Regarding the importance of research development, for example, stimulated by the increase of internal doctoral students the value of international exchange at the graduate and postgraduate level should be more emphasized. For example, German higher education institutions are strongly involved in exchange programs such as ERASMUS as well as getting many more applications of doctoral students from abroad than places available. In this sense, a precarious gap seems to develop between the increase of internationally recognized publications output of universities in Turkey, pointing to excellent research opportunities, but at the same time a decline of the attractiveness for doctoral students from abroad. Especially, the Atatürk University has great potential to strengthen again its cooperation and international exchange efforts as formerly being an important crossing point between the east and the west, as exemplified by Erzurum's prominent position on the old Silk Road. Such a development would significantly contribute to its strong academic development, not the least,

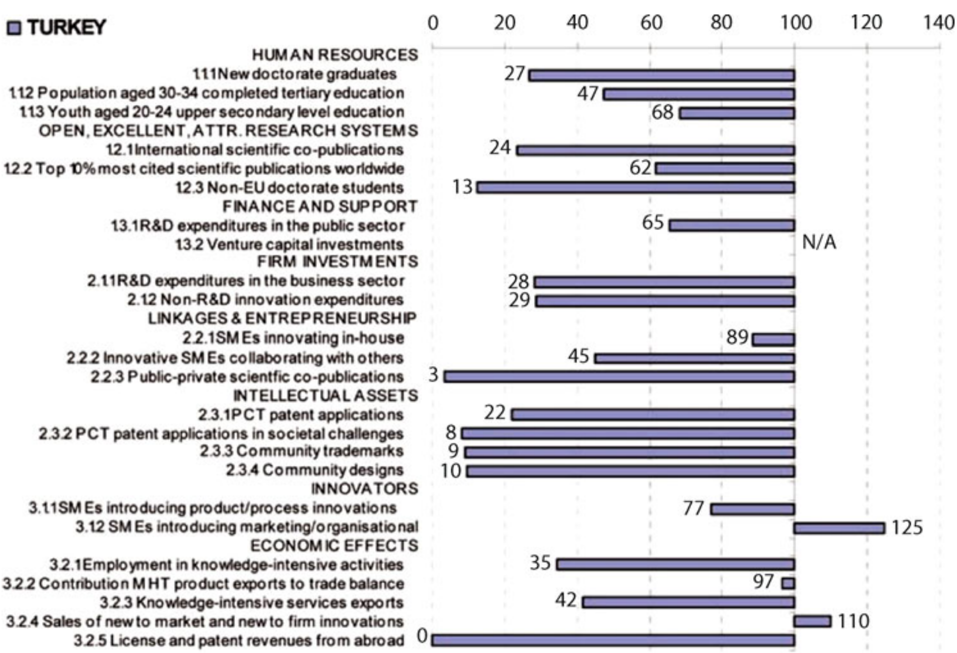

Fig. 13.5 Indicator values relative to the EU27 (EU27 = 100). (Source: IUS 2013, p. 56)

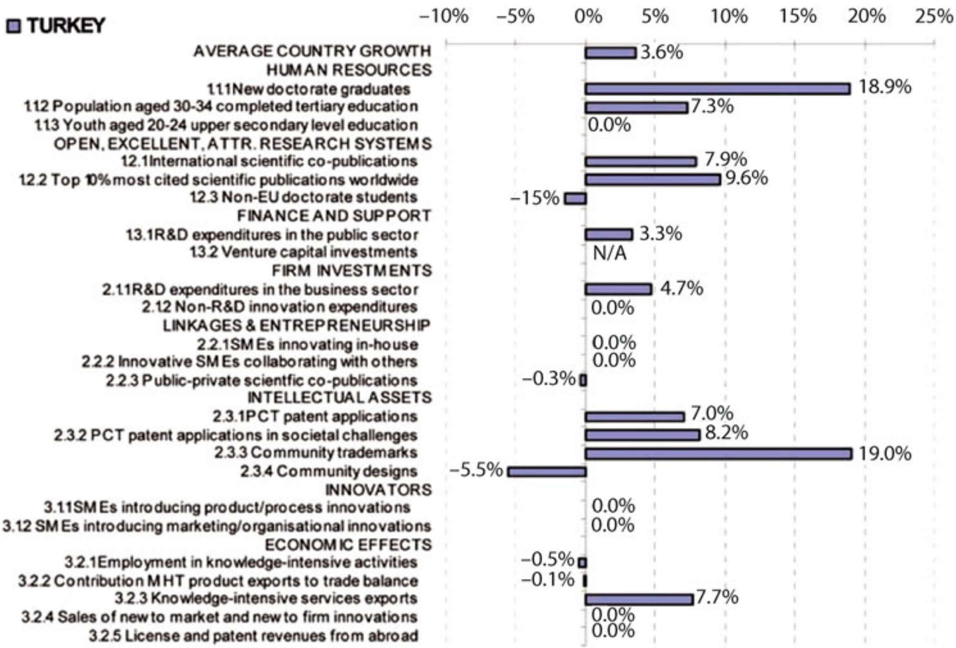

Fig. 13.6 Annual average growth per indicator and average country growth. (Source: IUS 2013, p. 56)

within the country. Atatürk University is 33rd among the 126 Turkish universities ranked by the Ministry of Science, Industry and Technology's "Intercollegiate Entrepreneurship Innovation Index". Universities were ranked on 5 dimensions, recognizing the great potential of academic institutions for economic development: 1) competence in scientific and technological research, 2) the intellectual property pool, 3) co-operation and interaction, 4) entrepreneurship and innovation culture, and 5) economic contribution and commercialization. On the dimension "co-operation and interaction" Atatürk University scored lowest and lower than the vast majority of universities.

A strong decline is observed for Community designs. Growth performance in Human resources, Open, excellent and attractive research systems and Intellectual assets is well above average and in Linkages & entrepreneurship below average.

In this respect, the growth and innovation potential of Atatürk University in East Turkey seems enormous, thus forming the center for a new kind of Silk Road, namely "the east-west knowledge bridge". Indications for such a development and some kind of knowledge transfer can already be seen in the establishment of medical or sports centers in Erzurum equally attractive to the local community as well as neighboring countries. Accordingly, institutional instruments and educational facilities must be established which encourage knowledge transfer and trial and error processes for creative companies. The government should provide support for people and companies in the eastern and central Anatolian regions to find out which nationally and globally existing technologies work in these places and can be adopted competitively. This requires deliberately pushing knowledge transfer and experimentation with products in less developed regions and providing the population with social security in case innovative businesses fail. The challenge will be to build a sustainable knowledge infrastructure through knowledge-to-practice programs, business development and knowledge transfer schemes, interaction and cooperation with the EU and among others neighboring partners and in general, open up for better mutual understanding enabling knowledge transfer at all levels. A particularly strong mechanism for knowledge transfer will be discussed in detail in the next section. It seems that Turkey needs to put more political prominence in such sustainable knowledge transfer programs to prevent a deep economic crisis, once the construction boom comes to a halt. Just in developing its knowledge base, Turkey will build a stable route, not only a road, to maintain the significant technological and productive improvements it has made in the last decade.

13.4 Innovation in Knowledge Transfer Using Graham's Knowledge to Action Cycle

There are several process models depicting the way on how to introduce, implement and manage knowledge transfer in enterprises and the economy, in general. Most of these process models contain some basic terms and procedures which are part of almost every knowledge transfer process. First of all, there need to be mediums which hold the knowledge as kind of a carrier. As defined, knowledge transfer is the process of moving it from one place to another place (cf. Eisenhardt and Santos 2002, p. 44) – therefore, it must be a sender and a receiver in each knowledge process.

Considering a sender and a receiver, there needs to be something to send and receive – the knowledge itself. All of this happens in an organizational or corporate context which includes special characteristics influencing the type of transferring the knowledge. Minbaeva described a very generic process to illustrate the simplicity of this concept (see Fig. 13.7). Additionally, it contains two more capacities of both, sender and receiver: the sender's disseminative capacity and the receiver's absorptive capacity (cf. Minbaeva 2007, p. 569).

This basic concept describes the foundation for any other knowledge transfer process models in various research areas. In 2006, Canadian physician and researcher Ian Graham, PhD, wrote an influential paper about knowledge transfer processes in the health sector. In course of the paper he introduced a new approach: the knowledge-to-action process (cf. Graham et al. 2006, p. 14 ff.).

The process is divided into two main phases. The knowledge phase specifies all the steps required to gather knowledge and synthesize it into to proper information packages. This phase can be easily supported by tools and software, especially comprehensive knowledge management suites.

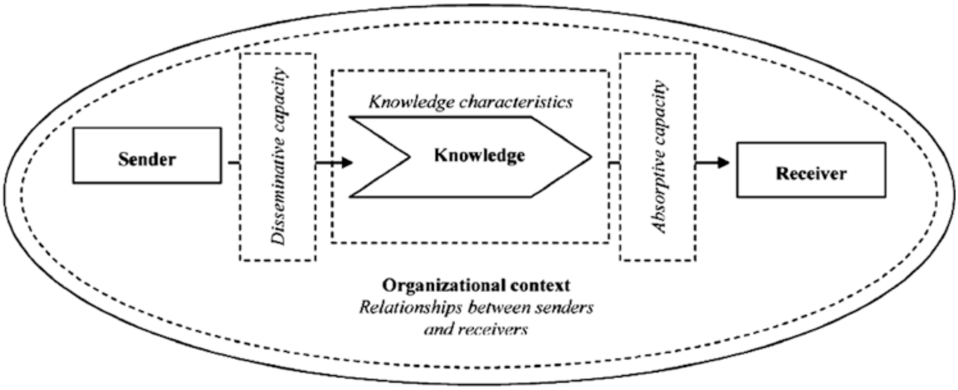

Fig. 13.7 Knowledge Transfer Model by Minbaeva. (Source: cf. Minbaeva 2007, p. 569)

The second phase, also known as action (or application) cycle, is based on the gathered knowledge. At appearance of a problem which can be solved by using existing knowledge the action cycle starts with identifying and selecting the appropriate knowledge supporting the problem solving process. After identification, a tailored solution will be applied based on the information input. Subsequently, an evaluation of results will take place to assure the possible reuse of the output. Graham's process model is depicted in Fig. 13.8.

Looking at Graham's knowledge-to-action process, there is high complexity in understanding and following the model. That is the reason why this paper aims to provide a model which is sufficient regarding complexity but as simple as possible to reduce confusion and overhead. It could be considered as "lean" knowledge-to-action process (see Fig. 13.9).

Similarly to Graham's model, there are two main phases comprising the whole process: the knowledge creation phase and the innovation/action phase. Also the content of the first phase is similar to the knowledge-to-action process. The only difference is that the focus on knowledge tools and storage is higher and there is an output produced within this step. When knowledge is acquired, it is necessary to store it somewhere. The actual place where the knowledge is stored does not matter; it is rather important that all of this knowledge is accessible (for example as part of a company knowledge store).

On condition that there is a company knowledge store which is actually accessible for all interested (and admissible) parties, the second phase "innovation/action" can be initiated. If in any situation, knowledge transfer is necessary or innovation is needed, there is now a given prerequisite: knowledge. By selecting the relevant knowledge, it is possible to adapt the input onto individual problems. Based on this adaptation the implementation of a problem's solution is achievable while the problem itself could be not only a revision of an error but also something more abstract like a new strategy for innovative products.

After "solving" the problem, the output needs to be evaluated so it can be used in a new innovation phase as knowledge. But the input which was used in the selection,

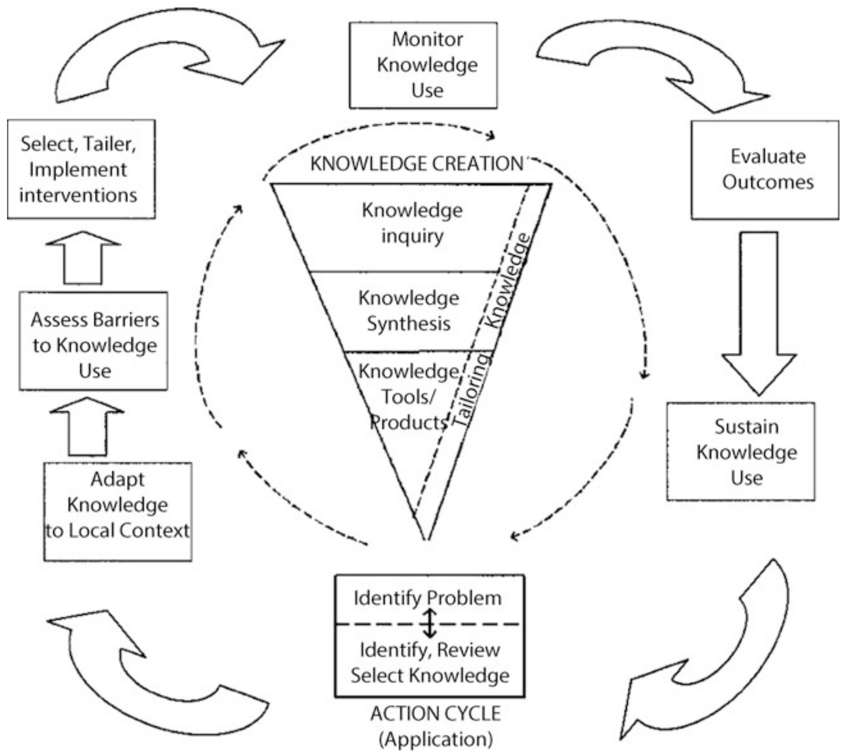

Fig. 13.8 Graham's Knowledge-To-Action Process. (Source: Graham et al. (2006), p. 19)

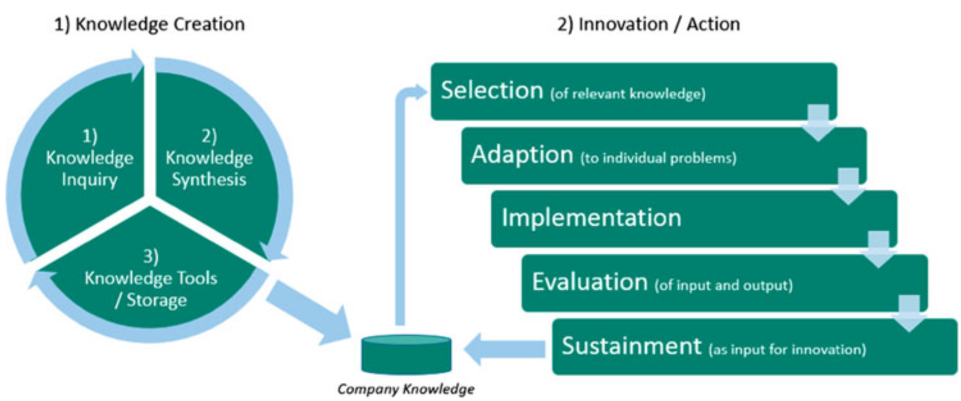

Fig. 13.9 Lean knowledge-to-action model

adaption and implementation step has to be evaluated as well to assure its knowledge value and to evaluate the quality of the knowledge. Finally, the sustainment phase ensures the reusability of the produced innovation to make further knowledge transfer possible.

13.5 Example Case of Knowledge Transfer in Eastern Turkey

Our lean knowledge-to-action model is a theoretical approach to manage and improve the process of knowledge transfer in various industries all over the globe. In order to comprehend the technique, it is necessary to give an example on applying the model to a real-life innovation process. The following example case provides an overview about the role of innovation and knowledge transfer in the agricultural sector of the Eastern part of Turkey.

The agricultural sector is still a very important pillar in Turkey's economy. While the number of people working in this area is slightly decreasing there were still about 7.8 million people working in agriculture in 2012 (cf. Statistisches Bundesamt 2015, p. 3 ff.). The infrastructure of the Eastern part of Turkey is not as developed as the Western part. Therefore, in East Turkey the amount of agricultural business is much higher than in West Turkey (cf. BMELV 2012, p. 2). The comparison of the population and the number of them working in the agricultural sector is depicted in Table 13.1.

Sezgin and Kaya analyzed the agricultural sector in the Eastern part of Turkey in order to discover the drivers for innovation in this industry. Their collected data indicated that there are various factors which influence the adoption of innovation in the Eastern Turkish agricultural sector. Age, income, and education are drivers for innovation and interfere with the willingness and ability to introduce innovative products and processes into the business. Other relevant factors were training for agricultural extension and mass media influence (cf. Sezgin and Kaya 2011, p. 781).

Knowing the influence factors for innovation or innovation drivers, there is the need to map these results onto the lean knowledge-to-action process described in Sect. 13.4. The goal of the first phase "knowledge creation" is to gather the knowledge, synthesize it into a useable format and store it at a place which is accessible for everyone who has

Table 13.1 Population working in the agricultural sector in Turkey. (Source: cf. Statistisches Bundesamt 2015, p. 3 ff.)

	2000	2005	2010	2012/2013/2014
Population (in 1000)	63,174	67,743	72,138	75,837 (2014)
Working population (in 1000)	21,381	22,331	25,644	27,541 (2013)
People working in agricultural sector (in 1000)	9062	8593	8005	7809 (2012)
Population working in agricultural sector (in %)	42.4	38.5	31.2	N/A (est. 28.4)

a valid interest in this knowledge. Looking at the influence factors described above, there is training and mass media. Knowledge is always gained through consuming and inquiring sources of knowledge. Training and mass media are such sources, thus, these two are valid innovation drivers, which fit into the lean knowledge-to-action process.

Switching to the second phase of the process, the innovation/action phase, there are five steps to apply existing knowledge to create new knowledge and innovation. To commence this phase people must not remain silent in an organization, they need to raise their voice. An English idiom says: “Wisdom comes with age.” Age is an important factor in starting the innovation phase because being older means being more confident, assertive, and, in some cultures, privileged. The factor income is similar to this. Having more income normally means taking less risks when investing in innovation.

The last, but not least, identified driver of innovation is education. Education has various meanings and can interpreted in many ways. In general, educated people are more capable to analyze risks and opportunities and therefore, are more likely to invest in innovation or drive their own innovation processes. But also the education of knowledge transfer processes can be an important step towards applying such methods and open up for an innovation culture.

The example case of knowledge transfer in the agricultural sector of Eastern Turkey is a great illustration how the lean knowledge-to-action process can be mapped to almost all industries and all countries. The results are fitting into the big picture of knowledge transfer processes. Eventually, in order to implement a knowledge transfer process properly, it is necessary to identify the innovation drivers of an industry and use them well.

13.6 Challenges in Knowledge Transfer Processes

There are two main challenges in implementing and executing knowledge transfer process as already hinted at in the last two sections. The first problem is communication and management. Both, in Germany and Turkey, there is an idiom called: “Talking is silver, silence is golden.” Silence is an important part of the German and Turkish culture. But silence can also lead to problems in organizations and enterprises. The referring term is called “silence organization” (cf. Çınar et al. 2013, p. 314 ff).

There are multiple reasons for a silent organization (cf. Zehir and Erdogan 2011, p. 1389 ff.). The fear job loss can lead to a “preserving knowledge” attitude – but not preserving for a company but for a person as kind of a unique characteristic. Also the lack of understanding for a knowledge sharing mindset hinders the induction of such a culture. Speaking of culture, the Turkish culture is known to be very hierarchical. This is another pain point because it prevents sharing of knowledge, especially when speaking with management.

Silence within an organization is also an impediment for getting innovation into a company. Often, employees know it best where the main problems within an organization lay and they might even have ideas to resolve these issues. (cf. Çınar et al. 2013, p. 315). If they are willing and able to raise their voices and share their ideas and concepts of improvements, the innovation process is well-implemented. Unfortunately, there are many employees who do not see the need of raising their voice or are not willing to speak up due to the reasons described above. That is why a proper knowledge transfer process needs to be implemented which handles also issues regarding organizational silence and awards those people who actually take part of the process (cf. Bagheri et al. 2012, p. 50 ff.).

Therefore, it is crucial to have well-built (communication) processes implemented to ensure a sufficient and effective knowledge management. Besides, not only the process itself needs to be well implemented, but also the communication of the process has to be elaborate and then properly conducted. If the (top) management is not committed enough, these challenges intensify and could lead to major issues in the knowledge management and transfer processes.

The second main challenge is the provision and usage of existing knowledge. Before an innovation phase is initiated, there needs to be quantitatively enough and qualitatively sufficient knowledge. Knowledge transfer as well as education in its various forms seems one of the keys. Often, knowledge is stored in form of abstract experience and/or wisdom of employees, especially of mature employees who are working in the company for a long time. The identification of this knowledge (for further use in knowledge transfer processes) is task of knowledge management. Unfortunately, it is very expensive and complex to identify such information. Sometimes it is even not possible due to lack of time, money, and resources. Furthermore, challenges emerging out of organizational silence can interfere with these problems. For example, the Turkish financial sector, at times, seems too limited in its approach. While large international companies are served by sophisticated bankers, smaller companies and start-ups make do with lenders who are often risk-averse and unfamiliar with a globalized economy. Surely, if a country loses out on the smaller companies and start-ups then the essential dynamism of the economy will suffer and a stable economic environment seems unlikely. As a consequence, investors will take a very close view on the market in Turkey as in 2015 a total of $8.6 billion Dollars has been spent on deals to acquire all or part stakes in Turkish companies by outside investors.

In this knowledge-driven environment, education seems a huge challenge, too. Turkey lingers at the bottom of the league tables in the OECD Programme for International Student Assessment (PISA).[2] Turkey spends 4% of its GDP on educational institutions at all educational levels, compared with an average of 6% for OECD countries. Overall, a correlation between financial investment in education and league table results referring to performance has been established.[3] Many SME face a dilemma: a high unemployment in general in the country, but a shortage of skilled labor in the regions. The problem, that often in heterogeneous economic zones skilled labor does not exist in many parts of a country, runs from the production sector through most levels even to junior and senior

[2] See http://www.oecd.org/edu/innovation-education.

[3] See Baker 2012 at http://www.shankerinstitute.org/resource/does-money-matter-second-edition.

management ones. The knowledge-based economy of the future needs social systems with knowledge-transfer and -savvy pathways at all levels in all parts of a country.

Furthermore, the importance of a society's political process in permitting or encouraging "seeking out behavior" on part of the entrepreneur, e.g. permitting easy entry into business, access to information, support in taking financial risks, and a legal system that reduces the risk of restrictive measures by authorities seems crucial for a country's economic development. For example, to encourage start-ups or innovations it seems most efficient when a social system allows free experimental approaches to business and to learn from failures. Interestingly, the Nobel Prize winner Edmund Phelps used a similar argument when comparing the Western Continental and the US/Canada/UK business models (see Phelps 2007).

If knowledge is available or was provided in course of the knowledge creation phase, the proper usage of this knowledge is necessary for the success of knowledge transfer processes. Therefore, clear and sufficiently communicated processes are crucial and training and education for both, management and employees need to be assured, especially regarding process compliance.

Conclusion

The term "knowledge transfer" has many definitions which were discussed in order to get a mutual understanding about this process. Knowledge transfer is able to leverage innovation processes in companies and organizations and is therefore considered as innovation driver.

Proposing major innovations and knowledge transfer in economic institutions is the most important way that economists make lasting contributions to social development in a society and economic growth in heterogeneous zones. While knowledge transfer is very important to any exchange of information between organizations, it is still underrepresented in heterogeneous economic zones like Turkey and Europe. In this paper we focused on this gap and suggested a lean knowledge-to-action action approach for countries like Turkey to improve their innovation ability by leveraging their knowledge transfer processes. Turkey seems to need a new growth model, a shift towards an innovation or knowledge transfer model to sustain past achievements.

To provide such a model, an approach of the medical sector was presented: Graham's "Knowledge-To-Action" cycle. After reviewing the model, it turned out that there is no need for a convoluted arrangement. Therefore, a modified version of Graham's cycle was introduced: the "lean knowledge-to-action model" which focuses on the most important steps of the original process. The goal of this lean model is to provide a method for introducing and executing knowledge transfer in various environments.

When implementing such a model, it is important to keep in mind that innovation-driving processes will always be highly challenging for any institution. Especially, organizations in hierarchic economies like Turkey need to handle organizational silence and further challenges. That is why the implementation of such models needs to be accompanied by empathy, prudence, and consulting.

Organizations are producing huge amounts of data, information, and knowledge every day. Such data need to be made available to extract more knowledge and to share it internally or externally. The exchange of knowledge seems especially important for companies in dissimilar economic zones like Turkey and Germany. Thus, these organizations need properly implemented knowledge transfer processes. By implementing such processes into the organizations, a big step for leveraging innovation is done.

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Part III
IT

Driver's Choice and System Outcomes in Congested Traffic Networks

14

Siegfried Weinmann, Kay W. Axhausen, and Christoph Dobler

Contents

14.1 Introduction

Motivation

The evolution of information technology opens an entirely new perspective to the central issues of transportation in overloaded road traffic networks. At the forefront of progress in information technology is the opportunity for the individual vehicle drivers to acquire knowledge through media.

Digital media have changed the markets and also the behavior of consumers, including that of road users. Telematics, in particular, has created innovations in driver assistant sys-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_14

tems. Zuurbier (2010), concerning the application and dissemination of navigation devices in vehicles, says: "in Europe 25% and in North America 20% of the vehicle fleet already have some sort of navigation device and growth in Europe is projected to 40% according to market research. In addition the route guidance service itself is also continuously improving due to innovation. As a result, there is a shift toward navigation on smartphones as an online service." The shift toward navigation by online services via smartphone leads to an information oriented (cybernetic) type of dynamic routing.

State of the Art

The abundance of studies regarding the possible influences of a traffic environment on individual knowledge and behavior is presented in general terms in Bell et al. (2001) and with respect to spatial-physiological-oriented route choice in the literature survey by Ramming (2002). Widely discussed are the approaches of information-oriented traffic modeling, such as route choice in Levinson (2003). A general survey is offered by Chorus et al. (2006). Both aspects, the spatial physiological and the temporal informational economical one, are also associated with each other, see Wochinger und Boehm-Davis (1995), or Karl (2003) who states: "It was found that commuter drivers enter a learning curve affected by previous experience and immediate need in which learning to access and utilize appropriate travel information is a dynamic process. Drivers learn about using traveler information, they learn about the types of traveler information available and they also learn whether to trust the information provider."

Among the studies analyzing the effects of traffic information under new realities are Busch et al. (2012a, 2012b), Mandir (2012), and closely related to the present work, Zuurbier (2010). Nöcker et al. (2005) report on the development of Anticipatory Advanced Driver Assistance Systems: The communication between vehicle and infrastructure creates a telematic horizon that provides information about current traffic conditions and dangers and enables road users to react in time to critical traffic situations. The vehicle becomes part of an interconnected cooperative system that gathers and diffuses information, harmonizes technical on-the-road behavior, and helps to optimally distribute the traffic load.

The trend of telematics shows that information technology influences traffic more and more. Assistance systems connect sensors to board computers, and to the GPS. Thus ordinary drivers become ideal drivers, i.e. a driver who behaves ideally from both a technical and an economic point of view. Driver assistance systems, on the one hand, offer help in steering the vehicle, such as in switching traffic lanes without interfering with traffic flow. Or they help adjusting the optimal distance from the vehicle in front to the current speed so that the capacity of the road section does not decrease below the calculated technical norm. Furthermore, to help the driver take the best possible itinerary towards his destination, the assistance system will inform about the current travel times on his routes. Changing conditions on the alternative links are detected at ever shorter intervals. The dynamically informed driver can re-plan his route at every intersection.

Objective of the Study

The present study investigates the effects of spatial orientation in typical situations. It starts from the following exemplary scenario: Road traffic in the Zurich metropolitan area is congested. Vehicles often move at walking pace. Traffic demand leads to an average volume of 118 vehicles per kilometer. Every driver has planned his itinerary with the help of an off-the-shelf navigation device and sticks to his shortest route. In view of this situation, the question investigated in this study is: How much will the traffic situation improve if part of the drivers use real-time navigation information (such as may be available via smartphone)? The research to answer this question proceeds on the assumption that a driver behaves either in a "conventional" or in a "progressive" manner. The conventional drivers move along on the route they perceived as the shortest one when they planned it before starting on their trip. The progressive drivers are informed about the current traffic situation and head for their destination dynamically by choosing the currently most advantageous link at each traffic node on their trip.

The decision processes of the informed drivers will be mapped in a simplified form and microscopically simulated using the MATSim software. A model postulated for the route choice describes the behavior of drivers guided by real-time navigation information, but not obstinately following it; their experience regarding the reliability of the traffic information also influences their route choice. The model analyzes how differing knowledge levels and modes of behavior of the drivers affect the state of the traffic system in the real-world setting of the Zurich metropolitan area.

14.2 Modelling Drivers

Basic Assumptions

The learning mechanisms and behavioral patterns of the drivers choosing their routes are at the core of the microscopic simulation of the transport system. Each progressive driver is presumed to decide rationally, and to wish up-to-the-minute information about the consequences of his decision. The main criterion for the choice of a route is its utility. Like every decision, the choice of a route also leads to an uncertain result. Drivers will accept detours if there is a chance of gaining time, or if the risk of loosing time on their habitual route seems to be too high.

The main factor of utility is the time required for the trip. Before getting into the issue of the choice of a route, it is appropriate to take a closer look at time as a property of utility and choice criterion. The question as to whether additional properties are to be taken into account when it comes to choosing a route will also be considered. A utility function that maps the behavior of a class of rational drivers shall, in the framework of this study, fulfill the following four postulates:

I. The utility of a route diminishes with increasing expenditure of time.
II. Drivers want to reach their destinations as quickly as possible. To avoid losses they are prepared to take risks as shown in the descriptive analyses of Kahneman and Tversky (1979), as well as Kroll (2010).
III. The principle of diminishing marginal utility shall be taken into account, so that it matters whether the difference of the utility of two routes relates to a small or to a large sum of times expended. (For example, the difference of the utilities in the case of saving 100 and 110 units shall be smaller than the difference of utilities in the case of saving 10 and 20 units.)
IV. The probability of a route being chosen shall be proportional to its utility. (For example, it shall not matter whether the expenditures of time on two routes amount to 10 and 20 units, or 50 and 100 units.)

Travel time is the most important attribute with respect to the evaluation of routes (e.g. Ortúzar and Willumsen 2001; Bezuidenhout and Zealand 2002; Wardman 2004). There are a number of reasons for considering the saving of time as the most important property of utility when it comes to choosing a route: (1) Travel time on a traffic-free road is proportional to its distance; i.e. the time required to travel is a transformed measure of the distance of a route – even though both variables, length of time and distance, are perceived differently. (2) In calculating the monetary cost of using a busy road, travel time carries the most weight (generally, i.e. if the variable costs weigh more than the fixed costs). (3) As opposed to monetary cost, length of time has the decisive advantage that the results of the decisions are generally comparable and transparent. (4) Time is the simplest, universal measure, available to every individual to a limited extent; the marginal utility of time varies substantially less than the individual marginal utility of practically unlimited resources like money or energy.

Random Utility Maximization

As discussed in Weinmann (2013), the random utility method is best suitable for simulation with the MATSim standard software (see Sect. 14.3). The random utility method associates a route's measurable property with a stochastic value that stands for the non-measurable part of the utility. Random utility maximization is generally applicable. The probit and the logit families (with Gaussian or Gumbel distributed additive stochastic residuals) are widely discussed, e.g. Thurstone (1927), Luce (1959), Marschak (1960), McFadden (1973), Cascetta et al. (1996), Ben-Akiva and Bierlaire (1999). Brilon and Dette (2002), also Bovy (1984), mention other sources for random utility approaches, such as Abraham and Coquand (1961), Beilner and Jacobs (1972), and LeClerk (1975). They postulate the utility $U_j = V_j \cdot \zeta_j$ of an alternative A_j as the product of its deterministic utility part V_j and its stochastic deviation factor ζ_j, and they base the deviation ζ_j on a Weibull distribution that has the expectation value 1. This approach yields for route r_j

and the travel time τ_j on r_j the probability π_j of being chosen:

$$\pi_j = \frac{u(\tau_j)}{\sum_k u(\tau_k)} = \frac{\tau_j{}^{\alpha}}{\sum_k \tau_k{}^{\alpha}}, \quad \tau_j \geq 1,\ \alpha < 0.$$

The distribution π_j corresponds to Kirchhoff's first law for electrical currents. The power utility $u(\tau) = \tau^{\alpha}$ respects the four basic assumptions. Additionally, the utility of a route depends on the reliability of the travel time information (Liu et al. 2004). This property can be evaluated by the driver's experiential confidence γ in the quality of the information τ, and included as weight $\varphi = 1 - \gamma$ in the utility $u(\tau_1) = (\varphi\tau_1)^{\alpha}$ of the currently most advantageous route r_1, and into the probability π_1 with which an informed driver decides in favor of the recommended route.

The weight φ is an endogenous component of the driver's knowledge which reflects his (short-term or long-term) experience with the accuracy of the guidance information. Two different types of confidence are applied in the decision processes: First, the experiential confidence γ which is postulated as the driver's probability of acceptance and second, a fixed level of confidence Γ in order to prescribe the driver's level of compliance:

$$\varphi = \begin{cases} 1 - \gamma, & 0 \leq \gamma \leq 1 \quad \text{(descriptive approach)} \\ 1 - \Gamma, & 0 \leq \Gamma \leq 1 \quad \text{(normative approach).} \end{cases}$$

Learning Mechanisms

The decision process of an informed driver is associated with an individual learning process: On his way towards his destination the driver is approaching an intersection (node). With probability π_1, he decides, based on the utility $(\varphi\tau_1)^{-1}$, ($\pi_1 = 1$, if $\varphi = 0$), to take the recommended (i.e. at the time most favorable) route (and with probability $1 - \pi_1$, one alternative route). Having reached the end of the chosen route section, the driver determines, by comparing the actually needed travel time c to the expected travel time τ_e, whether, given his tolerance range $\tau_e w$, the choice paid off for him (in retrospective), i.e. whether $(c - \tau_e) \leq \tau_e w$ came true. The outcome of this Bernoulli experiment leads to an adjustment of his confidence γ in the information τ, which changes the assessment φ of the utility of the information and, consequently, the probability of choosing the recommended route next time. The tolerance thresholds of the drivers in different cases (e.g. $c \geq \tau_e$) are discussed in Weinmann (2013).

Let U stand for the event "driver follows information", $\bar{U}$ for the event "driver does not follow information", E for the event "driver accepts information", $P(U)$ and $P(\bar{U})$ for the a priori probabilities of the events U and $\bar{U}$, and $P(E \mid U)$ and $P(E \mid \bar{U})$ for the conditional presumed likelihoods of the event E. A suitable measure of the confidence in the traffic information can be defined as the probability of its acceptance $\gamma := P(E)$. The probability of the acceptance results from the products of the a priori probabilities and the likelihoods in accordance with the statement of total probability:

$$\gamma = P(E) = P(U) \cdot P(E|U) + P(\overline{U}) \cdot P(E|\overline{U}).$$

14.3 Simulating Transport

Driver Classes

The microscopic part of the traffic simulation is based on the individual decision making as mentioned. In the course of every experiment, the population of the drivers Ω included in the scenario is divided into two classes $K^0 \cup K^I = \Omega$: Class K^0 with static knowledge and deterministic behavior, and Class K^I with dynamic knowledge and stochastic behavior. Central to the simulation is the class of (informed) dynamic drivers K^I. A class K^I driver chooses his route according to the principle of maximizing the utility he expects by his decision (see Sect. 14.2). The impact of the drivers' microscopic learning mechanisms and behavioral patterns on road traffic will be measured below using the MATSim simulation environment.

MATSim

MATSim (Multi-Agent Transport Simulation) is an open source software for the microscopic simulation of transport systems. It has been developed by research groups at the TU Berlin and ETH Zurich universities since 1998. The MATSim components model microscopically a traffic scenario on the basis of agents. Every agent may have individual properties. By using MATSim, it is possible to simulate certain sections of real traffic networks with real demand situations, so that travel times, traffic flows, and distribution of demand together form a dynamic self-consistent system.

Note: The documentation of the MATSim software, as well as publications about MATSim traffic analyses are available on the MATSim portal and on the pages of the research groups, see Balmer (2007), Balmer et al. (2008) and Balmer et al. (2010). The most important features of MATSim are described in Dobler et al. (2013): "To analyze road users' behavior, the knowledge models described are implemented in the iterative, agent-based micro-simulation framework MATSim [. . .]. In MATSim's agent-based approach, each person in a transport system is modeled as an individual agent in the simulated scenario. Each of these agents has personal attributes like age, gender, available transport types and scheduled activities per day. Klügl (2001), Eymann (2003) and Ferber (1999) give a detailed overview on multi-agent-systems and simulations."

Scenario

Meister et al. (2010) presents the application of MATSim to a large scale scenario of Switzerland (over six million agents simulated on a high resolution network with one million links) as described in Dobler et al. (2013):

"For the simulation runs, a square section of Zurich with an edge length of 100 km is used. As a constraint, a person is considered in the simulation only if all scheduled activities take place within the simulated area. To keep the computational effort reasonable, only 10% of the population within this area is simulated. As a result, an agent basically represents 10 people. The capacities of the road network and the activity locations are scaled accordingly. The simulation model includes about 87,600 people and 64,380 facilities (a facility is a place where activities can be performed). The used road network is based on the Swiss National Traffic Network (Vrtic et al. 2003). The focus of this case lies on individual transport; public transport is not simulated. This scenario contains a large amount of traffic, which increases differences in the mean travel times between the different timing strategies, depending on the quality of the created routes.

The underlying daily plans of the population result from an earlier simulation run with 150 iterations, for which the Charypar-Nagel-Scoring Function (cf. Charypar and Nagel 2005) was used, creating a realistic distribution of scheduled activities over the simulated time period. The plans of its last iteration are used as input for the simulations of this study. For the simulations, start and end times, as well as activities' durations, are fixed because only the quality of created routes matters in the experiments conducted (not an optimal distribution of activities and traffic during the day). Thus, the only parts of an agent's plan that can be changed are the routes."

14.4 System Outcomes

Travel Time Analysis

The effect of the traffic information is measured in terms of the mean daily travel times M for the entire population of drivers Ω, $M0$ for the class K^0 drivers and MI for the class K^I drivers, and is compared to the mean daily travel time M^0 (186 min). M^0 is the value of the $\tau(0)$ assignment (called *all-or-nothing assignment*), which is yielded by the simulation of the partition Ω^0 ($K^0 = \Omega$, $K^I = \varnothing$); i.e. every driver sticks to the time-wise shortest route of the load-free traffic network.

The various partitions are symbolized by means of $\Omega^{q,\varphi} = K^0 \cup K^{I,\varphi}$, where q is the percentage share of informed drivers K^I, and φ the 1-complement of the confidence factor γ or Γ in the context of the route choice π (see Sect. 14.2). $\Omega^{10,\Gamma 1/2}$, for example, stands for $q = 10\%$ $K^{I,\Gamma 1/2}$ drivers with a fixed confidence factor $\Gamma = 1/2$, and 90% non-informed drivers K^0, or $\Omega^{70,\gamma 3/4}$ for $q = 70\%$ informed drivers $K^{I,\gamma 3/4}$ with experiential confidence γ in the case of an a priori confidence $\gamma = 3/4$, and 30% non-informed drivers K^0.

The mean daily travel time (MDT) of different shares q of informed drivers K^I and $(100 - q)$ non-informed drivers K^0 as well as of the entire population of drivers Ω (mean of all) are shown in Fig. 14.1 which refers to the experiential confidence starting at $\gamma = 3/4$, in Fig. 14.2 for fixed confidence $\Gamma = 3/4$ and in Table 14.1 for both, the descriptive (γ) and the normative (Γ) mode of a driver's choice.

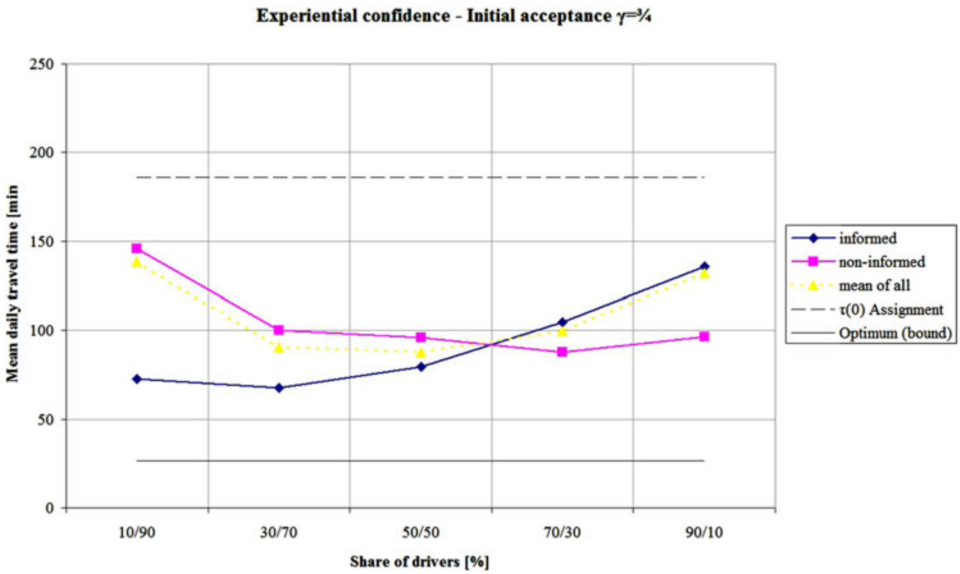

Fig. 14.1 MDT according to experiential confidence at initial value $\gamma = 3/4$

In the case of experiential confidence with the initial value $\gamma = 3/4$ (Fig. 14.1) and a share $q = 60\%$ of informed drivers K^I, the MDT (≈ 92) is the same for all drivers. In the case of fixed confidence $\Gamma = 3/4$ (Fig. 14.2), a share $q = 50\%$ of informed class K^I drivers suffices for all drivers to reach the same MDT (≈ 67). The comparison of the MDT of different shares q of informed drivers K^I with experiential confidence γ which a priori is $\gamma = 1$, and fixed confidence $\Gamma = 1$, respectively, is depicted in Table 14.2.

In the case of the experiential confidence at initial value $\gamma = 1$, and a share $q \approx 63\%$ of informed drivers K^I, the MDT (≈ 81) is the same for all drivers. In the case of fixed confidence $\Gamma = 1$ and a share $q = 70\%$ of informed drivers K^I, the same MDT ($M^U = 29.6$) is reached by all drivers (Table 14.2). That situation is the state of the stochastic user equilibrium (SUE); i.e. with 70% of the drivers being informed and re-planning their route according to current traffic conditions, and 30% of the drivers remaining on their stati-

Table 14.1 [min] according to experiential and fixed confidence 3/4

Share	Partitions $\Omega^{q,\gamma 3/4}$ and $\Omega^{q,\Gamma 3/4}$ of driver classes K^0 and $K^{I,\varphi}$					
q [%]	$MI^{q,\gamma 3/4}$	$MI^{q,\Gamma 3/4}$	$M0^{q,\gamma 3/4}$	$M0^{q,\Gamma 3/4}$	$M^{q,\gamma 3/4}$	$M^{q,\Gamma 3/4}$
10	72	83	146	149	138	142
30	68	72	100	96	90	89
50	79	67	96	67	88	67
70	105	78	88	58	100	72
90	136	100	96	70	132	97

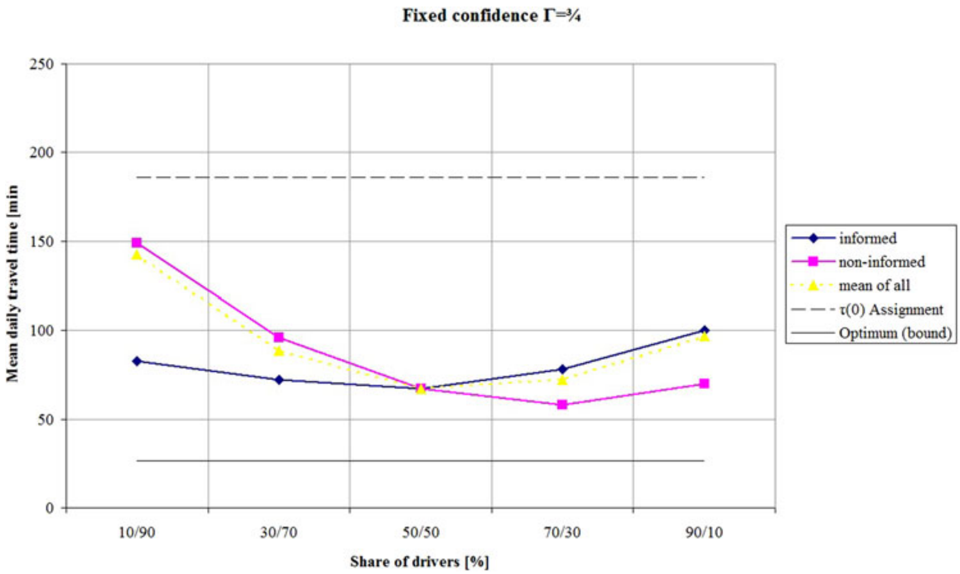

Fig. 14.2 MDT according to fixed confidence 3/4

cally shortest route, an equilibrium for both classes close to the optimum will be achieved: $MI^{70,\Gamma 1} = M0^{70,\Gamma 1} = M^{70,\Gamma 1} \approx 30$. At this relation ($\Omega^{70,\Gamma 1}$), the traffic network is least burdened by the total demand. All drivers equally benefit (Fig. 14.3).

Taking the mean daily travel time M^0 as the benchmark is reasonable; the reasons for doing so are (1) from a theoretical point of view: M^0 is the result of the information level of class K^0, which in the case of unhindered travel (on the load-free network), is optimal; (2) from a practical point of view: M^0 is a standard value which fairly corresponds (at least in traffic segments) to real conditions because every vehicle can be equipped with an ordinary router and the device is easy to operate; (3) from an empirical point of view: M^0 is the result of a typical behavior which views every deviation from the shortest route (on a load-free traffic network) as a detour, the time loss of which the driver does not like to put up with; (4) from a methodological point of view: The benchmark M^0 also corresponds to the

Table 14.2 MDT [min] according to experiential and fixed confidence 1

Share	Partitions $\Omega^{q,\gamma 1}$ and $\Omega^{q,\Gamma 1}$ of driver classes K^0 and $K^{I,\varphi}$					
q [%]	$MI^{q,\gamma 1}$	$MI^{q,\Gamma 1}$	$M0^{q,\gamma 1}$	$M0^{q,\Gamma 1}$	$M^{q,\gamma 1}$	$M^{q,\Gamma 1}$
10	66.0	56.0	144.0	139.0	136.0	130.0
30	60.0	36.0	95.0	55.0	84.0	49.0
50	65.0	29.2	86.0	31.7	75.0	30.5
70	89.0	29.6	79.0	29.6	86.0	29.6
90	116.0	33.0	88.0	32.0	113.0	33.0

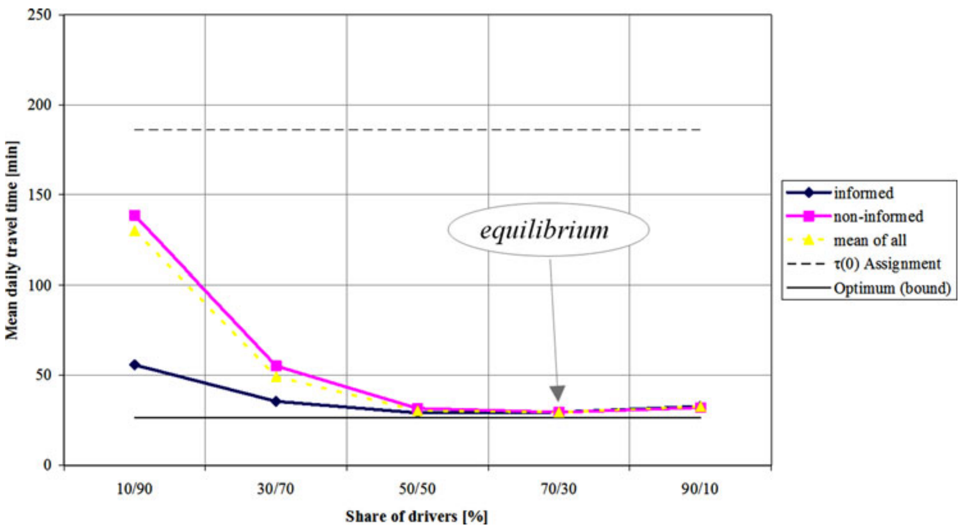

Fig. 14.3 SUE with 70% informed drivers complying absolutely

results of two characteristic partitions, $\Omega^{50,\Gamma 1/2}$ (the value $MI^{50,\Gamma 1/2} \approx M^0$ results for the class K^I drivers when one-half of all drivers have traffic information at their disposal, and choose the recommended routes with the fixed confidence factor $\Gamma = 1/2$), and $\Omega^{100,\gamma 1/2}$ (the value $MI^{100,\gamma 1/2} = M^{100,\gamma 1/2} \approx M^0$ will result, if all drivers are informed about the current travel times and follow a recommendation with a variable factor γ, which a priori is $\gamma = 1/2$).

Time Savings Analysis

The analysis for the time savings S for Ω, $S0$ for K^0, and SI for K^I as compared to M^0, as well as the analysis of the traffic conditions MD (density), MS (speed) and MF (flow) underline the potential of the traffic information.

$$S = \frac{(M^0 - M)}{M^0} \cdot 100$$

The percentage mean daily travel time saving (MDTS) of different shares q of informed drivers K^I, and different levels of the descriptive (γ) and the normative (Γ) mode of a driver's choice, are shown in Tables 14.3 and 14.4 and in Fig. 14.4.

Note: Class K^I drivers in situations inferior to the partitions $\Omega^{100,\gamma 1/2}$, $\Omega^{50,\Gamma 1/2}$ and $\Omega^{90,\gamma<1/4}$ will not save any time; that is, the informed drivers K^I will only achieve the norm time M^0, if all drivers are informed ($K^I = \Omega$, $K^0 = \varnothing$) and the experiential confidence γ of the drivers is a priori $\gamma = 1/2$, or if 50% of the drivers are informed, but comply with only a level depending on $\Gamma = 1/2$, and, likewise, when 90% of the drivers are informed in the case of experiential confidence being at the initial values $\gamma < 1/4$.

Table 14.3 MDTS *SI* [%] of informed drivers K^I according to fixed confidence $\Omega^{q,\Gamma f}$

Confidence	Share q of informed drivers				
Γ	10%	30%	50%	70%	90%
1/2	24	18	1	−23	−48
3/4	55	61	64	58	46
1	70	81	84	84	82

Table 14.4 MDTS *S0* [%] of non-informed drivers K^0 according to fixed confidence $\Omega^{q,\Gamma f}$

Confidence	Share q of informed drivers				
Γ	10%	30%	50%	70%	90%
1/2	11	17	18	23	16
3/4	20	48	64	69	62
1	25	70	83	84	83

Table 14.3 shows that once the share q of informed drivers K^I exceeds 30% and they behave in an undisciplined way ($\Gamma < 3/4$), they will hurt themselves (and the entire population of drivers Ω, Fig. 14.4). The non-informed drivers K^0 will not be entirely spared, but they will benefit to some degree even under such circumstances (Table 14.4).

Acceptance Analysis

The sensitivity of the drivers corresponds to the chance $P(E \mid U)$ of achieving the expected travel time τ on the recommended route within the tolerance range τw (see Sect. 14.2).

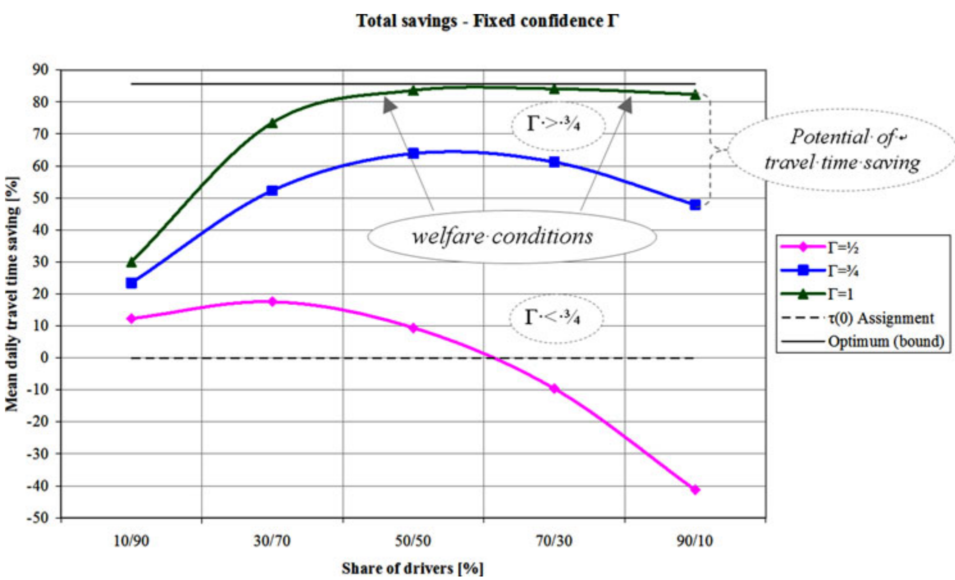

Fig. 14.4 MDTS of all drivers Ω at state of welfare with absolute compliance

With the tolerance thresholds (e.g. $w = 0.25$) chosen in Weinmann (2013), the confidence (or probability of information acceptance) γ amounts 3/4 for the partition $\Omega^{50,\gamma 1/2}$, and γ lies between 75 and 87% for the partitions $\Omega^{q,\gamma f}$ with $q \leq 50$ and $f \geq 1/2$.

$$0.75 \leq \gamma \leq 0.87 \quad \text{if } \Omega^{q,\gamma f}, \quad q \leq 50, \quad f \geq 1/2$$

The entirety of the drivers and the non-informed drivers will always save time as soon as there are informed drivers participating in the traffic. This is due to non-informed drivers possessing a static knowledge that is optimal in the load-free traffic network, and that their ways are disencumbered owing to the informed (progressive) drivers. Related thereto is the comparison between the ordinary (descriptive) and the normative choice of routes. The scenario's estimated mean saving potential $S^{q,\Gamma 1} - S^{q,\Gamma 3/4}$, which was found to be 25%, consists of the difference of time saving between the experienced compliance level that corresponds to $\Gamma \approx 3/4$ and fully normative behavior $\Gamma = 1$ (Fig. 14.4).

Network Analysis

The given demand of the Zurich traffic scenario leads in the case of the partitions $\Omega^{q,\gamma 1}$ and $\Omega^{q,\Gamma 1}$ to the values listed in Table 14.5. The mean densities at a share of q percent of informed drivers K^I are denoted by the symbols $MD^{q,\gamma 1}$ and $MD^{q,\Gamma 1}$, measured in vehicles per kilometer. The mean speeds are denoted by the symbols $MS^{q,\gamma 1}$ und $MS^{q,\Gamma 1}$, measured in kilometers per hour. The mean traffic flows are denoted by the symbols $MF^{q,\gamma 1}$ und $MF^{q,\Gamma 1}$, measured in vehicles per hour.

The analysis of the traffic network underlines the essential findings of our study on the knowledge-oriented and behavior-oriented choice of the routes: The states of the traffic depend, firstly, on the degree of compliance with the information provided, and, secondly, on the share of the informed drivers. Even the normative choice of the routes cannot prevent traffic from slowing down when more than 70% of the drivers are informed. This finding would suggest that the state of the traffic also depends on the quality of traffic information.

Table 14.5 Network states of partitions $\Omega^{q,\gamma 1}$ and $\Omega^{q,\Gamma 1}$ at different shares q of K^I drivers

	Mean outcomes *MD* (density), *MS* (speed) and *MF* (flow)					
Share q	$MD^{q,\gamma 1}$	$MD^{q,\Gamma 1}$	$MS^{q,\gamma 1}$	$MS^{q,\Gamma 1}$	$MF^{q,\gamma 1}$	$MF^{q,\Gamma 1}$
[%]	[veh/km]	[veh/km]	[km/hour]	[km/hour]	[veh/hour]	[veh/hour]
0	118	118	4	4	471	471
10	105	104	6	6	631	643
30	77	56	13	22	996	1266
50	64	33	18	48	1162	1573
70	55	31	24	51	1291	1597
90	56	36	22	42	1267	1530
100	60	43	20	34	1221	1447

Notes: (1) The mentioned traffic data is self-consistent and serves the purpose of comprehensively expressing the relations within the system. (2) Every model of a real socio-economic system is inaccurate, on the one hand, due to irregularly occurring effects (stochastic effects) and, on the other hand, because not all system-related influences can be taken into account. The results of the simulation of concrete scenarios can also vary because they are differently configured and calibrated. (3) The purpose of the model is to demonstrate the interaction between the microscopic level (that of the driver's decision) and the macroscopic level (the state of the traffic). (4) The mean values of Table 14.5 relate to the following technical data: The distance between the vehicles (at a standstill) is specified to be 6.5 meters, and the drivers' reaction time 1.8 s. The experimental boundary for the optimum is $M^S \approx 27$ MDT (called *optimum bound* in the figures); at this level, the mean traffic density is $MD^S \approx 26$ vehicles per kilometer, the mean speed is $MS^S \approx 64$ km/h, and the mean traffic flow is $MF^S \approx 1660$ vehicles per hour. The Zurich scenario marks a mean traffic flow of 96% of capacity, according to the ratio of $MF^{70,\Gamma 1}$ and MF^S. (5) M^S denotes the mean daily travel time at the theoretical state of the capacity of all links being arbitrarily high and all drivers belonging to class K^0. Arbitrarily high capacities mean arbitrarily small obstruction on the links so that in the presence of any traffic demand the load-free network travel times will apply, and no class K^0 driver could fare any better by deviating from his statically shortest route (Wardrop's first principle). Because under these conditions the marginal travel time cost on all links is equal to 0, M^S is a lower bound not only for the stochastic user equilibrium, but also for the system optimum (Wardrop's second principle).

Summary and Outlook

Summary

The results of the experiments testify the existence of considerable differences in respect of the load on the road network, the mean daily travel times and the consequential properties of a trip up to the driver's arrival time at his destination. A key result is that all drivers benefit even if only part of them navigate by using current traffic information. Further results show in detail the time savings that each of the two classes of drivers achieves, and also how the entirety of drivers benefits from certain shares of informed drivers. The effect of descriptive and normative behavior varies significantly. The scenario's estimated mean saving potential can be fully exploited if the dynamically informed drivers behave in a disciplined manner and follow the recommended links.

In the case in which 30% of the drivers in the Zurich metropolitan area are guided by real-time navigation system information and comply exactly with it, the traffic density will be reduced from 118 vehicles to 56 vehicles per kilometer, and traffic speed will increase from 4 to 22 km/h. Starting from a share of 50% of informed drivers, traffic density will diminish to just above 30 vehicles per kilometer, and a driver will reach his destination at an average speed of little more than 50 km/h. Better distribution of the traffic may triple the distance of an informed driver, and yet it amounts to an 84% time saving for all drivers. If more than 70% of the drivers go by real-time navigation system information, the traffic situation will again deteriorate to as many as 43 vehicles per kilometer moving at a speed of 34 km/h.

This (probably unexpected) deterioration of the traffic situation at a high share of drivers being guided by real-time navigation system information asks for more research. Further analyses will be required to find out the level of load on the road traffic network this effect occurs, and whether it can be prevented by improving the quality of information. The conclusion is that navigation system guidance must be based on marginal cost, which in turn requires that the traffic densities and the time-flow-capacity curves of the links are measured exactly, and that this information is made available in real time. The question is whether under real traffic conditions such information carries additional value for the driver as compared to the kind of traffic information available to him at present; in other words: whether more accurate measurements of the travel times on the roads and calculation of the marginal costs amount to the hoped-for step towards improvement.

Conclusion

Our simulation shows two levels for the mean saving of travel time. First, the scenario's estimated mean saving potential $S^{q,\Gamma 1} - S^{q,\Gamma 3/4}$ of about 25%; this finding lead to the conclusion that if the aim is achieving optimal use of the traffic system and letting all drivers alike share in the benefits of this achievement, traffic planners must strive for normative driving behavior. Second, the saving potential $M^U - M^S$ of about three minutes mean daily travel time (the difference between $M^U \approx 30$ at user equilibrium and the optimum bound $M^S \approx 27$); it is to expect this saving gap can be closed by providing anticipatory information in the form of marginal travel time costs.

Outlook

The dynamic allocation of traffic demand to the traffic network is closely connected with the potential of traffic information. To better use the potential of the information, traffic must be understood as a cybernetic space. Just making information available is not enough. The driver must be provided with an incentive for normative behavior. Whether decision models that maximize the driver's expected utility make it possible to move real-world traffic systems in a self-regulating way toward the optimal state that fulfills in practice both of Wardrop's principles is the general question. The next step should try to realize the potential of saving mean travel time through the increase in expected utility.

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15 Development of an Efficient Europe-wide e-Recruiting System (European Recruiting 2020)

Ricardo Büttner

Contents

15.1 Introduction

When recruiting new employees it is necessary to consider a candidate's suitability or fit for a vacant position in advance. A good fit leads to better job performance, greater job satisfaction, higher commitment and a longer duration of employment. In order to predict the fit between applicant and position, the recruiter can currently form an opinion based on the traditional means of personnel selection (CV, personal interview, etc.). Candidate fit is composed of three aspects: (1) the candidate's personality should match the business culture (person-organization fit, P-O), (2) his or her social skills and competences should match the work group (person-group fit, P-G) and (3) the candidate's abilities, skills and knowledge should match the precise position (person-job fit, P-J).

Existing recruiting solutions and job recommendation systems mainly focus on the match between job requirements and a candidate's abilities exclusively (P-J fit) and thus cover only one of the three aspects of the candidate fit. It is precisely here that great potential for e-recruiting solutions and job recommendation systems lies. Internet based social

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*,
FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_15

networks such as LinkedIn, XING, Twitter or Facebook contain all the data necessary to identify the entirety of a candidate's fit. One promising trend within e-HRM (electronic Human Resource Management) is the inclusion of online social networks (OSN) (Buettner 2016a; Buettner and Buettner 2016; Buettner 2015e, 2015b, 2015a, 2014b; Funk et al. 2012). In recent years e-recruiting in OSN (OSN-Recruiting) has therefore evolved into an area of research of its own within the greater field of information systems (Buettner 2011, 2014d; Landes and Buettner 2011). The analysis of such large scale and complex data allows for the deduction of a candidate's personality, organizational culture, communication styles and roles relevant to group dynamics (Buettner 2015c, 2014c, 2014a). If that analysis occurs with the explicit permission of the applicant or even by him or her during the usage of job recommendation systems, a socially beneficial and economically efficient solution would be created that is in line with privacy laws allowing candidates to search for jobs more comfortably and more quickly while offering companies a faster way to find suitable employees. Besides requirements concerning information, privacy and the technological connection of social networks, data mining procedures need to be implemented that can, for example, calculate scores for the extraversion personality trait based on social network information such as the number of steady social contacts, intensity of use, number of profile pictures, number of group memberships, number and extent of comments as well as profile depth.

At the Institute of Management & Information Systems (mis) we have developed such a data mining procedure along with a barrier-free system prototype of high usability (Buettner 2015f, 2015d; Buettner et al. 2015, 2014; Buettner 2014a). Due to its high degree of innovation and its economic significance the respective research project "efficientRecruiting 2.0" is funded by the German Federal Ministry of Education and Research (BMBF; sponsorship no. 03FH055PX2).

15.2 Data Extraction from Social Networks for the Prediction of Candidate Fit

In order to determine candidate fit, personality, organizational culture, communication style, role behavior, abilities, skills and knowledge are required. These pieces of information can be extracted from social networks.

Traits relevant to personality are extracted based on the Five Factor Models that describe personality using five dimensions:

- Openness to experience
- Conscientiousness
- Extraversion
- Agreeableness
- Emotional Stability

First of all the hypothesis that only manipulated or overly "whitewashed" profiles can be found on OSN has been proven wrong. Many psychological studies have identified strong correlations between personality traits and usage behavior of social networks. A high score in trait extraversion is for example correlated with an above average number of contacts in OSN.

A manual way of determining organizational culture utilizes questionnaires to survey members of an organization. However, analogous to the deduction of a single user's personality from OSN, organizational culture can also be automatically detected. Preliminary work has for example shown that cultural features can be extracted from OSN through text-mining based analysis of individual pieces of written text (posts, querying and answering behavior, etc.).

The deduction of communication styles and role behavior from OSN poses yet another promising field of research. The frequency of use of the Facebook wall feature and the connection of OSN profiles with communication services such as Skype, ICQ or Twitter allow for a judgement of communication frequency and intensity. First patents regarding this concept by companies like Cisco and Yahoo already exist. Given that a group member's personality predicts his or her potential role behavior, the role behavior itself is conveyed through the personality traits deducted from OSN. It has thus been shown that the role of the "initiator-contributor" is associated with four of the Five Factor personality dimensions. The role of the "information seeker" can be deducted from Facebook usage or the number of Twitter accounts a user follows, while the role of the "harmonizer" on the other hand stems from the usage of group features in OSN.

Another interesting area of research lies in the measurement and standardization of abilities, skills and knowledge. HR-XML constitutes a current standard for the machine readable expression of abilities, skills and knowledge. The German Federal Employment Agency has taken up this format and developed its own specification called HR-BA-XML. It will not be long before particularly work related OSN, such as XING or LinkedIn, develop a universally accepted, machine readable standard for CVs, certificates and letters of recommendation.

15.3 Information Privacy

In practice it obviously cannot be assumed that all information contained in OSN is openly accessible. The availability of data is limited by users' privacy settings, standard form contracts used by OSN, data protection directives and privacy laws. The relevant legal guidelines originate from mainly two different fields of law, privacy and labor law (Buettner and Pennartz 2011) and can be found in the German Bundesdatenschutzgesetz (BDSG), a federal data protection act, the German Telemediengesetz (TMG) which regulates tele-media, and in §§ 57, 87 of the German Betriebsverfassungsgesetz (BetrVG) which directs the interaction between employees and employers. Generally all legal and sociopolitical guidelines must be followed when automatically extracting personality or organizational features. Notably, as little personal data as possible should be collected, processed and used. If possible anonymized information should be used, failing this personal data needs to be pseudonymized. Users of the e-recruiting system must be educated about the investigation's method, extent and purpose in a transparent manner and where applicable agree to the data collection, processing and usage. Additionally the e-recruiting system should not form the sole basis for a decision on an admission to employment or turn into an extended application process. Personal data has to be deleted once it no longer serves a purpose and its storage is unnecessary. Data that contains information on heritage – ethnical or other, ancestry, nationality, religion or ideology, disabilities, age, political or unionized activity or attitudes as well as gender or sexual identity requires particularly strong protection.

The prognosis of candidate fit, however, refers to the P-O, P-G and P-J aspects outlined in the introduction. The said aspects are the decisive factors in a recruiting decision – not the aforementioned grounds of discrimination. That is why the "efficientRecruiting 2.0" project implements such a nondiscriminatory solution. The respective existing laws will most likely become even stricter in the future as the intense sociopolitical debate on this matter is ongoing.

15.4 Business Models

The approach to recruiting presented in this article could become common practice within different business models. One such business model proposes the use of the project's final results as a software add-on with costs for existing recruiting-IT or as independent recruiting platform. Recruiting companies are thus offered the chance to improve their prediction for candidate fit fully automatically and to make more educated choices before personal job interviews – if the user consents to this process.

Another business model refers to the operators of social networks such as LinkedIn or XING who are highly interested in mechanisms of candidate fit. By integrating these mechanisms, users of those occupational networks receive more adequate job recommendations which boosts the attractiveness of LinkedIn, Xing, etc. The same applies to online job markets. Their appeal will also be increased by an integration of the mechanisms developed in the "efficientRecruiting 2.0" project.

Furthermore this functionality could be offered as an independent web service for which recruiting companies and people seeking employment could register to receive recommendations for ideally suited candidates or applicable corporations respectively.

All those options (recruiting software for companies, additional function for occupational social networks, additional function for online job markets, independent web service) are, according to internal and external appraisal, both plausible and feasible.

15.5 Economic Effects

The economic effects of the presented project are far reaching. According to a study by the German Federal Ministry of Family Affairs, Senior Citizens, Women and Youth the monthly costs of a vacant position in the middle income group, e.g. due to a loss of production resulting from a lack of market and customer service, amount to up to €1600. If this amount is extrapolated under consideration of the average time until reoccupation which is 2.3 months the effective costs of a vacant position adds up to €3600. For a position in a high income group this number even rises to €10,800. If, with the help of the suggested approach to recruiting, the period until reoccupation of a middle income position can be decreased by merely two weeks to 1.8 months, €720 per position in the middle income range would be saved. If just 5% of the 434,353 positions that have been reported as open in Germany in 2013 had been filled using the highlighted recruiting approach, the total savings would have amounted to €15.6 million a year. The potential savings for high income positions would thus be even higher. This estimation is solely based on the advantages of an efficient recruiting solution, while secondary advantages regarding effectiveness additionally emerge from a better candidate fit in the context of personnel selection.

15.6 Degree of Innovation and Industry Partners

The presented project is highly innovative both technologically and economically. Its innovativeness stems from the further development of groundbreaking multi agent technology as a subarea of artificial intelligence (see Buettner et al. 2013; Landes and Buettner 2012a, 2012b, Buettner and Landes 2012; Buettner 2010a, 2010b; Buettner and Kirn 2008; Buettner 2007a, 2007b, 2006a, 2006b), of personality mining in OSN (representing another innovative web 2.0 technology) and its technological application to the economically and managerially highly relevant challenge of recruiting specialists. The goal of which is to accelerate personnel acquisition as well as improve candidate selection.

The implementation of the proposed e-recruiting approach will not only facilitate the recruiters' task of finding experts to fill vacant positions but also check whether an applicant is well suited for his or her future work group and the business culture (Buettner 2014b).

The following business corporations are involved in the project "efficientRecruiting 2.0" as industry partners:

- advola GmbH, Munich
- Airbus Operations GmbH, Hamburg
- brainGuide AG, Pöcking
- Dahmen Personalservice GmbH, Düsseldorf
- Deutsche Bahn AG, Frankfurt

- HCM4all GmbH, Munich
- HR4you Solutions GmbH & Co. KG, Grossefehn/Timmel
- Leaders In Science – Die DHV-Personalberatung, Bonn
- Pape Consulting Group AG, Munich
- Philips Deutschland GmbH, Hamburg
- Portalwerk AG, Pöcking
- SanData Solutions GmbH, Garching
- Taylor Wessing Deutschland Partnergesellschaft, Munich

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Cloud-computing in the Insurance Industry

16

An Application of the Theory of Club Goods

Thomas Christiaans and Stefan Steden

Contents

16.1 The Significance of Costs in the German Insurance Industry

A German insurance company faces a great challenge regarding differentiation from competition. The homogeneity of products and the simplicity of comparing them in the internet or via comparing websites make it difficult for them to differentiate by other attributes than prices. Further on, there is no emotional relationship between owner and product. This is because of the fact that the products can only proof their quality if a loss occurs, an event which is not desirable for the owner. Even a cash value life insurance contains a component, which applies if the assured person dies. The survival is only the absence of the claim. The same applies to a pension insurance, which should be distinguished from the social pension programme. It is a product for saving money, which complements the gov-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_16

ernmental pension. With this product a risk is assured that the governmental pension is not sufficient when the owner retires.

An insurance product cannot avoid the claims and most of the time does not even compensate it fully. Because of that, it provides only a monetary compensation of a claim (Braeß 1960). Quite obviously an insurance product cannot compensate for example the death of an insured person. But it can at least provide some money to ease the economic impact this incident has for the surviving persons dependent on the insurance contract. Thus, with each regulation there is a monetary compensation for the economic disadvantages of the claim.

It therefore seems to be quite logical that pricing is the main criterion for potential customers when choosing among available insurance products, even more since there are comparison websites promoting their services to find the best price. E.g., Verivox.de and Check24.de promote with buzzwords like *cheapest tariff* and *potential savings*. They even show prices in a ranking list without considering things like quality.

Insurance companies thus mainly engage in price competition. Products like car insurance, insurance of contents and liability insurance differentiate hardly by any other feature. So a company with a cost advantage will have a competitive advantage because it can offer its products cheaper than any competitor.

The biggest cost pool most probably is governmental regulation, but next to this IT and communication costs are significant. Nearly all insurance companies have an own IT department or an own IT service provider within their groups. This means that they have extensive fixed costs because the IT infrastructure has to be scaled to fit the maximum demand the company could face. The same applies to labour costs. Specialists with adequate know-how cannot be found easily at the labour market, at least since there is a lack of skilled employees in Germany. Further on, the specific and company relevant know how which is needed in this area builds up slowly, and sometimes it even takes years. Moreover, dismissing redundant employees is very expensive because of legal issues. Hence, it makes sense to analyse these cost categories further.

This paper aims at showing that insurance companies should seriously consider whether joining a club providing an insurance cloud would imply significant cost reductions and therefore competitive advantages. It will be argued that IT services to a major extend have the characteristics of a club good (Buchanan 1965), implying that costs per user would significantly decrease with an increasing number of IT users.

Competitive advantages can be due to quantifiable or qualitative effects that are only measurable indirectly. Quantifiable effects can be achieved in the IT area by reduced capital costs regarding hard- and software, less maintenance costs, lean processes and also less labour costs as the own workforce can be reduced (cf. Wiesehahn 2001). Further and perhaps even more significant advantages can be realised by more efficient and optimised processes and staff savings when providing insurance services (Han and Mithas 2013a).

Qualitative advantages which are indirectly measurable can be achieved by service improvements and a better reputation. The latter could be achieved when because of the cloud the insurance agent is able not only to calculate the conditions of a contract in real-time, but also finish the contract with all necessary legal formalities. An example for this is the Santander Consumer Bank which quite successfully practises similar automated processes when granting loans (Santander 2011).

For many insurance companies cost reduction is an instrument to face the pricing pressure of the market. Even more it is sometimes the only chance to enter this market with its relatively homogenous products. Even though the companies try to highlight other topics in terms of diversification of the products, customers most of the time recognise just price differences. Because of that, most of the insurance companies have already reached a good level of cost efficiency. The internal optimisation is the first cost cutting wave.

The second cost cutting wave deals with resource bundling, which can be done by outsourcing (cf. Di Romualdo and Gurbaxani 1998), cooperation, or merger and acquisitions. The strategical outsourcing of IT within branches of knowledge based services like the insurance and finance industry has huge economic potential (cf. Quinn 1999; Erdmann 2001).

Merger and acquisitions will not be considered in this article as they are not relevant for club good theory. Strategical outsourcing (Quinn 1999) and cooperation are the possible alternatives which will be analysed. Large companies can outsource IT resources to their subsidiaries. They can realise huge cost savings although all the data stay *in-house*. Particularly by outsourcing to low-wage countries labour costs can be reduced significantly. Examples of this can be found in the finance sector where enterprises like Deutsche Bank, HSBC or Allianz have already founded offshore centres in India (Handelsblatt 2004).

This service centre could be turned into a profit centre within the group and afterwards into an own operational unit which offers its services to outside companies as well. That would be the transition to a highly specialised service provider who offers not only a cost advantage but also a progressive know-how advantage.

Sourcing out to foreign-language providers would include the disadvantage that there would be additional effort needed because of more frictions. These could even turn the technical advantages into economic disadvantages. This is true all the more for German customers, e.g., who need to communicate with these service providers and will certainly not accept correspondence in broken German. A compromise would be a near shoring solution for example to Eastern Europe. Service providers would be located within the same time zone and could be able to communicate in an acceptable way (Yu 2006).

Perhaps the most interesting and innovative possibility for the insurance industry would be a cooperation with the intention of using cloud computing services. The aviation industry is a good example of a highly regulated industry which has realised a great increase in efficiency and cost savings as well. All this was achieved without any mergers or acquisitions, only by bundling of resources. Lufthansa was a first mover in this field when establishing the Star Alliance in the 1990s. They realised that in addition to the positive effects of the cooperation in the primary service (transport) the cost advantages were even bigger when pooling purchasing and cooperating in the secondary services (Pompl 2007).

Insurance companies should analyse carefully whether setting up strategic alliances, that is joint ventures without equity capital, would be ideal. They would get IT resources from the insurers for providing cloud services (Han and Mithas 2013b).

The analysed IT costs consist of costs for hardware, software and for running the IT department, which is responsible for maintenance, training and updates. The latter are necessary because of new technical or legal requirements or even shifts in the market.

The costs for software and hardware can be divided into depreciation and interest for purchasing costs and maintenance. Usually there are step costs for the internal IT department, for example, when a new server is needed or a new employee has to be hired. In contrast to this companies outsourcing IT services do not need to build up resources to fit the maximal requirements and can rely on the external service provider. The advantage of the cloud is the *dynamic resource provisioning,* which means resources can be provided dynamically, fast and flexible when needed (cf. Zhang et al. 2010). This is even more important for high-growth companies that want to avoid step costs.

Nearly no other industry is as fast developing as the IT industry and because of that the costs are quite high according to Moore's law. A constant renewal of hardware and corresponding updates of the software in conjunction with training for the employees is necessary. Labour costs are generally the biggest cost pool, especially in Germany, which is a high-wage country. Experienced project managers and specialists are paid extremely well. Supply and demand are in favour for them and that is one reason for the pressure on the market to outsource IT services (cf. Earl 1996).

With an increasing number of customers cloud service providers will gain economies of scale and positive learning curve effects (cf. Weinhardt et al. 2009; Kushida et al. 2011). The profit margin they will charge could be overcompensated by the other advantages an insurance company would get.

The costs formerly mentioned are fixed and occur without any relation to the effectively utilised capacity. Because of security reasons, service level agreements and legal requirements the insurance companies have to keep available resources for peak times with full capacity. These are expensive and most of the time redundant.

The insurance sector and the finance sector at all constantly face new legal requirements requiring software updates, amendments, better or more hardware and training of the employees. These legal requirements originate from the national legislative authorities as well as from the European Union and even from other states. To avoid the costs, an alternative for the insurance companies is to outsource these activities.

Companies which change to cloud computing can realise major cost savings. Jobs which were planned for these activities can be rearranged or even cancelled. A prerequisite is certainly that the cloud service provider can offer the service in the same quality, in compliance with the legal requirements and cheaper. The internal IT department can be reduced to handle the user hardware and the interfaces to the cloud. A full service provider would certainly offer service levels and support for the operating department as well. It is not possible and not advisable at that to suspend the whole IT department because of the need for *cloud readiness*, the cooperation with the cloud service provider, and for strategic reasons (cf. Quinn and Hilmer 1994). IT expertise has to be available in-house (cf. Earl 1996).

Even investments in hardware can be reduced when changing to cloud computing. The same is true for software, which is quite expensive when being purchased as a standard software package and sometimes even more when built by the companies themselves. With cloud computing only the effective usage of the services induces costs.

The advantage of not having huge investments in hard- and software is quite important. The liquidity improvement and with it more solvency is available for investments in the economic core activity. For some new or rising companies it makes it just possible to enter new markets as it decreases the entry barriers. Because of that, smaller companies as measured by the number of customers, turnaround and profit can gain a bigger advantage than bigger ones as cloud computing can reduce economies of scale disadvantages at least in terms of IT costs.

Leasing would be an alternative to reduce fixed costs, but quite obviously it does not have the potential of a real pay-per-use system like cloud computing. With leasing there is a one to one relationship per product while with cloud computing each customer can benefit from each new customer because of lower costs.

With increasing capacity the service provider's marginal costs will decline and even tent to zero. But the IT costs for the customer cannot be reduced to zero because there has to be at least the service and maintenance for the terminals within the operating department. In addition, the broadband connection to the cloud services has to be realised. Initial investments to establish this are not avoidable. As hardware and internet access already exist in the insurance companies, however, the costs should be low. The terminals operate as displays only, which means that the technical requirements in terms of performance and memory are lower. Thus, insurance companies can work longer with older systems, implying fewer investments in hardware and lower costs.

In summary, a major part of the fixed costs can be reduced significantly by changing to cloud computing. Insurance companies of each size are able to benefit from it. The elimination of major initial investments lowers the entry barriers especially for new and rising companies in the market. For them it is possible to enter new areas that would have not been accessible given their otherwise high costs.

Most of the factors which cause fixed costs also cause variable costs. A higher workload of the IT immediately results in higher electricity and maintenance costs. Most often these peak times result in overtime as well, causing even higher hourly wage rates. If needed, external staff and additional hardware services would increase costs, too.

The situation changes with cloud computing because of the pay-per-use approaches. Assuming that the cloud service provider offers his services to many insurance companies, the costs will decline with an increasing capacity. To pass at least part of this advantage on to his customers is part of his business model. So in contrast to increasing costs because of higher wage costs with overtime the costs will decrease with additional usage up to a certain degree.

This effect can even be enhanced if the insurance companies build up a cloud services provider themselves. A pooling of cloud capacities in a joint venture would be ideal. All participating companies would have the same intention – to strengthen this venture and to transfer a huge amount of IT services to it. The participation in this venture would result in a far better possibility to calculate risks in contrast to purchasing the services from a third party provider. This argumentation shows that risks have to be analysed as well.

Insurance companies are used to calculate and bear risks. Risk is defined here as the possibility of loss occurring multiplied by the possible amount of loss. But in spite of this simply appearing formula the details are at the core of the problem. Thus, risk costs are far more difficult to calculate than the formerly mentioned cost dimensions (cf. Nguyen and Romeike 2013).

Some frequently occurring risks can be rated easily and are therefore taken into account a priori. Examples for this are the obsolescence of software before maturity or the loss ratio of mobile phones. With cloud services this is even more difficult because they are new and companies do not have experience with it (cf. Earl 1996). This is an obstacle in an industry which is well known for its risk-averse managers, which appears to be justifiable because of the macroeconomic importance of insurance products (cf. Ngyuen and Romeike 2013).

In addition, a special law for cloud computing is still missing. Besides the economic risks, there are some pre-economic issues which will be analysed without being exhaustive. This analysis is a prerequisite for a discussion of risk costs, which are strongly dependent on them. Potential worst-case scenarios could be identified by this approach.

The PEST-analysis of Porter (Porter 1980) seems to be appropriate to analyse environmental and market risks for the insurance industry. In the analysis of the industry environment political and legal, economic, social and technological risks will be investigated. The market investigation will analyse risks which come from customers and suppliers, substitutes and new or existing competitors.

For cloud computing political risks arise when data security is threatened. Information from a health insurance may be economically of no interest for anyone, but making for example politician's medical record folders public would be critical. The loss of trust not only in the affected insurance company but in the complete industry would be disastrous. The same would be true for a cloud service provider working for one or more insurers. The industry as a whole would suffer from nearly irreparable reputation damage.

The data are no longer in a company-owned domain when putting them into a cloud, which may be considered a loss in security. But the standards for data security in many companies are not as safe as they could be and a professional cloud service provider would certainly have to offer a higher security standard. It can be assumed that for German insurance companies the cloud-servers and with that the data have to be kept under the legal shelter of the European Union (cf. Winkelmann 2010).

Another political risk could be the legal restraint to store certain data not in the cloud but on company-owned servers. It has to be investigated whether a club could meet this requirement. A rollback of the outsourcing is quite expensive and when coming from a club all of the insurers would have to do it simultaneously. It could be a proper way to ask for an advanced approval from the legislator. It is definitely in favour of the customer to have lean, nonbureaucratic and hence cheap processes, all the more if part of the cost reductions are passed on to the customer in form of cheaper products.

Macroeconomic threats for cloud computing in the insurance industry can be disregarded as all insurance companies would suffer from an economic crisis. But as cloud computing offers cost advantages the economic performance of the participating companies would probably improve.

The social risks, which are tied closely to the political ones already mentioned, are more substantial. If cloud computing would be criticised because of some scandalous event, the public pressure could force the insurers to reintegrate their processes and data into their companies. Insurers with a strong end consumer business would suffer the most. The opposition to cloud computing could arise from other issues which are not the insurance companies' responsibility. The German end consumers sometimes seem to be quite receptive to threat scenarios.

To avoid the risk of a worst case incident in terms of cloud computing does not mean to waive fully but to consider these risks carefully when planning. The insurance industry certainly needs an appropriate cloud model designed to avoid additional risks as much as possible.

From a technological point of view the most critical risk is surely the failure of components which are essential for the cloud. But it can be assumed that a cloud provides similar or even better failover mechanisms than the IT department of any particular insurance company. This makes the risk acceptable (cf. Winkelmann 2010).

The preliminary conclusion is that there are major external risks that do not make a case against cloud computing, however. But it would be advisable to have the cloud service provider within the same legal environment as the insurance company. In addition there are good arguments for choosing an insurance specialised provider. He should host no industry-external data and should be familiar with the specific requirements of the insurance industry. Such a cloud could be operated by a third party or a joint venture of insurers (cf. Mell and Grance 2011, or Haselmann and Vossen 2010). A lot of arguments are in favour of a club solution incorporated by some insurance companies. By bundling resources they would reach the targeted efficiency improvement. The data security level should be quite higher than it is for each single company. Following the National Institute of Standard and Technology (NIST) this would be a *community cloud*, being a cooperation of several institutions with similar interests. For the sake of security, a specialised community cloud should be favoured especially in the surance industry (Wollenweber and Steden 2014).

Cloud computing fits the classical theory of club goods as introduced by Buchanan (1965) very well. The next section analyses the decision to enter a cloud-computing club by explicitly solving the corresponding optimisation problem along the lines of the economic theory of clubs. It turns out that many of the conjectures relating to the efficiency gains of cloud computing can be founded more rigorously by using this approach.

16.2 Profit Maximization with a Club Intermediate Product

Let x be the quality of an intermediate product that is jointly consumable or usable, although congestion may arise with an increasing number of users. Other than in case of pure public goods, however, firms not willing to pay for this intermediate product can be excluded from consumption. Thus, we are dealing with an intermediate product that has the characteristics of a club good, defined by joint consumability and excludability (cf. Blümel et al. 1986). A *club intermediate product* therefore is an intermediate product that can be used by many firms at the same time, provided these firms participate in project funding.

In the present setting, x describes the provision of a cloud of quality level x. Since a cloud comprises employees, hardware, and software, it is a club intermediate good that is partly congestible. While software is a pure club good being jointly consumable without limits, in case of employees and hardware rivalry will eventually arise with an increasing number of club members.

Suppose there are many potential users (firms). For the sake of simplicity, all firms shall be identical. Let $R(x,n)$ be the revenue of a representative firm depending on cloud quality x and the number of club members n. The first and second derivatives of $R(x,n)$ shall satisfy $R_x(x,n) > 0$, $R_{xx}(x,n) < 0$, $R_n(x,n) < 0$ and $R_{nn}(x,n) \geq 0$. Revenue therefore increases with cloud quality, but at a decreasing rate. Revenue decreases with the number of cloud users, who are competitors in the insurance market, although the negative effect of additional competitors decreases or at least does not increase.

The costs of providing a cloud of quality x are denoted $\tilde{C}(x,n) = C(x) + an$. This function captures the idea that part of the cloud is jointly consumable without limit giving rise to the term $C(x)$ depending just on cloud quality, while another part of the cloud is congestible giving rise to costs depending on the number of members n, which for the sake of simplicity is assumed linear, an, where $a > 0$. On the other hand, $C(x)$ is independent of the number of users and mainly represents the necessary costs of software development that do not increase with the number of users due to joint consumability. Let the derivatives of the cost function meet $C_x(x) > 0$, $C_{xx}(x) > 0$, $\tilde{C}_n(x,n) = a > 0$, and $\tilde{C}_{nn}(x,n) = 0$. In addition, it is reasonably assumed that $C(0) = 0$. Marginal costs of cloud quality x thus are positive and decreasing while marginal costs due to additional users are assumed to be constant for the sake of simplicity.

As a first result, given a particular cloud quality x, costs are always lower if a firm is a club member than if it was staying outside the club, because total costs inside the club are always divided by the number of users $n > 1$, while $n = 1$ in case of an outside firm:

$$\frac{C(x) + an}{n} < C(x) + a \cdot 1 \quad \text{for } n > 1$$

A possible decision to stay outside the club therefore must rely on other considerations than cost efficiency, except for the case of significant transaction costs inside the club.

Such transaction costs could involve negotiation and coordination costs, e.g., which would have to be added to the left side of the inequality, implying a less unambiguous result. The issue of transaction costs will be resumed in the concluding section.

Apart from costs more generally revenues have to be considered. E.g., it was possible that revenues per firm decreased in case of an increasing number of club members. There could also be other provisos preventing the foundation of a club, an issue that also will be resumed in the concluding section.

In order to analyse revenues as well costs, the problem of profit maximization will now be considered. The club aims at choosing the values of x and n that maximize the profit

$$\Pi\,(x,n) = R\,(x,n) - \frac{\mathrm{C}\,(x,n)}{n} = R\,(x,n) - \frac{C\,(x)}{n} - a$$

of each club member, where it should be observed that costs are divided by the number n of club members. The optimization problem faced by the club can be formulated as follows. Maximize the profit $\Pi\,(x,n)$ of a representative club member under the constraints that cloud quality is at least 0 and does not exceed a given upper limit $\bar{x}$. Also, the number of club members must be at least 1 and must not exceed a given upper limit $\bar{n}$:

$$\max_{x,n}\left\{\Pi\,(x,n) = R\,(x,n) - C\,(x)\,/n - a \,|\, 0 \le x \le \bar{x}, 1 \le n \le \bar{n}\right\}$$

Using the Lagrangian

$L = R\,(x,n) - C\,(x)\,/n - a + \lambda_1 x + \lambda_2\,(\bar{x} - x) + \lambda_3\,(n-1) + \lambda_4\,(\bar{n} - n)$, the Kuhn-Tucker conditions for profit maximization read:[1]

$$L_x = R_x\,(x,n) - C_x\,(x)\,/n + \lambda_1 - \lambda_2 = 0 \tag{16.1}$$

$$L_n = R_n\,(x,n) + C\,(x)\,/n^2 + \lambda_3 - \lambda_4 = 0 \tag{16.2}$$

$$L_{\lambda_1} = x \ge 0, \quad \lambda_1 \ge 0, \quad \lambda_1 x = 0 \tag{16.3}$$

$$L_{\lambda_2} = \bar{x} - x \ge 0, \quad \lambda_2 \ge 0, \quad \lambda_2\,(\bar{x} - x) = 0 \tag{16.4}$$

$$L_{\lambda_3} = n - 1 \ge 0, \quad \lambda_3 \ge 0, \quad \lambda_3\,(n-1) = 0 \tag{16.5}$$

$$L_{\lambda_4} = \bar{n} - n \ge 0, \quad \lambda_4 \ge 0, \quad \lambda_4\,(\bar{n} - n) = 0 \tag{16.6}$$

These conditions can be used to characterize the club's profit maximization.

[1] Necessity of the Kuhn-Tucker conditions is assured since all constraints are linear, cf. e.g. Takayama (1985, pp. 97–98).

Case 1: Interior solution If $0 < x < \bar{x}$, (16.3) and (16.4) imply that $\lambda_1 = \lambda_2 = 0$. If $1 < n < \bar{n}$, (16.5) and (16.6) imply that $\lambda_3 = \lambda_4 = 0$. Therefore, from (16.1) and (16.2),

$$R_x = C_x/n$$

$$R_n = -C/n^2$$

Condition $R_x = C_x/n$ or $nR_x = C_x$ is the present partial-equilibrium equivalent to the general-equilibrium Samuelson (1954)-condition, which for the case of public inputs in general equilibrium can also be found in Manning et al. (1985), e.g.:[2] The sum of marginal revenues of cloud quality for all users together must equal its marginal costs. The second condition corresponds to the general-equilibrium Buchanan (1965)-condition for membership and states that the negative marginal revenue R_n of an additional club member must equal the marginal reduction of costs $-C/n^2$ due to an additional user. This solution requires the necessary and sufficient first and second order conditions $R_{xx} - C_{xx}/n \leq 0$, $R_{nn} - 2C/n^3 \leq 0$ and

$$|H| = \begin{vmatrix} R_{xx} - \frac{C_{xx}}{n} & R_{xn} + \frac{C_x}{n^2} \\ R_{xn} + \frac{C_x}{n^2} & R_{nn} - \frac{2C}{n^3} \end{vmatrix} \geq 0$$

for an interior maximum to be met. If $R_{xx} - \frac{C_{xx}}{n} < 0$, which is the regular case, these conditions imply that cloud quality usually increases with the number of users. To prove this assertion, total differentiation of $R_x = C_x/n$ yields:

$$R_{xx}dx + R_{xn}dn = C_{xx}/n\,dx - C_x/n^2 dn,$$

Implying that, if R_{xn} is not too negative:

$$\frac{dx}{dn} = -\frac{R_{xn} + \frac{C_x}{n^2}}{R_{xx} - \frac{C_{xx}}{n}} > 0$$

Case 2: Minimum cloud quality Since $x = 0$, (16.3) and (16.4) imply that $\lambda_2 = 0$ and $\lambda_1 \geq 0$, together with (16.1) therefore $R_x(0, n) - C_x(0)/n \leq 0$. The club does not produce a cloud (that is, a cloud of quality 0) only if marginal revenue of the cloud falls short of marginal costs per user already at $x = 0$. If $x = 0$, (2) together with $C(0) = 0$ implies that $R_n(x, n) + \lambda_3 - \lambda_4 = 0$. Since $R_n(x, n) < 0$, this condition can only be met if $\lambda_3 > 0$. Condition (5) thus implies $n = 1$, that is, no club is founded.

[2] The Samuelson condition is valid even if the good under consideration is not a pure public good. The crucial criterion is joint consumability which also applies to club goods.

Case 3: Maximum cloud quality If $x = \bar{x}$, (3) and (4) imply $\lambda_1 = 0$ and $\lambda_2 \geq 0$, together with (1) therefore $R_x(\bar{x}, n) - C_x(\bar{x})/n \geq 0$. The club produces the maximum cloud quality only if marginal revenue of the cloud exceeds marginal costs at the maximum value $x = \bar{x}$. This case may arise combined with an interior solution regarding the number of club members as well as with both types of boundary solutions with respect to n.

Case 4: No club If $n = 1$, then $\lambda_4 = 0$ and $\lambda_3 \geq 0$. Eq. (16.2) thus implies

$$R_n \leq -C/n^2$$

This solution can only be optimal if revenue declines sharply with the number of club members. This case may arise combined with an interior solution regarding cloud quality as well as with both types of boundary solutions with respect to x.

Case 5: Maximum club size If $n = \bar{n}$, then $\lambda_3 = 0$ and $\lambda_4 \geq 0$. Eq. (16.2) thus implies

$$R_n \geq -C/n^2$$

This solution can only be optimal if revenue does not decline too sharply with the number of club members. Again, this case may arise combined with an interior solution regarding cloud quality as well as with both types of boundary solutions with respect to x.

In summary, the analysis of the club's optimization problem gives rise to the following conclusions:

- Becoming a club member reduces IT costs. The only exception could arise if transaction costs inside the club were significantly high, e.g. due to necessary negotiation and coordination.
- Cloud quality inside a club will usually exceed cloud quality of a single firm outside a club.
- If no boundary solutions to the optimization problem occur, conditions analogous to those derived by Samuelson (1954) and Buchanan (1965) must be met.
- A club should not produce a cloud only if marginal revenue of the cloud is always smaller than marginal costs per user. In this case no club should be founded.
- A club should produce the maximum cloud quality if its marginal revenue always exceeds its marginal costs.
- Not founding a club is the optimum solution only if revenue declines sharply with the number of club members.
- A club of maximum size is optimal only if revenue does not decline too sharply with the number of club members.

16.3 Expert Interviews

Several experts from the insurance industry were interviewed as part of the research. Although the survey is not finished yet some interesting preliminary results can be reported. The experts (CIOs and IT directors) are from the top two management levels and can therefore be assumed to be able to estimate the future strategic direction of their companies or even to influence it.

The interviews so far support the approach of the authors that the change to cloud computing has the potential of significantly reducing IT costs. Over the last years there has already been a transition to the use of more standard software in order to save costs. A change to a cloud service provider would also mean to standardise and to save costs. The services from the cloud are offered via standardised interfaces. Thus, the development during the last years would already constitute a preliminary work for the companies.

The interviewees could imagine the approach of a joint venture with other insurers as well as purchasing the cloud services from a third party provider. The focus of this article is on cloud computing as a club good and quite obviously the creation of a joint venture would be an advantage in contrast to the assignment of a third party provider. A third party provider has to realise profits which is not necessarily true for a joint venture of insurers. But especially during the kick-off phase there would be additional learning costs for the joint venture, while already existing providers would have more expertise and experience.

As all of the companies have an own IT department (even though it is outsourced within the group for some of them) the interviewees were fully aware of the immense costs of the IT projects which were undertaken in each company. The monetary costs were considered as well as the high workload of the employees. In all interviewed insurance companies yearly project portfolio is built to prioritise the projects and sometimes even abandon some. The high number of regulatory and legal requirements for the insurers requires mandatory projects tying up monetary and personnel resources. The legal requirements do not arise only from the German legislator (e.g. GDPdU – Grundsätze zum Datenzugriff und zur Prüfbarkeit digitaler Unterlagen) but also from the European Union (e.g. SEPA – Single Euro Payments Area) and even other countries, e.g. the USA (FATCA – Foreign Account Tax Compliance Act).

The mandatory projects arising from legal requirements compete with the core projects a company undertakes for economic reasons in terms of money and human resources. Such projects could be the replacement of an operating system or standard software, e.g. e-mail software, when they are running out of maintenance, legacy and claims systems with expiring contracts and even self-written programs that cannot be maintained any more. In addition to software, hardware is also subject to change. New servers are needed from time to time because of ageing or expiring leasing contracts, e.g. In addition, producers of standard software dictate frequent updates to hold up the support right. It should be mentioned that the project is not only to update the software but to build up a testing environment, to plan the release, and to arrange with other projects. All these tasks are resource consuming. When operating with other programs, undesired side effects have to be corrected. At the end of the list of projects there are projects the company needs to keep up its competitiveness.

This is just a brief and not exhaustive overview of the challenges in terms of IT projects an insurance company faces. But it is more than sufficient to explain why the experts have recognised the economic advantages of a cloud solution in cooperation with other companies. Most of the problems and risks mentioned above could be avoided when using a club good and it would mean a competitive edge compared to the companies which are not participating.

The first expert interviews have shown that there is no general aversion against working with other insurers to establish a club operating a community cloud. Concerns about data security were no topic as the requirements in terms of security are mandatory for the whole industry and therefore a general prerequisite. Similarly, differentiation from competitors would be no barrier because such a cloud would only offer standard or core processes. So the processes in which differentiation takes place could still be within the participating companies, at least if it was in form of IT programs or processes. The decision makers saw the cost advantages as being substantial even without consideration of the associated benefits (cf. Lamberth and Weisbecker 2010). But in spite of this the interviewees named insurance companies they would not cooperate with. Most often these were the larger insurance companies. No rational reasons were provided and no pattern was identifiable for potential partners or their elimination. The expert interviews are still in progress so this has to be monitored carefully.

16.4 Critical Acclaim and Outlook

It has been argued that insurance companies could decrease their IT costs considerably by joining a cloud-computing club. The cost reduction is mainly due to the fact that significant parts of IT products have the characteristics of jointly consumable club goods. The industry supplies very homogeneous products and differentiates mainly by prices. At the same time, there is a high level of market transparency due to internet access of their customers. So the insurers are dependent on low costs to keep up their competitiveness. Companies joining the club have a competitive edge in contrast to those not joining it.

At the same time a club always has a better cloud quality than any single company because the bundling of resources does not only has a quantitative, but also a qualitative benefit. Best practices will arise not only from a single company and will be improved by every company joining the club. More efficient processes in the cloud lead to profits which can result in staff savings (cf. Han and Mithas 2013a).

A conclusion could be that it would be ideal to establish a club of maximum size. But this is true only if the profit does not decline to sharply with the number of participants. It therefore could also be an option that several clubs would coexist at the same time. In any case, if some companies are club members and others are not, those belonging to a club will most probably have a cost advantage compared to the outsiders.

The only economically sound reason for not joining a club turns out to be the possible presence of substantial transaction costs. If transaction costs among the negotiating prospective club members occur that are higher than the cost savings in the IT department, a membership obviously does not make sense economically. Transaction costs could be for example costs for negotiation or any overhead in this context. Some companies have reintegrated their processes which they outsourced to low-wage countries before because the transaction costs were higher than the cost advantage. It can be assumed that this will not happen to a club operating within the legal environment of Germany or at least the European Union. So if a company does not join a club there have to be other reasons but costs.

The first interviews reveal reservations regarding cooperation or even founding a club with other insurers. It has to be observed carefully whether this trend corroborates by interviews with other companies. As stated above the reasons for the denial would have to be analysed as they seem to be in contrast to sound economic reasoning. Another possibility could be that the reasons for the denial would not have been mentioned within the interviews for whatever reason. Further research is expected to shed light on these issues.

The research and the interviews are restricted to Germany. A comparative study in other countries could be done to show differences which arise perhaps because of different legal or other conditions. Similarly, the problems associated with cloud computing are certainly not limited to a single branch or industry. Thus, an expansion of the analysis to other industries seems to be promising, but is left here for future research.

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Dynamic Store Procedures in Database

17

Muhammet Dursun Kaya and Hasan Asil

Contents

17.1 Introduction

In production of applied software, different methods have been proposed for communication with the database (Feizi et al. (2010a). These methods are generally classified in two main groups. In the first method, questions are usually written in the program section and inside the code. In the second method, questions are stored in the database as stored procedures and the stored procedures are recalled in the database (Deshpande 2007). Typically, both of the above methods have advantages and disadvantages (Rogers and Prügel-Bennett 1999). In the first method, the velocity of coding rate is higher than the first condition and

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_17

there is the possibility of generating complex query in the code. In the first method, the response time to the query was high and in each step of sending the query to the database, the seven steps of query processing in the database (query, analyzer, analysis tree, optimizer, execution plan, execution, and the results of query) (Sybase 2008) are implemented for the query (Feizi et al. 2010b). So, the response time to queries is longer than in the second method (Agent Working Group 2000).

The second method is programming by using stored procedure (Baeza-Yates and Ribeiro-Neto 1999). A stored procedure (as its name implies) is the order of a process or function which is stored in the database. Stored procedure is of significant importance for several reasons. In the second method of communication with the database of stored procedures, the seven query processing is not necessary and the number of processing steps is lower than the first method, because the queries are kept in a precompiled format. The response time to queries is therefore lower than with the first method. In this method, the programmer has to create a query and a store procedure in the database, due to the static parameters of store procedures. The cost of producing the software is therefore higher than with the first method (Belkin and and Crof 1992).

In addition to the mentioned advantages, stored procedure has disadvantages such as making the programming environment a multi environment, parametric constraints of stored procedures in the database, the impossibility of producing stored procedure for some systems (such as report producers, form producers, etc.), repetitive production of the stored procedures in the database by different programmers in software production etc.

Optimization of query processing in the database is one of the important issues which has attracted attention in recent years. Different methods have been used to optimize query processing.

This research attempts to propose a different method based on versatility and combining the above methods to optimize query processing.

17.2 Aim

In the world, extensive research is performed on the database and optimization of query processing. Most of the approaches have attempted to optimize the previous methods or have used methods such as caching, increasing the resources and so on for optimization (Feizi et al. 2010b).

Although different methods have been proposed for optimization of queries (Belkin and and Crof 1992), the problem which exists here is that most of these methods remove the execution plan after executing a query. This study attempts to adapt DBMs by introducing the idea of dynamic store procedures with the complex approach of communication with the database (the present queries inside the programming code and using the stored procedures).

With the help of dynamic store procedures, DBMS can use the optimal execution plan which is obtained from a query execution for the next executions or similar executions and in this way, it can decrease the query execution time and therefore the system response time and its workload. This is carried out by versatility.

To keep the plan of optimized query execution, dynamic store procedures are produced. In this method, the query processing time for the queries which are sent in large numbers to the database is decreased by automatic creation of dynamic store procedures.

This research attempts to present DBMS which is adapted by the time and in terms of the sent queries to the database, frequent queries are identified and dynamic procedures are produced for them to optimize the query processing time. In this method, there is no need to create static store procedures by programmers in the applied programs, and they will produce the program by the first method of programming (writing the query within the program). In this method, after a period of time, the query will produce the store procedure automatically. Then, the program will become a store procedure program.

This paper attempts to present the big picture which covers the available methods and techniques, and also by using substitution methods and based on the number and type of the sent queries to the database of applied systems. As time passes, these databases become adaptive and enhance the optimization of query processing by producing dynamic store procedures.

In fact, this research follows two objectives.

1. It has decreased the number of steps which are required for query processing in the event that queries are sent in a large amount of repetitions to the database, and therefore it has decreased the system workload and query processing time. This approach optimizes query processing in the database (Feizi et al. 2009).
2. By presenting adaptive DBMS, it has combined the methods of communication with the database and has solved some of the previous problems.

The objective of making the database adaptive is to select a proper approach for quick response to queries which are sent in great numbers from applied software to the database.

17.3 The Proposed Algorithm

In order to present the proposed algorithm, the discussion is divided into two main parts. The first part is related to how to write the queries inside the program code or programming method, communication with the database and writing the queries inside the program and without store procedure, so there is no need to write codes by static store procedures and the programmer will work with a single environment.

The second part of the proposed algorithm is the proposed method for making the database management system adaptive. This type of database management system is created by adding a factor to the database management system. A combination of two techniques of optimizing queries and factors has been used to add the factor. By using the data collection technology based on the queries processing of users, an adaptive environment is presented based on the type and method of queries.

The objective of this approach is usage in applied software in the database which sends queries based on the user need and satisfies the users need based on these queries (Feizi et al. 2010a). This software usually sends queries to the database and receives a response based on the queries and satisfies the users' needs. In this software, the sent queries usually have the same structure and are repeated as time passes. This is why similar queries and queries which are sent to the database with a high iteration number are identified in this method. Then, it creates dynamic store procedure to respond to the similar queries. In other words, this method makes the database adaptive in order to respond to the queries at lower cost by producing dynamic store procedures.

To operate this algorithm, a factor will be added to the DBMS to perform the production of dynamic store procedures (Zafarani et al. 2010).

This algorithm consists of commands separator, selection policy and identifying similar query parts. The separator part of this algorithm first investigates the queries and then identifies the queries which have low processing cost or non-adaptive queries which are sent with low iteration to the database. If the orders are inherently non-adaptive or low cost, they will be run as usual query processing (Feizi et al. 2009).

Otherwise, they are sent to the part which identifies the sending similarities. The identifier of similarities investigates whether there is any query among the adaptive queries or not. If there is a query among the adaptive queries, then ready store procedures will be used to run the queries. In the absence of a query among adaptive queries, the query will be run normally. Furthermore, a section is needed which will be able to identify adaptive queries and introduce them to store procedure section. The store procedure creation section is responsible for creating store procedures based on the selected queries.

In this algorithm, first the queries are examined and then the queries which have low processing cost and unneeded commands which are sent with low iteration to the database are identified. If the commands are unneeded, they will be run normally, otherwise, they will be sent to the section which identifies the similarities and this section checks whether the query is present among the adaptive queries or not, and if the query is present, then produced store procedures will be used to execute the query. And if the query is not present among the adaptive queries, the query will run normally. In addition to this section, we have another section which is able to identify adaptive queries and produce dynamic store procedures for them. Later, we will discuss the details of each section. The following overview illustrates an example of semi-codes related to the algorithm.

Query processing optimization Algorithm in database

1. Begin
2. Examine query by separator
3. Produce query execution plan normally if query is one of the exceptions
4. If it's not an exception, check its dynamic stored procedure's availability on the system by similarity recognizer
   a. If the stored procedure exists, select it
   b. Otherwise, send it in order to produce execution plan
5. Executing plan or stored procedure for replying to query
6. Check whether it is time for query substitution or not?
   If so, carry out the substitution.
7. Recall stored procedure creator function in necessity
8. END

17.3.1 Commands Separator

Each command incurs a cost for being executed, this cost has been decreased by using different optimization methods (Feizi et al. 2010a). But there are some exceptional commands whose cost will be decreased by optimization methods. That's why the first part of our algorithm is related to the separation of queries. For example, we can't perform optimization for "Insert commands", so we separate them and send them normally to DBMS, after processing we will send the response to the use . In fact, this algorithm aims to separate exceptions and commands whose processing costs are not decreased by making the database adaptive.

17.3.2 The Identifier of Similarities of Queries

To make the query processing in the database adaptive, we need a section in the proposed system which will be capable to compare the sent queries and identify similar queries. For example, consider the two queries:

1. Select * from tbl commodity where commodity id = 20
2. Select * from tbl commodity where commodity id = 31

As it can be seen, these two commands request the information about commodities 20 and 31 from the database. But these two commands have similar structures and can be executed with a single program and this part of the system should be able to identify such commands.

The method which is used here to identify similar executing query programs is to distinguish from the query whether the execution program is the same or not. The issues which exist here are query parameters and the fields and conditions of query to solve this kind of queries as a standard sample and compare them.

The first work which must be done for standardization is to substitute a constant value for query parameters, then the query fields are sorted based on the alphabet and are compared with each other. If they are the same, the execution plan will be the same too, otherwise their execution plan will be different.

It should be noted that there is a database of adapted queries in this paper and if the query exists among the adapted queries, then its store procedure will be used. In this database, queries will be stored in a standard form (Zhang and Seo 2010).

17.3.3 Selection Policy

One of the most important parts of this research is to identify how and when the substitution operation must be carried out and to define the policy of substitution operation. As we know, adding a factor to the database which makes the queries continuously adaptive causes costs for the system. The proposed idea in this research is that the system listens to the sent queries to the database and examines the queries and identifies the similar queries which are sent to the database with high iterations. Then, their store procedures will be created. It should be noted that only those queries will be sent to this section that have been considered by the separator. As far as the interval between two adaptation operations is concerned, we should note that the interval is considered constant and will be performed in low traffic time. We also perform an adaptation operation on the queries which are sent to the database in high traffic time. For this purpose, the sent queries are stored in high traffic time and then in low traffic time and the adaptation operation will be performed on them.

Now, we consider a bank of sent queries to the database for the adaptation method, and if the sent query to the database is similar to one of the present queries in the database, then the weight of the available query in the bank of queries with execution plan will be increased, but if the query is not available in the bank, then it will be executed normally. After completion of the adaptation period, queries with the highest scores will be kept in the bank and the queries with the lowest scores will be replaced with new queries. An $N \times M$ matrix is considered to determine the low and heavy traffic. N is the number of days which the number of sent queries requires to determine the high traffic time. M is the time intervals which are specified as heavy traffic or low traffic times in every day. Now, these two variables can be changed depending on the system and its characteristics. For example, if the system is listened to for a week, then the time intervals will be every two hours. For example, A[2] [3] shows the number of sent queries to the database on the third day and time interval between 4 and 6. The total number of sent queries at any time interval throughout the days and the interval with the heaviest traffic will be specified. Also, by choosing the lowest value, the interval with the lowest traffic will be determined.

17.3.4 Producers of Dynamic Store Procedure

In terms of the above substitution policy, the queries with the highest scores are selected and substituted in the system. Keeping queries and their store procedure in the database follows a special format and standard to decrease the cost of queries investigation.

Query standardization means that the query fields are kept in alphabetical order. Also, their data will be omitted or replaced with a constant parametric value.

In the store procedure, parameter selection depends on the available variables in the adaptive query.

17.4 System Evaluation

The system is designed and simulated as an object-oriented system. This system is added to the database as a factor which consists of three parts that are explained in the above section. Then, the execution results of this simulation system are compared to the results of the typical method.

After the simulation of the system, the results will be investigated based on two aspects.

- Query execution time
- Solving some of the problems of the mentioned communication method with the database.

The first aspect (query execution time) has presented good results without store procedure. In applied systems which uses stored procedure it presents the same results, because the system produces the store procedure itself after adaptation.

This algorithm is tested on different samples of applied software, and showed a good enhancement in the execution time and changed the software to a software which uses store procedure.

This is added to applied software, and its results are compared with the normal condition and the results were obtained as follows. In this system, the required time to execute the sent queries to the database, the adapted and the non-adapted database is compared.

Fig. 17.1 shows the daily required time for response to adaptive and non-adaptive queries. In this diagram, the total required time for executing adaptive queries in the database and also the total required time to execute adaptive queries in a non-adaptive mode is illustrated. It should be noted that the required cost for making the queries adaptive is not added to the calculation in this figure, because this system is not made adaptive at all times and it is adaptive only in low traffic times. However, this cost will be considered in further evaluations.

Fig. 17.2 shows the required time to execute queries per day during heavy traffic time of the system. Heavy traffic time means the time when a larger number of queries are sent to the database for execution. The reason to show this figure is that we use queries which are sent in heavy traffic time to the database for adaptation (Chen and Sycara 1998).

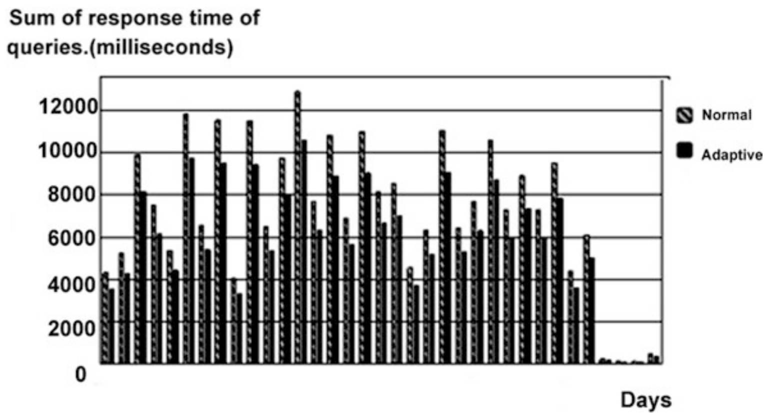

Fig. 17.1 Report on the daily response time of the system for adapted queries (the sent queries on different days)

As is evident, adaptive queries are the queries which are sent to the database in the heavy traffic time. Table 17.1 shows the overall results of the experiment. The first row of the table shows the total required time for response to adaptive queries and also the decreased response time to all of the adaptive queries which are sent to the database. Also, this table shows the necessary cost for making the queries adaptive. In this system, the separator separates the queries when they are sent to the database. The second row shows the required time and cost for all the sent queries to the database and also the cost of adaptability.

As Table 17.1 shows, the system decreased the response time to queries to 11%. As shown here, the approach of adaptability and creating stored procedures has relatively good results in the first method of communication with the database (without stored pro-

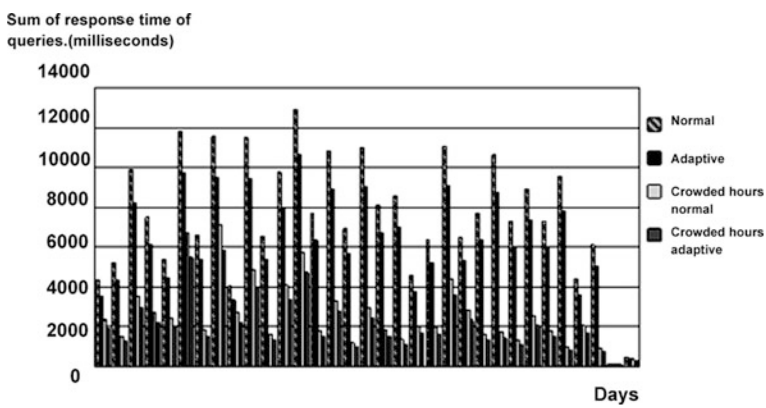

Fig. 17.2 Report on the daily response time of the system for heavy traffic time

Table 17.1 The overall results of evaluation

Row	Type of queries	Total Execution time (Normal)	Total execution time (adaptive)	Decrease response time	Decrease response time (%)
1	Adaptable queries	328,636.3215	239,872.033	88,764.288	27
2	All queries	897,712.5817	828,964.1905	68,748.3912	7.65

cedure) and in addition to increase of response time, it adds other advantages and solves the problems of store procedure programming, which will be discussed in the conclusion section.

Conclusion

This study attempts to propose a method to create store procedures automatically in software production by presenting adaptive DBMS. In order to make the database adaptive, the proposed algorithm is divided into four sections: separator, selection policy, queries identifier and producer of dynamic store procedure. The proposed approach in this paper is tested on a real database of applied software and the results show an 11% improvement. In addition to the improvement, other advantages of this algorithm include: making the programming environment a single environment, eliminating the parametric limitations of the stored procedures in the database, producing dynamic stored procedures in the database, enabling the production of stored procedures in the database for the systems which don't have the possibility to produce stored procedures in the database (such as report producers, form producers, etc.), eliminating the repetitive production of stored procedures in the database, not changing the database structure, etc. In fact, in this method, it needs to make the programming environment a multi environment. Finally, the results of typical communication and adaptability of the database system is turned to a store procedure system.

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The Impact of High-Tech Expenditures on Exports in Turkey: 1996–2012

18

Aziz Kutlar and Ali Kabasakal

Contents

18.1 Introduction

In this study, the efficiency of high technology usage and the export of high-tech products from China, Eastern Bloc countries, and Turkey are measured. This study examines the years between 1997 and 2012. The reason for not including more recent years is that in recent years, relevant data has not been published. The variables related to use and production of high-tech products are total telephone membership (PHM), higher education enrollment rate (HENRL), total labor force (LBR), total domestic patent number (PTNT), high-tech export (HTX), high-tech export share in manufactured goods (HTXR, %), R&D

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_18

expenditures (RDE, in thousands of dollars), fixed capital investments (FCI, in thousands of dollars), foreign direct investment inflows (FDI, in thousands of dollars). Export of high-tech is considered to be output of technology by a country. In this study, the export of high technology and the monetary value of these total exports are evaluated as indicators of performance in countries' high-tech manufacturing. However, the number of students enrolled in higher education, R&D expenditures, and fixed capital investments are also used as inputs. All data has been obtained from World Bank, World Development Indicator, OECD, UNESCO, and UNCTAD. Studies by Gökçe et al. (2010) and Özer and Çiftçi (2009) have processed similar themes.

Turkey's use of high-tech products, production, and impact of technology on export to neighboring Eastern Bloc countries and China are on a comparative basis. For comparison, DEA is used. Panel regression analysis is used to determine efficiency scores. As discussed in the introduction, Turkey's high-tech export and high-tech production have not had high performance values. However, when compared with other countries, Turkey is seen to have achieved some success. After evaluating Turkey's data, comparisons will be made between these values and the values obtained from other countries.

18.1.1 High-Tech Status in Turkey

Table 18.1 shows the descriptive statistics of 17 years of high-tech data in Turkey, and the data follows a normal distribution. It should be noted that the increase in R&D expenditures is up to eight-fold, with a 3-fold increase for higher education, a 23-fold increase for the number of patents, and a 12-fold increase in foreign direct investment. Of particular interest is that the export of high-technology goods has tripled over 17 years. While Russia and Romania have the lowest numbers for exports of high-tech products, Turkey has fallen behind the rest of the countries covered in past years, and Turkey stands out as being above the 3–5% range.

The assumption that regular increases in Turkey's data will occur over the coming years is not realistic because the export of high-technology products has shown a downward trend in the last three years. In the following chart, these values can be easily monitored.

In Fig. 18.1, we see different graphics illustrating Turkey's data as mentioned above. Rapidly increasing phone membership can be seen at the beginning of the period, peaking in 2004 and then decreasing. One of the most important reasons for this trend is introduction of mobile phone technology. The number of students enrolled in higher education, which is located in the second place position above, has been rapidly increasing. Employment levels and numbers of patents are increasing in a similar way. However, export of high-tech does not appear to follow a similar pattern. While the export of high-tech products peaks in 2000, it shows a rapid decline after that. Fixed capital investments and foreign direct investments are increasing in a zigzag shape.

Table 18.1 Descriptive Statistics for Turkish Data (1996–2012)

	RDE	HENRL	HTX	HTXR	PTNT	FDI	FCI
Mean	5,310,584	35.81383	2,841,076	4.846559	1362.294	73,759,545	91,698,185
Median	3,566,116	30.63620	3,156,040	5.311833	682.0000	38,591,000	79,771,025
Maximum	12,517,549	69.38549	4,490,020	7.550384	4434.000	1.87E+08	1.69E+08
Minimum	1,564,537	22.92740	638,375	2.873211	189.0000	15,655,315	31,245,261
Std. Dev.	3,552,384	14.41286	1,290,252	1.588128	1399.237	64,407,135	45,645,706
Skewness	0.768260	1.087098	−0.265419	0.049898	1.015191	0.657073	0.331945
Kurtosis	2.206665	3.029941	1.680433	1.512956	2.669020	1.878083	1.655215
Jarque-Bera	2.118112	3.349018	1.432991	1.573391	2.997663	2.114854	1.593182
Probability	0.346783	0.187400	0.488461	0.455347	0.223391	0.347348	0.450863
Sum	90,279,934	608.8352	48,298,299	82.39151	23,159.00	1.25E+09	1.56E+09
Sum Sq. Dev.	2.02E+14	3323.689	2.66E+13	40.35441	31,325,840	6.64E+16	3.33E+16
Observations	17	17	17	17	17	17	17

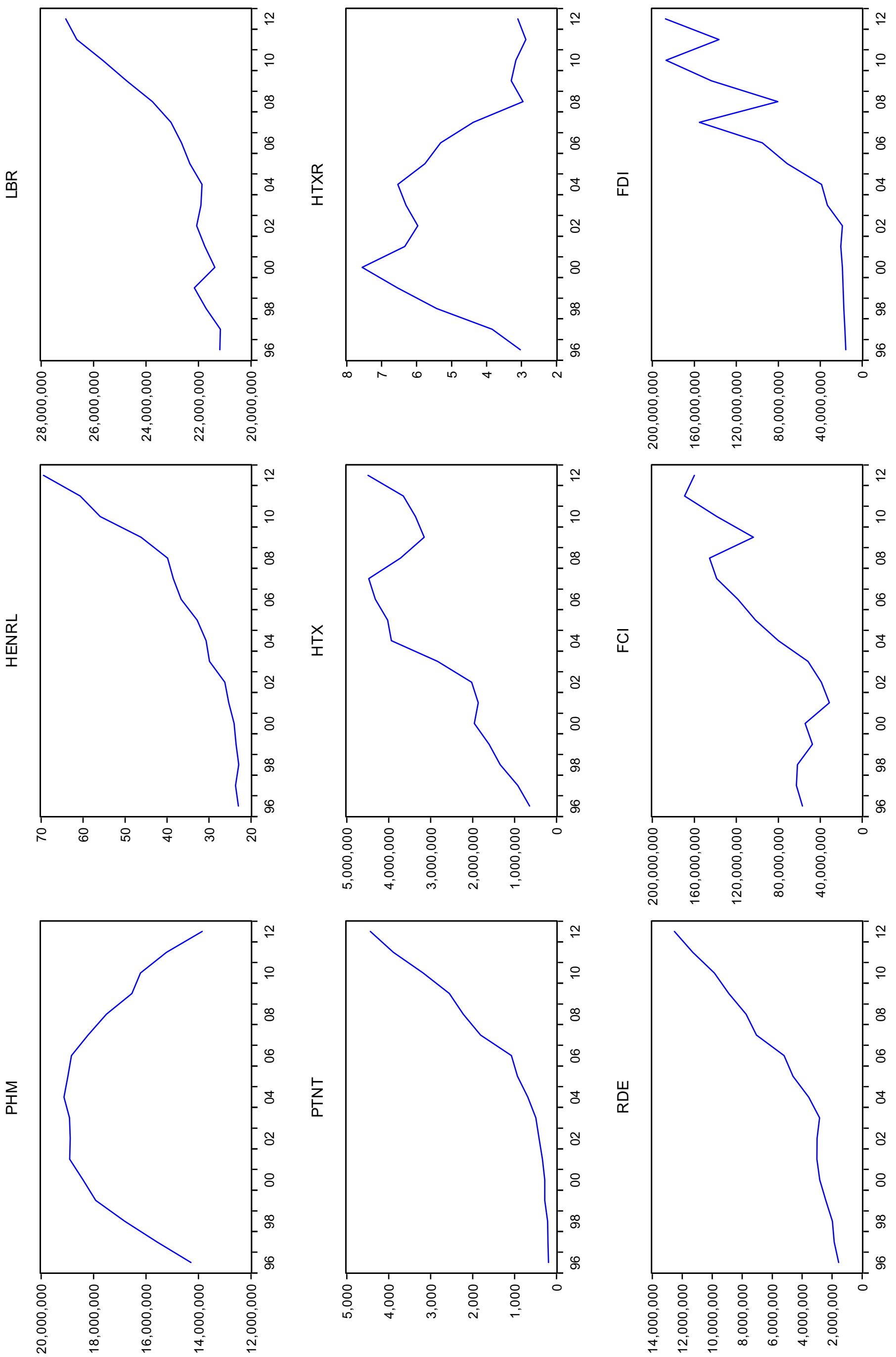


Fig. 18.1 Turkey's Data

18.1.2 Correlation of Variables

Another issue in Turkey surrounds the investigation of the existence of a correlation among variables relating to high-tech products. In Table 18.2, the correlation of seven variables with one another is examined. Although a substantially correlated relationship exists among these variables, this correlation is not always positive. In particular, the HTXR variable has a negative correlation with almost all other variables. This means that there is a reverse trend between high-tech technology and high-tech export. It is obvious that Turkey does not show sufficient performance in high-tech exports. Usage of telephones follows a similar trend. There is a 99% positive correlation between number of patents and variable of RDE.

In addition to data envelopment analysis (DEA), panel regression estimations are investigated as an econometric study method to make predictions. In the panel regression, technical efficiency scores obtained from the results of DEA are used as input. The output of model variables is used as an independent variable.

The literature review is given in the following section of this study. Then, a short explanation on the methodology is given, including DEA. In Sect. 18.3, panel regression is offered. In Sect. 18.4 of the study, empirical results of the analysis are outlined. In Sect. Conclusion, a conclusion and suggestions are given.

18.2 Literature

In the study by Rousseau and Rousseau (1997), a strong potential is seen in the graphs on efficiency frontier for the sample. This visualization makes it easy to see which countries are efficient on the scatter-plot diagram. However, this study includes a limited sample of countries (only 18 countries) and takes care of only OECD countries. Furthermore, no further econometric analysis of efficiency scores was done. In the study by Hollanders and Esser (2007), a comprehensive set of input and output variables is used for the analysis of the efficiency of national innovation systems (NIS). Moreover, authors pay attention to variables directly related to innovation activities.

In a study by Sharma and Thomas (2008), the authors investigate the relative efficiency of the R&D process for a group of 22 developed and developing countries using several specifications of the DEA model. The main advantage of their study is that they use very clear graphs and tables in their presentation. The R&D technical efficiency is investigated using a model with samples granted to residents as an output, and with gross domestic expenditure on R&D and number of researches as inputs. Results of CRS (constant returns to scale) show that, Japan, the Republic of Korea, and China are efficient. In the results of the VRS (variable returns to scale), Japan, the Republic of Korea, China, India, Slovenia, and Hungary are all efficient countries. The authors don't go on to make a further econometric analysis of the efficiency scores, as in some other reviewed studies.

Table 18.2 Covariance Analysis

	RDE	HENRL	FDI	FCI	HTX	HTXR	PTNT
RDE	1.000000[*]						
	–[‖]						
	–[±]						
HENRL	0.980635	1.000000					[*]Correlation
	19.39300	–					[‖]t-Statistic
	0.0000	–					[±]Probability
FDI	0.935788	0.919090	1.000000				
	10.27982	9.033489	–				
	0.0000	0.0000	–				
FCI	0.902693	0.876134	0.882172	1.000000			
	8.125113	7.038958	7.255142	–			
	0.0000	0.0000	0.0000	–			
HTX	0.709076	0.683881	0.740208	0.776256	1.000000		
	3.894647	3.630325	4.263693	4.768949	–		
	0.0014	0.0025	0.0007	0.0002	–		
HTXR	−0.659723	−0.648899	−0.633308	−0.689691	−0.196209	1.000000	
	−3.399959	−3.303010	−3.169391	−3.688923	−0.774977	–	
	0.0040	0.0048	0.0063	0.0022	0.4504	–	
PTNT	0.992392	0.989578	0.914911	0.891962	0.652118	−0.697007	1.000000
	31.21808	26.61638	8.778374	7.640956	3.331467	−3.764651	–
	0.0000	0.0000	0.0000	0.0000	0.0046	0.0019	–

Özer and Çiftci (2009) research the relationship among R&D expenditures and overall export, export of information and communication technologies, and high-tech export. By using a panel data technique, they reach some findings that show a positive, high-level relationship between R&D and export in countries of OECD.

Abbasi et al. (2011) use their own output-oriented DEA model in their paper. Furthermore, they analyze the "source of differences in innovative performance and to survey the impacts of the country-specific factors across the pattern countries" (ibid) through the Tobit model and define "the variation of DEA efficiency scores between DMUs" using ordinary least squares regression. Their study suffers from offering a very uncertain and difficult-to-understand representation of the analysis.

Cullmann et al. (2009) conduct a comprehensive literature review of previous empirical studies measuring the efficiency of the NIS using DEA. They also make an analysis of the impact of previous experimental factors on efficiency.

Pan et al. (2010), in their paper, reconcile diverse efficiency measures to characterize the operating performance of the NIS in 33 Asian and European countries via DEA. The NIS efficiency rating should be considered a key element for achieving greater innovation and competitive advantages. Empirical results indicate that the overall technical inefficiencies of the NIS activities in these countries are primarily due purely to technical inefficiencies rather than to scale inefficiencies. Korea and Taiwan perform very well on their NISs and rank numbers 1 and 2 respectively on the Asian list, while Romania ranks number 1 among the European countries. In addition, the Asian countries are generally better performers than the European countries in production activities.

Guan and Chen (2011) also use the DEA super-efficiency model to measure the efficiency of the NIS. The authors make their analysis of several sets of variables in OECD countries. Guan and Chen (2010) measure the typical innovation production process (IPP) from the system term incorporated with a relational network DEA. This structure is a systematic and simultaneous efficiency measurement to ensure the overall and internal sub process. The experimental innovation measurement ensures in-depth evidences of China's high-tech innovations inefficiency.

Chen et al. (2011) have made an analysis of several variables for the period of 1998–2005. Like Pan et al. (2010), they give a complete mathematical description of the models used, and in the results they include an obvious graphical and table presentation of the analysis. Other parts of the study are detailed with descriptions of the set of variables. The absence of a graphical representation of the efficiency frontier and a small sample size are the restrictions of this study.

According to Hu and Shieh (2013), the advantages of mainland China include its ample land, low labor costs, monoethnicity, and ease of communication. These features make it an attractive location for Taiwanese high-tech industries. DEA is used to evaluate overseas investment efficiency of Taiwanese high-tech businesses in China. The Delphi method is used to select the inputs of the number of employees, and the variables are R&D expenditures and gross sales in total assets in China.

For the period of 1999–2007, a total of 27 European countries and high-tech exports to Turkey (the share of high-tech products of total exports) of the R&D are examined using Panel Causality Analysis by Gökçe et al. (2010). It is determined that these two values have a relationship with each other. Uzay et al. (2012) also tested the relationship between exports from the manufacturing sector in Turkey and R&D expenditures by using panel data analysis. It is found that the impact is a delay in exports of R&D expenditures.

Koyuncu and Yilmaz (2010) found a statistically significant, positive relationship between the share of a country's imports from China and labor productivity in the manufacturing sector of that country by using cross-section, fixed and random-effect models. They also found that imports from China have a larger impact on China's main Asian-Pacific trade partners and countries with higher manufacturing shares in their total exports.

In addition to studies in the country and industry-level research, there are also some studies at the firm level. The effect of the technological innovation activities of 2100 firms in Turkey's manufacturing industry on sales volume is researched by Uzun (2001). It is found that sales of new products, R&D expenditures, firm size (in terms of employment), and number of researchers have a weak effect on sales volume. Shortening the period of investigation and taking into account the different sectors of the manufacturing industry caused these unexpected results.

18.3 Methodology

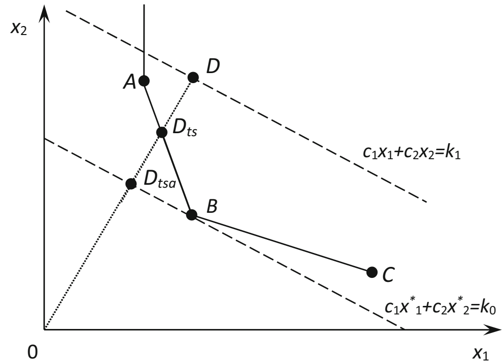
The most widely used non-parametric methods of DEA are linear programming techniques. These compare firms with each activity to be measured in a homogeneous structure and accept the firm that has the best observation as a reference (efficiency limit); then other firms are evaluated accordingly. Activities limited by the DEA are not based on assumptions, but are based on actual observations.

18.3.1 DEA of Mathematical Structure and Efficiency

Efficiency can be defined as the success of getting the highest possible output when utilizing the method that uses the most efficient combination of inputs. This means that it is not possible to increase the quantity produced from one output without reducing one of the outputs by economically changing the input distribution.

Based on a definition given by Koopmans (1951), if production limit is defined as $f(x_t, y_t) = 0$, then $f(x_t, y_t) < 0$ shows the technically efficient production limit. If $f(x_t, y_t) > 0$, then this equation gives input-output combinations that are impossible to be produced by using an exact production technique (Kumbhakar and Lovell 2000). By Koopmans's definition, there are two different statuses—one is input oriented, and the other is output oriented.

Fig. 18.2 Input-Oriented Allocative Efficiency



I. A functionally input-oriented technical efficiency:

$$TE_1(y, x) = \min\{\phi : \phi x \in P(y)\} \tag{18.1}$$

II. A functionally output-oriented technical efficiency:

$$TE_0(x, y) = [\min\{\phi : \phi y \in P(x)\}]^{-1} \tag{18.2}$$

The first studies on the effectiveness of the allocation under the umbrella of DEA were done by Farrell (1957) and Debreu (1951). Fig. 18.2 (x_1, x_2) shows the single output equivalent product segments that occur based on the possible input components.

The p point in the figure shows the same output level that is produced with more input and located in the set of production facilities of DMU.

To show the performance of the p point, the Farrell radial effectiveness measurement can be expressed as follows:

$$0 \leq \frac{d(0D_{\text{ts}})}{d(0D)} \leq 1 \tag{18.3}$$

Here, technical efficiency can be defined as the ratio of the distance from the origin to D_{ts} with respect to the distance from the origin. For allocative efficiency in the same figure, from the point of D, a budget line of $c_1x_1 + c_2x_2 = k_1$ is passed from the point of D. This budget line can be lowered down to the left so as to pass a tangent to the point B on the isoquant curve. At the point B, for x^* and c, the new budget becomes $c_1{x^*}_1 + c_2{x^*}_2 = k_0 (k_1 > k_0)$. The total cost has decreased. For the point of C, the solution of optimal x^* is as follows:

$$cx^* = \min cx \quad (c = 1, 2, \ldots, m) \tag{18.4}$$

Similarly, the ratio of the relative difference of D_{tsa} to D_{ts} is the following:

$$0 \leq \frac{d(0D_{\text{tsa}})}{d(0D_{\text{ts}})} \leq 1 \tag{18.5}$$

This gives the allocative efficiency for Farrell (Cooper et al. 2006).

DEA is developed and adopted by using the relative technical efficiency suggested by Farrell in the effectiveness measurement, and it uses many inputs and outputs that are weighted by linear programming methods. DEA is a technique based on the concept of performance. The first study on performance measurement is based on measurable ratios such as cost per unit, earnings per unit, and so on. This ratio can be defined as output/input.

DEA uses the techniques of "mathematical programming"—which can evaluate many variables together under certain constraints to provide a more comfortable working environment—rather than techniques that cannot evaluate a large number of inputs and outputs together and are more restrictive. If it is assumed that DMU generates outputs y_i, ($i=1, 2, \ldots, t$) from inputs x_k, ($k=1, 2, \ldots, m$), then an equation can be defined in the following way by the appropriate weights ($v_i = 1, 2, \ldots, t; w_k = 1, 2, \ldots, m$) to be applied to the variables. There is a maximum performance of DMU "p" related to the performances of other units:

$$\text{Max. } v_i w_k \frac{\sum_{i=1}^{t} v_i, y_{ip}}{\sum_{k=1}^{m} w_k, x_{kp}} \tag{18.6}$$

Here, the efficiency value of the "z" number of DMUs under one (≤ 1) constraint is given below:

$$0 \leq \sum_{i=1}^{t} v_i y_{ic} / \sum_{k=1}^{m} w_k x_{kc} \leq 1 (c = 1, 2, \ldots, p, \ldots, z) \tag{18.7}$$

$$v_i, w_k > 0 \quad (v_i = 1, 2, \ldots, t; \quad w_k = 1, 2, \ldots, m) \tag{18.8}$$

In the model, "v" and "w" represent variables and weight. Solution of model "p" for DMU gives a efficiency value and the set of weights required to reach this value. That the performance calculated by help of this equation is equal to 1 means the observed performance equals to the performance potential. In this situation, it is accepted that the observed DMU is the best observation.

A fractional program utilizes the rate of total factor activity. In a sense, the DEA should be considered a conceptual model and the linear model should be considered a practical method for calculating efficiency. For each output and input in DEA, weights belonging to the DMU are determined. There are two constraints in determining this weight through linear programming: first, the weight must be positive, and second, the ratio of weighted outputs to weighted inputs should not be greater than one for DMU, which is included in the model. In the literature, this weight value is called a "virtual input-output" or "virtual weight."

The solution of non-parametric programming in the form of the fractional efficiency measurement model is converted to the linear programming model, which is easier to solve

(Charnes et al. 1978; 1979; Banker et al. 1984). This equation is calculated separately and a weight set is obtained. The purpose for this is to maximize the weight in function under the value of the unit activity (≤ 1) constraint.

18.3.2 Panel Regression Analysis

For the estimation of panel analysis, there are two important approaches: the fixed effects approach and the random effects approach (Gujarati 2004; Balgati 2008). In this study, the appropriate model for the obtained estimations is the random effects model. This panel model is as follows.

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \ldots \beta_k X_{kit} + u_{it} \tag{18.9}$$

For the equation, the random variable is $\beta_{1\mathrm{i}}$ with an average of β_1. The intercept can be defined as follows for each firm:

$$\beta_{1i} = \beta_1 + e_i, \quad (i = 1, 2, \ldots, 31) \tag{18.10}$$

Here, e is the random error term with a zero average and constant variance. The emphasizing sense behind the equation is that the constant (β_1) is the same for the five outputs we cope with and it is evaluated as a general average. The individual and subjective constants are defined in the error term (e_i).

18.4 Empirical Findings

In Table 18.3, the statistical values of 17 years of components relating to high-tech for eight countries—including six eastern European countries, China, and Turkey—are given. In the table, the minimum value in higher education and the maximum values in all other matters belong to China. However, the lowest values belong to Lithuania. It is a remarkable point that China comes in first place on the revenues of R&D, patents, and trade. Of particular note, high-tech exports in China are at their highest level, making up 35% of total manufactured goods exports; however, Romania's high-tech exports make up the lowest ratio, at 1% of total manufactured goods exports. For all countries, R&D expenditures have increased over the years. It is interesting that the number of students enrolled in higher education correlates negatively with technology data. While the Republic of China is often first, it seems that in the area of higher education, China maintains a ratio around 5% during its first years, which is the lowest value on the table. However, Lithuania, which is behind in every other area, has the highest value in the area of higher education. When looking at Turkey's data, none of the numbers in this table are extremes.

As mentioned in the beginning of the study, efficiency in the export of high-tech is evaluated by making comparisons between Turkey's neighbors in Eastern Bloc countries

Table 18.3 Some Figures about the Countries for 2003 & 2012

	RDE	HENRL	FDI	FCI	HTX	HTXR	PTNT
Mean	14,520,784	47.06771	1.03E+08	2.07E+08	35,255,615	11.39200	20,733.85
Median	2,136,527	47.03487	46,341,563	39,153,845	2,801,096	6.544599	1012.500
Maximum	2.43E+08	78.95482	8.33E+08	3.85E+09	6.32E+08	35.28611	535,313
Minimum	117,494	5.066800	554,470	1,140,691	85,066	1.052646	62.00000
Std. Dev.	36,933,641	20.16156	1.47E+08	5.67E+08	1.09E+08	10.51002	69,172.97
Skewness	4.158887	−0.241314	2.449377	4.524491	3.922963	1.239148	5.290827
Kurtosis	21.45406	1.993049	9.755837	24.70099	17.89187	2.934940	33.65017
Jarque-Bera	2321.847	7.065646	394.6217	3132.630	1605.517	34.82839	5957.957
Probability	0.000000	0.029222	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1.97E+09	6401.209	1.40E+10	2.82E+10	4.79E+09	1549.312	2,819,804
Sum Sq. Dev.	1.84E+17	54,875.96	2.90E+18	4.33E+19	1.61E+18	14,912.16	6.46E+11
Observ.	136	136	136	136	136	136	136

and China. For this, developments over a 17-year period were determined. The results of the analysis are given in the following table. Then, regression analysis is performed on the condition of foreign trade data being the independent variable and the efficiency score being the dependent variable. Obtained results were evaluated in a similar manner.

Outputs that have either a positive or a negative impact on these obtained efficiency scores are investigated by econometric methods. When determining the DEA efficiency scores, excess of input or lack of output is determined by using input-oriented or output-oriented models. Firstly, technical efficiency and allocative efficiency are calculated using an output-oriented constant returns CCR model and an input-oriented variable return BCC model. Table 18.4 illustrates the inputs and outputs used in DEA models. There are three inputs and two outputs in the basic models.

For these two different approaches, the CCR and BCC models, which can carry out an analysis on the basis of constant and variable returns to scale, are used. In this study, the CCR model (referred to as the constant returns to scale) and the BCC model (referred to as the variable returns to scale) were used to conduct the efficiency analysis, and the subsequent results were evaluated.

In Table 18.5, technical efficiency scores are given according to the CCR model over the years in eight countries. In the table, China and Hungary have the most efficient values across all years. Although Lithuania has full technical efficiency until 2006, thereafter its efficiency is lost a little. The most noteworthy point in the table is that the Russian Federation has incredibly low efficiency values. After 2005, this country's efficiency values are below 1%. After Russia, Romania, Poland, and Turkey have the next lowest efficiency values. However, Romania has reached risen above its starting efficiency value of below 1%. The increase of efficiency in this country is readily apparent. Similar things can be said for Poland, but in Turkey it is a little different. Turkey's efficiency score started at a higher point, but ended the period with an efficiency score of 1%. Russia has the lowest efficiency values, according to this table, and is followed by Turkey.

In Table 18.6, efficiency scores obtained with the BCC model are more positive than those obtained with the CCR model. Bulgaria, China, Hungary, and Lithuania have full

Table 18.4 Variables of the Model

Inputs (X)		Outputs (Y)	
X_1: HENRL	Higher Education Enrollment Rate	Y_1: HTX	High-Tech Export ($1000)
X_2: RDE	R&D Expenditures ($1000)	Y_2: HTXR	High-Tech Export Ratio in Manufactured
X_3: FCI	Fixed Capital Investments ($1000)		
Dependent Variables			
TE_{CCRt}	CCR Technical Efficiency		
TE_{BCCt}	BCC Technical Efficiency		

Table 18.5 Technical Efficiency Scores of Input Oriented CCR Model

Years	Bulgaria	China	Hungary	Lithuania	Poland	Romania	Russian F.	Turkey	Mean (CRS)
1996	0.819	1	1	1	0.375	0.187	0.232	0.341	0.619
1997	1	1	1	1	0.178	0.069	0.121	0.197	0.571
1998	1	1	1	1	0.178	0.069	0.121	0.197	0.571
1999	0.587	1	1	1	0.164	0.212	0.148	0.326	0.555
2000	0.466	1	1	1	0.143	0.431	0.117	0.352	0.564
2001	0.508	1	1	1	0.165	0.414	0.129	0.33	0.568
2002	0.674	1	1	1	0.172	0.394	0.182	0.307	0.591
2003	0.612	1	1	1	0.183	0.313	0.181	0.333	0.578
2004	0.501	1	1	1	0.175	0.242	0.137	0.35	0.551
2005	0.57	1	1	1	0.212	0.216	0.075	0.332	0.551
2006	0.696	1	1	0.953	0.28	0.228	0.065	0.3	0.565
2007	0.808	1	1	0.848	0.311	0.164	0.06	0.242	0.554
2008	0.83	1	1	0.886	0.387	0.243	0.046	0.15	0.568
2009	1	1	1	0.839	0.443	0.5	0.061	0.123	0.621
2010	0.887	1	1	0.864	0.435	0.599	0.048	0.096	0.616
2011	1	1	1	0.755	0.383	0.617	0.049	0.09	0.612
2012	1	1	1	0.863	0.424	0.558	0.111	0.097	0.632

efficiency scores throughout the whole period. Romania and Turkey bear full efficiency scores through only part of the period. However, the presence of erosion of Turkey's efficiency values over the last three years is a concern. Poland and the Russian Federation are two countries that did not have full efficiency scores across the entire period. When looking at the entire table, the lowest efficiency scores belong to the Russian Federation. When looking at the average efficiency scores, it is seen that the average efficiency rate decreased a little before the year 2000 and increased after this date.

Fig. 18.3 illustrates the mean efficiency values for CRS and VRS. CRS values seem to present the lowest efficiency scores for the years of 1999 and 2005 and then a continuous increase after the year 2005. The VRS values, on the other hand present relatively small fluctuations at the beginning and at the end of the investigated period but more stable path for increase otherwise.

The panel regression of technical efficiency scores provided by the CCR and BCC models was assumed. In this assumption, independent variables are outputs of efficiency scores and dependent variables are the actual efficiency scores. These technical efficiency scores are related to the panel regression for each DMU. Two-panel regression analysis is applied.

$$\mathrm{TE}_{\mathrm{CCRt}} = \beta_1 + \beta_2 \ln \mathrm{HTX}_t + \beta_3 \ln \mathrm{HTXR} \tag{18.11}$$

$$\mathrm{TE}_{\mathrm{BCCt}} = \beta_1 + \beta_2 \ln \mathrm{HTX}_t + \beta_3 \ln \mathrm{HTXR} \tag{18.12}$$

Table 18.6 Technical Efficiency Scores of Input Oriented BCC Model

Years	Bulgaria	China	Hungary	Lithuania	Poland	Romania	Russian F.	Turkey	Mean (VRS)
1996	1	1	1	1	0.596	1	0.427	0.881	0.863
1997	1	1	1	1	0.518	1	0.419	0.827	0.846
1998	1	1	1	1	0.518	1	0.419	0.827	0.846
1999	1	1	1	1	0.489	1	0.443	0.907	0.855
2000	1	1	1	1	0.47	1	0.427	0.948	0.856
2001	1	1	1	1	0.517	1	0.445	1	0.87
2002	1	1	1	1	0.559	1	0.475	1	0.879
2003	1	1	1	1	0.627	1	0.499	1	0.891
2004	1	1	1	1	0.654	0.982	0.503	1	0.892
2005	1	1	1	1	0.674	0.961	0.505	1	0.893
2006	1	1	1	1	0.709	0.895	0.525	1	0.891
2007	1	1	1	1	0.748	0.892	0.518	1	0.895
2008	1	1	1	1	0.766	0.845	0.524	1	0.892
2009	1	1	1	1	0.785	0.887	0.603	1	0.909
2010	1	1	1	1	0.78	1	0.733	0.994	0.938
2011	1	1	1	1	0.723	1	0.65	0.838	0.901
2012	1	1	1	1	0.754	1	0.673	0.756	0.898

Each score contains data for the number of DMUs (number of countries). These regression analyses were predicted one by one by means of fixed effects and random effects methods. In the predictions, the method used in the *fixed effects* panel regression analysis, in which technical efficiency scores are used as dependent variables, was understood to be correct according to Hausman's test.

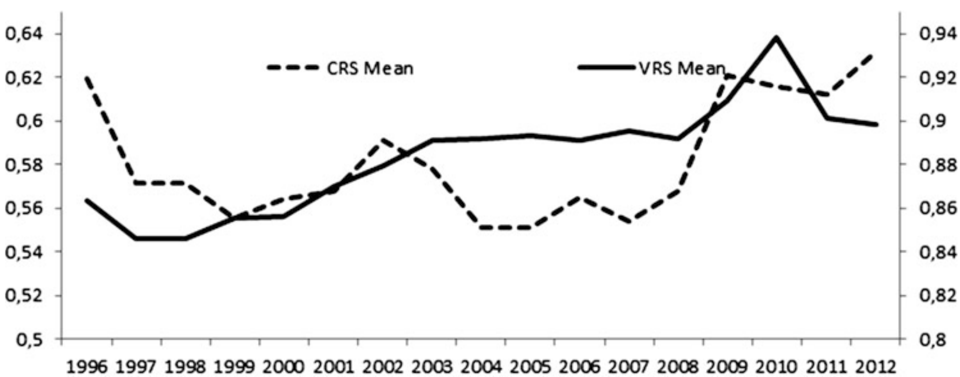


Fig. 18.3 Mean Efficiency Score of CCR and BCC

In the regression analysis, which is done for two different scores, it is discovered that the log values of independent variables LNHTX and LNTXR are significant at 1%, and the F statistics are also significant at the 1% level. However, the sign of the coefficient for the LNHTX is negative which means that this variable has a reduction effect on efficiency. High-tech exports have an increasing effect on efficiency, as is seen in the positive slope of the variable. On the last part of Table 18.7 it is seen that according to the BCC model, none of the results on efficiency are statistically meaningful.

Table 18.7 Panel Regression Estimators of TE with CCR and BCC Models

Dependent Variable: $TE_{CRS,}$				
Method: Panel Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNHTX	−0.143701	0.015040	−9.554587	0.0000
LNHTXR	0.588590	0.033184	17.73712	0.0000
C	1.524959	0.177715	8.580912	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.759114	Mean dependent var		0.581441
Adjusted R-squared	0.722055	S.D. dependent var		0.373627
S.E. of regression	0.196978	Akaike info criterion		−0.282520
Sum squared resid	4.539633	Schwarz criterion		0.124395
Log likelihood	38.21135	Hannan-Quinn criter.		−0.117160
F-statistic	20.48376	Durbin-Watson stat		2.324676
Prob (F-statistic)	0.000000			
Dependent Variable: TE_{VRS}				
Method: Panel Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNHTX	−0.008387	0.014935	−0.561571	0.5755
LNHTXR	0.013918	0.032952	0.422366	0.6735
C	0.979076	0.176475	5.547970	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.029639	Mean dependent var		0.881890
Adjusted R-squared	−0.119647	S.D. dependent var		0.184856
S.E. of regression	0.195603	Akaike info criterion		−0.296532
Sum squared resid	4.476469	Schwarz criterion		0.110383
Log likelihood	39.16414	Hannan-Quinn criter.		−0.131172
F-statistic	0.198541	Durbin-Watson stat		2.488007
Prob(F-statistic)	0.999850			

Conclusion

The efficiency of high-tech products, production, foreign trade, and usage for the eight countries (Turkey, China, and six former Eastern Bloc countries) over a seventeen-year period has been the subject of this study. When looking at the data relating to Turkey's production and usage of high-tech products, Turkey is located below the average of the other countries covered in the given period. It is observed that high-tech products did not exceed the rate of 3–5% in issued shares in the manufacturing sector, and after 2009, this ratio decreased. As for the overall usage of technology, decreases in numbers of land phones reveal that new technological products are being used.

The efficiency scores of Turkey and seven other countries in high-tech exports are evaluated by using DEA. Then the exports variables that contribute to the efficiency are the regressed with efficiency scores. Results of the DEA technique show that China is the leader in high-tech exports. These results are obtained from the technical efficiency scores of the CCR and BCC models. Especially in the CCR model, it can be seen that Russia has the lowest efficiency scores with Turkey following behind. Not only were Turkey and Russia's scores low, but their scores followed a continual declining trend over the examined seventeen years. Technical efficiency scores, which are determined using the CRR model, increased slightly in the middle of the period and then increased slightly more at the end of the period. In the BCC model, Poland and Russia are the two countries that cannot achieve a fully effective position during the year.

In the panel regression analysis, technical efficiency scores obtained from the CCR model have a positive relationship with export variables. However, these efficiency scores have a negative relationship with the HTX variable and a positive relationship with the HTXR variable. This result indicates the presence of a positive contribution on the efficiency scores of high-tech export.

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A Fresh Look at an Old Classification Algorithm 19

Bernd-Jürgen Falkowski

Contents

19.1 Introduction

Recently, it has been realized that ranking and classification algorithms are of considerable practical importance. In particular the severe banking crisis, occurring only a few years ago showed what can happen if the creditworthiness of customers is not correctly assessed. Considerable efforts have been made to avoid such disasters in the future (see e.g. Basel III 2016; Falkowski 2012b). Whilst in this context ranking algorithms are of paramount importance (see e.g Falkowski 2012a, 2012b; Shashua and Levin 2003; Shawe-Taylor and Cristianini 2004; Thomas 2000), other applications like recommender systems (cf. e.g Ricci et al. 2011), need classification systems without ranking. Moreover, the analysis of "Big Data" (cf. Mayer-Schönberger and Cukier 2013) requires similar algorithms. In either case, applications of statistical methods (e.g. Bayes' theorem) are useful.

Of course, there exist many well tried methods like logistic regression or more recently neural networks and in particular support vector machines (cf. Bishop 1998; Evgeniou

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_19

et al. 2000; or Schölkopf and Smola 2002). However, all these algorithms suffer from certain shortcomings. Hence, it seems worthwhile to look at Minsky's original perceptron algorithm again. This algorithm is astonishingly simple to implement. Moreover, its original shortcomings can be overcome to a large extent by recent developments concerning slight algorithmic improvements as well as progress in available hardware and programming techniques.

Thus, in Sect. 19.2, Minsky's original perceptron is described. In Sect. 19.3, the Krauth/Mezard algorithm is introduced. Sect. 19.4 contains an application of Bayes' theorem and a discussion in Sect. Conclusion completes the paper.

19.2 The Perceptron

In their seminal work (Minsky and Papert 1990), Minsky and Papert describe a perceptron as a simple classifier by means of a linear threshold function as follows.

Definition: Let $\Phi := \{\varphi_1, \varphi_2, \ldots, \varphi_m\}$ be a family of (generalized) predicates (in general real valued functions defined on some set of objects). Then the truth-valued function ψ (predicate) is a linear threshold function with respect to Φ if $\exists$ a real number θ and coefficients $\alpha(\varphi_1), \alpha(\varphi_2), \ldots, \alpha(\varphi_m)$ such that

$$\psi(x) = \text{true if and only if } \sum_{i=1}^{m} \alpha(\varphi_i)\,\varphi_i(x) > \theta.$$

Any predicate that can be defined in this way is said to belong to $L(\Phi)$.

Now suppose that two disjoint sets of objects S^+ and S^- and a family of generalized predicates Φ on $S := S^+ \cup S^-$ are given. Then one would like to construct a predicate ψ in $L(\Phi)$ such that $\psi(x) = \text{true}$ if and only if $x \in S^+$, in other words one would like to construct a ψ in $L(\Phi)$ that separates S^+ and S^-.

As shown by Minsky and Papert, this can be done using the following simple program (the **P**erceptron **L**earning **A**lgorithm), in which the convenient scalar product notation instead of $\sum_{i=1}^{m} \alpha(\varphi_i)\,\varphi_i(x)$ is used and $\boldsymbol{A}$ and $\boldsymbol{\Phi}(x)$ are considered as elements of $\Re^m$, if a solution exists. (It is instructive to note here that the basic geometric concepts of length and angle may be described in purely algebraic terms using the scalar product. Taking this into account and generalizing to higher dimensions, the solution may thus be considered in geometrical terms as a separating hyperplane.).

```
Start    Choose any value for A, Θ
Test   Choose x ∈ S
       If x ∈  S⁺ and A·Φ(x)> Θ go to Test
       If x ∈  S⁺ and A·Φ(x)≤ Θ go to Add
       If x ∈  S⁻ and A·Φ(x)< Θ go to Test
       If x ∈  S⁻ and A·Φ(x)≥ Θ go to Subtract
```

```
Add Replace A  by A + Φ(x) and Θ by Θ -1
      Go to Test
Subtract
      Replace A by A - Φ(x) and Θ by Θ +1
      Go to Test
```

If there exists a more general partition of $S = \bigcup_{i=1}^{q} S_i$ then one can still construct a suitable classifier as follows.

Given $\boldsymbol{\Phi}$ as above, find a vector $\mathbf{A}^* := (\mathbf{A}_1^*, \mathbf{A}_2^*, \ldots, \mathbf{A}_q^*)$ and a number θ such that $\mathbf{A}_i^* \cdot \Phi(x) > \mathbf{A}_j^* \cdot \Phi(x) + \theta$ for all $j \neq i$ if and only if $x \in S_i$.

This problem can be reduced to the one described above, if one defines $\boldsymbol{\Phi}_{ij}(x) := (0, \ldots\ 0, \boldsymbol{\Phi}(x), 0, \ldots\ 0, -\boldsymbol{\Phi}(x), 0, \ldots, 0)$, where $\boldsymbol{\Phi}(x)$ appears in the i-th place and $-\boldsymbol{\Phi}(x)$ appears in the j-th place. Indeed, this leads to

```
Start    Choose any value for A, Θ
Test   Choose x ∈ S
      If x ∈  Si and A·Φij(x)> Θ go to Test
      If x ∈  Si and A·Φij(x)≤ Θ go to Add
      If x ∈  Sj and A·Φij(x)< Θ go to Test
      If x ∈  Sj and A·Φij(x)≥ Θ go to Subtract
Add Replace A  by A + Φij(x) and Θ by Θ -1
      Go to Test
Subtract Replace A by A - Φij(x) and Θ by Θ +1
      Go to Test
```

Note, in order to avoid confusion, that by abuse of notation we have used the same $\boldsymbol{A}$, θ as above.

The interesting point about this is the fact that, as already noted by Minsky and Papert, a straightforward error-correcting feedback results in a correct algorithm. Of course, the required existence of a solution is by no means guaranteed in general although, if suitable predicates on $\mathfrak{R}^n$ are used, in many cases a solution can be found.

In order to see this note that the number of different monomials of degree i in $x_1, x_2, \ldots, x_n$ is given by $\binom{n+i-1}{i}$ (cf. e.g Knuth 1973, p. 488). Hence, an easy induction proof shows that the number of different monomials of degree is less than or equal to i in $x_1, x_2, \ldots, x_n$ is given by $\binom{n+i}{i}$. Thus $\boldsymbol{\Phi}$ may be defined by

$$\Phi(x) = \left(1, x_1, x_2, \ldots, x_n, x_1^2, x_1x_2, \ldots, x_n^i\right)$$

as a map from $\mathfrak{R}^n$ to $\mathfrak{R}^{\binom{n+i}{i}}$. Hence, the separating capacity of the corresponding hyperplanes may be increased with i, for details see e.g. Cover (1965). So in the sequel instead of a general set S a subset S of Euclidean space will be considered (which for most applications is not a very severe restriction).

19.3 The Approximately Optimal Separating Hyperplane

Although the **PLA** algorithm constructs a separating hyperplane, it does not in general construct an optimal separating hyperplane. This can, however, approximately be achieved by utilizing the so-called Krauth/Mezard algorithm, whilst still retaining a very simple update operation

To this end note first that this problem can be reduced by a standard trick as follows.

Embed the vectors in a space whose dimension is one higher than that of the feature space by defining $\boldsymbol{\Phi}(\mathbf{x}) \rightarrow \mathbf{y} := [\boldsymbol{\Phi}(\mathbf{x}), -1]$, respectively $[-\boldsymbol{\Phi}(\mathbf{x}), 1]$ if $\mathbf{x} \in S^+$, respectively $\mathbf{x} \in S^-$ and map the weight vector $\mathbf{A}$ to $\mathbf{A}_1 := [\mathbf{A}, \theta]$. Then clearly the problem is reduced to finding a weight vector $\mathbf{A}_1$ such that $<\mathbf{y}, \mathbf{A}_1 \gg 0$ in the higher dimensional space. In the sequel, it is this reduced problem that will be considered.

19.3.1 The Krauth/Mezard Algorithm

Given samples (patterns) $\mathbf{y}_1, \mathbf{y}_2, \ldots, \mathbf{y}_p$, find a vector $\mathbf{A}^*$ such that

$$\langle A^*, y_j \rangle \geq c \quad \text{for} \quad j = 1, 2, \ldots, p \quad \text{and} \quad c > 0.$$

Assume throughout that such a vector exists with $\| \mathbf{A}^* \| = c / \Delta_{\text{opt}}$, where Δ_{opt} denotes the maximal distance of separation of the samples from zero.

This problem can be solved by the following algorithm due to Krauth and Mezard, (cf. Falkowski 2008; Krauth and Mezard 1987).

Note that this algorithm computes an approximately optimal separating hyperplane where the degree of optimality is defined by the stopping criterion, for further details see Krauth and Mezard (1987).

Algorithm

Set $y := \max_j ||\mathbf{y}_j||^2$.
At $t = 0$ set $\mathbf{A}_0 = \mathbf{0}$
At $t = 0, 1, \ldots$ determine a sample $\mathbf{y}_{j(t)}$ by
$\quad < \mathbf{A}_t, \mathbf{y}_{j(t)} > := \min_j < \mathbf{A}_t, \mathbf{y}_j >$
and if
$\quad < \mathbf{A}_t, \mathbf{y}_{j(t)} > < c$ (c is a fixed positive number)
use it to update $\mathbf{A}_t$ by
$\quad \mathbf{A}_{t+1} = \mathbf{A}_t + (1/y)\mathbf{y}_{j(t)}$
If $< \mathbf{A}_M, \mathbf{y}_{j(M)} > \geq c$ stop.

Explanation: The Krauth/Mezard algorithm clearly only slightly modifies the original **PLA**. Instead of testing an arbitrary sample, it first looks for the "worst classified" sample

Table 19.1 Results

Active cores	1	2	3	4
CPU times (sec)	30	17	12	9

and uses it for the update until the stopping criterion is satisfied. Of course, thus the complexity of the algorithm is increased somewhat. Fortunately, this can be taken care of, by an efficient implementation, see below.

19.3.2 Implementation Aspects

In order to speed up the algorithm in a Java implementation, it was decided to use concurrent programming since nowadays multicore laptops are commercially available at reasonable cost.

To this end a new class "Minover" was created. The work in the main loop of the algorithm is split by a "director" (an element of class *Minover*) amongst a number of "worker" threads corresponding to the number of processors available. Each of these is initially passed the vector **A** together with a "latch" from the "director". The data and the latch are encapsulated in a "work unit" and put in an instance variable of type ArrayBlockingQueue of capacity 1. Then the director is told to wait. The workers (they hold the required samples in instance variables) then compute their worst classified training example using the data contained in the work unit and pass it to the director who is waiting. In addition they decrease the current count of the latch. Thus, when all worker threads have finished their computations and the current count of the latch is zero, the director combines their results and updates the vector **A** whilst the worker threads are waiting until their blocking queues have new work units. Thereafter, the process starts afresh till the stopping criterion is satisfied. For a more detailed description the reader is referred to (Falkowski 2008).

19.3.3 Preliminary Experimental Results

For performance tests, a (real life) data set with approximately 5000 data vectors containing 52 attributes describing "good" or "bad" banking customers was used. The set contained 123 "bad" customers. A fault tolerant version of the **PLA** was implemented using Java concurrent programming as described in (Falkowski 2008). The Krauth/Mezard algorithm was applied to improve the separating hyperplane for the correctly classified examples. 50,000 iterations of the main loop were run on a QuadCore PC (8 GB RAM). In order to test the improvement effected by the concurrent programming techniques, CPU times were measured for 1, 2, 3, 4 active cores. The results are contained in Table 19.1.

So the improvement was considerable and the algorithm appears to be quite suitable for practical purposes (The tests were run under Windows 7. A better operating system might distribute the work more evenly amongst the Java threads.).

A preliminary comparison with a classical method still frequently used in commercial applications (logistic regression) concerning generalization properties proved rather encouraging: Using a data set as described above, but with unseen data, a slightly improved error rate (2 to 3%) could be achieved without tuning of the relevant parameters. This does not sound very impressive. However, the improvement was obtained on the "bad customers" which, of course, is rather important for bankers since a "bad" customer erroneously classified as "good" is more costly than a "good" customer erroneously classified as "bad" by a factor estimated to be as high as twenty. Of course, more systematic tests concerning the generalization properties are still outstanding.

19.4 Probabilistic Interpretation of the Output

If one makes certain assumptions on the class conditional densities, then the output of the perceptron can be interpreted as a probability. Indeed, assume that the class conditional densities belong to the family of exponential distributions of the general form

$$p(\boldsymbol{\Phi}(x)|x \in S_i) = \exp\{B(\boldsymbol{\beta}_i) + C(\boldsymbol{\Phi}(x)) + \langle \boldsymbol{\beta}_i, \boldsymbol{\Phi}(x)\rangle\}$$

Then the posterior probability can be computed using Bayes theorem as

$$\begin{aligned} p\,(x \in S_i|\boldsymbol{\Phi}(x)) &= \frac{p\,(\boldsymbol{\Phi}(x)|x \in S_i) \cdot P(S_i)}{\sum_j p\left(\boldsymbol{\Phi}(x)|x \in S_j\right) \cdot P(S_j)} \\ &= \frac{\exp\{B(\boldsymbol{\beta}_i) + C(\boldsymbol{\Phi}(x)) + \langle \boldsymbol{\beta}_i, \boldsymbol{\Phi}(x)\rangle\} \cdot P(S_i)}{\sum_j \exp\{B(\boldsymbol{\beta}_j) + C(\boldsymbol{\Phi}(x)) + \langle \boldsymbol{\beta}_j, \boldsymbol{\Phi}(x)\rangle\} \cdot P(S_j)} \\ &= \frac{\exp\{B(\boldsymbol{\beta}_i) + \langle \boldsymbol{\beta}_i, \boldsymbol{\Phi}(x)\rangle\} \cdot P(S_i)}{\sum_j \exp\{B(\boldsymbol{\beta}_j) + \langle \boldsymbol{\beta}_j, \boldsymbol{\Phi}(x)\rangle\} \cdot P(S_j)}. \end{aligned}$$

Setting

$$\boldsymbol{A}_i = \boldsymbol{\beta}_i \quad \text{and} \quad -\theta = B(\beta_i) + \ln[P(S_i)]$$

one obtains

$$p\,(x \in S_i|\boldsymbol{\Phi}(x)) = \frac{\exp a_i}{\sum_j \exp a_j} \tag{19.1}$$

with

$$a_i = \langle(\boldsymbol{A}_i, \boldsymbol{\Phi}(x)\rangle - \theta.$$

Hence, it becomes clear that, provided that the assumed class conditional density is appropriate, deciding that an x belongs to S_i if a_i is maximal is also the Bayes decision since the a posteriori probability is maximal in this case.

In this context also note that the function given in Eq. 19.1, describes a generalization of the logistic sigmoid activation function which is known as the normalized exponential or softmax activation function. The term softmax is used because this activation function represents a smooth version of the winner-takes-all activation model. For further details, see e.g. Bishop (1998).

Conclusion and Outlook

Clearly, the approach sketched out above can only be a first step towards generating a commercially viable classification algorithm from Minsky's original version. In fact, a fault tolerant version (of Gallant's Pocket Algorithm (see Falkowski 2009; Gallant 1990), will most probably be needed to achieve good generalization properties since otherwise a large Vapnik/Chervonenkis bound (see Vapnik 1998), would be detrimental due to the danger of overfitting. Moreover, instead of the feature map positive definite kernels (see e.g Falkowski 2012a), ought to be applied since otherwise in spite of concurrent programming enormous CPU times could occur. In addition, in this case also the danger of overfitting has to be considered. However, the theory of regularization networks (cf. Evgeniou et al. 2000), suggests that this can be taken care of by introducing a smoothing parameter. Finally, more extensive tests need to be conducted in order to explore the suitability of a probabilistic interpretation of the results.

Nevertheless, it seems to be somewhat remarkable that such a compact and truly elegant classification algorithm using an extremely simple and easy to implement update operation can be obtained from Minsky's original version by exploiting improvements in the algorithmic structure, programming techniques and hardware.

Acknowledgement The author is indebted to M. Stern for help with the experimental work.

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Part IV

Finance

Islamic Banking 101: Turkish Banks in Germany

20

Fragments of a Novel Marketing Concept in Consideration of Ethical and Sustainable Ways of Life

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Contents

20.1 Introduction

Nowadays, the Islamic Banking System is not only limited to Islamic countries, but has also increased in popularity in Western countries, especially in the United Kingdom and

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_20

in the United States of America (cf. Schuster 2013, p. 3). Those countries have not only perceived the increasing trend, but also realized the potential of Islamic Banking and became one of the hotspots of Islamic Banking in the Western world (cf. Schuster 2013, p. 4; Karl 2012, p. 1 f.; Wentler 2012, p. 5; Geilfuß 2009, p. 1 f.).

Besides that, Europe came more and more into the focus of Muslim people and thus grew up to an area with a considerable large Islamic population, especially Germany with more than 4 million Muslim inhabitants becoming increasingly important for the economic situation in Europe (cf. and hereinafter Geilfuß 2009, p. 2 et seqq; Chaboune and El-Mogaddedi 2008, p. 33; Zerth/Kiepe/Mittendorf, p. 19 et seqq.). However, according to those facts, it is questionable why the German finance industry has not taken any action to implement the way of Islamic Banking yet. Furthermore, after the financial crises in 2008, a remarkable demand for alternative banking products and banking systems with ethical features is perceptible in Germany (cf. Abidemi 2015, p. 35 et seqq.).

This paper provides information about the basics of Islamic Banking, points out the differences to the traditional conventional banking system and focuses on chances and risks for an Islamic Banking system in Germany. Due to the German-Turkish cooperation project and the conference-forum "E2E Building a Bridge on Sciences" Munich in November 2015, this paper has a specific focus on Turkish Banks and Turkish financial institutes.

Thus, this paper investigates the following research topics:

- What is the Islamic Banking system and what are the differences to the traditional Western Banking systems?
- Is there a market potential for Islamic Banking, especially for Turkish Banks in Germany?
- How can one set up a marketing concept for Turkish Banks?

Sect. 20.2 describes the fundamental principles and notions according to Islamic Banking to understand the basic idea of the system while section 20.3 points out the differences to the common banking system known as traditional banking system in the Western world. Sects. 20.4 and 20.5 intend to meet the research questions by clarifying the market potential in Germany and discussing some thoughts about a marketing concept for Turkish Banks that is based upon Islamic Banking. A conclusion is provided with final thoughts of the authors.

20.2 Islamic Banking 101

In general, Islamic Banking refers to a banking system that is in accordance with the Islamic law, which is also known as the Sharia law (cf. among others Abduh and Ramjaun 2015, p. 72; also cf. Abidemi and Foudalmoula 2015, p. 35 et seqq.).

Beside basic economic goals like profit maximization, generating liquidity and equity, the Islamic Banking system pays attention to its fundamental principles based on social justice and human welfare as well as financial and social sustainability (cf. Geilfuß 2009, p. 4 and p. 11; Käseberg 2013, p. 12 et seqq.).

The ideas of common business and their realisation became very relevant within the last years (cf. and hereinafter Zerth et al. 2014, p. 19 et seqq.; also Sadoveanu 2011, p. 8 et seqq.): Approximately 300 Islamic Banks and financial institutes are operating in 65 Islamic and a small number in Western countries. These institutions coast assets of more than $750 billion as of 2006 (cf. Singer et al. 2014, p. 2 et seqq.). Their annual growth rates are about 10–15% of revenue which surpasses those of conventional banks substantially. And on the financial market more than thousand Islamic investment funds exist; mainly consisting of equity shares. Especially within the last years since the financial crisis in 2008/09, the demand for Islamic Banking products has increased tremendously and became more popular in Europe and especially in Germany (cf. Geilfuß 2009, p. 5 et seqq. and hereinafter Abidemi and Foudalmoula 2015, p. 30 et seqq.). E&Y, a consultancy and accounting firm, estimates that Islamic banking assets grew at an annual rate of 17% between 2009 and 2014, and will grow by an average of about 20% a year to 2019 (cf. Geilfuß 2009, p. 6).

20.2.1 Derivations of Islamic Banking

The entire Islamic system is based on Islamic law, which is the Sharia. The Sharia refers primarily to the Quran, the holy scripture of Islam, which contains the verbatim revelation of God (Allah to the Prophet Mohammed according to Muslim faith (cf. and hereinafter Käseberg 2013, p. 8 et seqq.)). Secondly, it refers to the Sunnah, which is a summary of the teachings of Muhammad, the Islamic prophet. The Sunnah is particularly used in the Islamic jurisprudence and tradition science. That is why the Sharia has an outstanding significance according to the Islamic Banking. It prescribes rules and guidance to many aspects of Muslim life, starting from daily routines, politics, penalties, inheritances, and family obligations to economic behaviour and financial dealings. Speaking in terms of business, it should be clear that all transactions of Islamic Banking are subject to the rules of the Sharia. To ensure this, every Islamic institution is supposed to have a Sharia Committee that guides, examines and ensures that all of the financial products and internal processes of the Islamic bank are compliant with the Sharia (cf. Heb 2015, p. 45 et seqq. and Tarig and Tahir Arshiya 2012, p. 10 et seqq.).

20.2.2 Prohibitions and Principles in Accordance with Ethical Conception of Life

The Islamic Banking system is required to adhere several principles that prohibit economic operations and transactions that are considered ethically or socially harmful of involve exploitation in any form. The main purposes of the principles are to prescribe solely in ethical investing and moral purchasing operations.

No Transactions with Interest Rates

One of the most important principles of the Islamic Banking system is the prohibition of interests (riba) (cf. and hereinafter Karl 2012, p. 12; Schulze 2012, p. 30 et seqq.; Zaman 2015, p. 14 et seqq.). According to that rule, Islamic credit institutes do not pay interests on customer deposits or charge interests on loans. Dealing with interests is prohibited because it is considered as a threat to the welfare of a society and leads to injustice and exploitation. The Quran understands interests as exploitation or menace and condemns those operations in any form. Charging interests from people, especially those with general needs, is considered ruthless and not reconcilable with Islamic principles. Besides that, interest is understood as one main reason of the gap between wealth and poverty (cf. Karl 2012, p. 22).

What is Unlawful?

Additionally transactions, which are referred to as illegitimate, are unlawful and also strictly prohibited (cf. and hereinafter Geilfuß 2009, p. 5. also as Karl 2012, p. 20 et seqq.). Those transactions are called haram and every Muslim should refrain from engaging in those business transactions. These include investing or trading with companies involved in pork, alcohol, pornography, gambling or weapons. Besides that, business investments in entities indicating a debt ratio of more than 33% are also forbidden. Furthermore, it is forbidden to realize transactions which are of excessive uncertainty and unsafe (gharar) or which are entangled in gambling (maysir) or in games of hazard (cf. Geilfuß 2009, p. 5 et seqq. and hereinafter Abidemi and Foudalmoula 2015, p. 30 et seqq.). In gambling transactions, one participant gains at the expense of another party. Or in other words, one receives the others loss which could cause in those poverty and bad luck in life. This is strictly against the understanding of welfare of a society according to Islamic understanding and is interpreted as an act of fraud or injustice (cf. Minhas 2015, p. 75).

Those kinds of prohibitions are of high importance for credit institutes operating under principles of Islamic Banking and which are engaged in derivatives transactions and insurances. Derivatives like futures and options are assumed to be invalid because the object of the sale may not exist during the lifetime of the trade. This approach triggers uncertainty and is inconsistent with the Sharia principles (cf. Sadoveanu 2011, p. 9). The cause for this forbiddance is due to the fact that it may promote unethical actions and could foster social problems and poverty.

20.2.3 Permitted Finance Instruments

To respect the ideas of Islamic banking, one is required to operate in conformity with the discussed principles, especially with the prohibition of interest, which is one of the main profit sources of traditional Western credit institutes and the idea of traditional banking. Therefore, the approach of Islamic Banking is based on two important main methods: the Profit & Loss Sharing and the Murabaha or Markup principle (cf. Singer et al. 2014, p. 2; and among others Abduh and Ramjaun 2015, p. 72).

PLS Model (cf. and hereinafter Geilfuß 2009, p. 15. also Karl 2012, p. 22 et seqq.)
According to the PLS model or Profit & Loss Sharing principle, the bank provides a part of the capital whereas the customer provides either the know-how and/or another part of capital. Under this paradigm, the generated profit and/or loss has to be shared among both parties in accordance to a pre-determined ratio. Referring to credit transactions, Islamic banks will not receive a fixed rate of interest on their outstanding loan like conventional banks. Moreover, both parties are required to share the risk and not only the customer who borrowed the money. In this way, excessive losses and profits are minimized.

As a consequence, the profit and loss sharing principle requires Islamic banks to analyse and monitor their potential customers more precisely since they aim at entering profitable business relationships and avoiding losses for both parties.

This, in turn, means that the customers of an Islamic Bank also have to choose the bank wisely in order to be sure that their deposits are well looked after. Furthermore, Chapra argues that the financial system would benefit from this paradigm and that it would lead to greater discipline because the sharing of risks by both bank and customer would curb banks excessive lending practices (cf. Alexander et al. 2010, p. 22 et seqq.).

Moreover, this principle implies the significance of trust between the bank and the customer in Islamic Banking, as long-term lending under the PLS model is a lot riskier than lending in the conventional way (cf. Gassner and Wackerbeck 2010, p. 20 et seqq.).

If trust and honesty were not the foundation of all transactions, Islamic Banks would be subject to extremely high monitoring costs because long term lending takes the form of an equity-like-investment in the business that would otherwise be borrowing funds from a conventional bank (cf. Abidemi and Foudalmoula 2015, p. 25 et seqq.).

Murabaha or Markup Principle (cf. and hereinafter Geilfuß 2009, p. 15. also as Karl 2012, p. 22 et seqq.)
Murabaha is an Islamic term for a sale where the buyer and seller agree on the markup for the item being sold. In recent decades, it has become a term for the most prevalent financing mechanism in Islamic finance. As an Islamic financing structure, the seller is the lender, typically selling something the borrowing person or company needs for their business. The buyer/borrower pays in periodic instalments, and at a higher price than the seller/lender paid for the item, but with a profit margin agreed on by both parties. The profit made by the seller/lender is not regarded as interest on a loan or any kind of compensation

for the use of the lender's capital, as this would be viewed as riba[1]. Instead, it is considered as a profit on the "sale of goods". Murabaha is similar to a rent-to-own arrangement, with the intermediary retaining ownership of the property until the loan is paid in full.

20.3 Distinction to the Conventional Banking System

The commonalities of Islamic and conventional banks are that they fulfil the function of a financial intermediate and of a financial trustee of people's money in the economic cycle (cf. Minhas 2015, p. 75 et seqq.; Wentler 2012, p. 33; Schulze 2012, p. 30 et seqq.). As outlined above, the most fundamental difference between those two banking systems is that the Islamic Banking system based upon the Islamic ideology and thus offers only banking services and products which are in accordance with the Sharia (cf. Zaman 2015, p. 13 et seqq.). However, the realisation of this approach is very different and needs to be demonstrated within the next section and focuses on profit maximization and banking operations.

20.3.1 Profit Maximization Vs. Wealth Maximization

The overarching objective of conventional banks, which are predominantly based upon the concept of individualism, is profit maximization and loss minimization of the individual (cf. Schuster 2013, p. 71; Schulze 2012, p. 31; Karl 2012, p. 29).

In conventional banks one source of profit is based on transactions with interest and banking fees while the Islamic approach is based on realizing gains through trade bargains and commission fees (cf. and hereinafter Geilfuß 2009, p. 15). Conventional banks aim is to support the risk-taking individual and its profit or his wealth. The Islamic approach is more holistic: The society is in the heart of its activities and would like to do business for the prosperity of the community. In the Islamic Banking system a collective interest dominates the decision making process while in conventional banking system the interest of the individual dominates the decision making process.

20.3.2 Differences in Banking Operations

The different approaches mean that the daily transactions and usual banking transactions with customers are fundamentally different (cf. and hereinafter Geilfuß 2009, p. 15). Traditional businesses, which are based on saving accounts or loans, are not feasible as they are based on interest rates. It is also usual for conventional banks to charge default interest or compound interests as a form of penalty to minimize their own risk. This fact causes

[1] See above.

to different risk diversification of those two banking systems since Islamic Banking is not allow to charge interests to customers. So they are not able to ensure or to hedge credit defaults which lead to different readiness to assume risks within the conventional and the Islamic Banking system.

Furthermore regarding banking operations, there is some other massive difference in daily business: While conventional banks generate profit by interest and commissions because of fixed interest on loans and interests from securities, Islamic Banks on the other side primarily generate profit according to the concept of profit sharing and from commissions and fees for the supply of services to their customers (cf. Schuster 2013, p. 71; Schulze 2012, p. 31; Karl 2012, p. 29).

Another important characteristic of daily operations in Islamic Banking is the use of asset-backing. Money cannot grow without any connection to tangible assets like commodities, goods or inventories – a strong relationship is required or at least a tangible underlying asset. This requirement ensures that Islamic Banking remains a part of an economy made of tangible goods and not operating on financial markets with intangible assets (cf. Zerth et al. 2014, p. 19 et seqq.).

This is a strong contrast to conventional banking where an underlying asset element is not required. Furthermore, the conventional banking system is predominantly debt-based and fosters risk transfer whereas the Islamic system is predominantly asset-based and follows the profit and loss sharing principle where risk and return get shared among two parties. Consequently, during the financial crisis in 2008, Islamic Banks were less severely affected which was mainly due to the fact that the Sharia prohibits excessive investment practices that were the main reason for the 2008 financial crisis like investing in debt-based financial instruments (cf. and hereinafter Geilfuß 2009, p. 20). Since the majority of transactions of Islamic Banks are asset-backed, excessive leveraging is almost impossible.

20.4 Application of Islamic Banking by Turkish Banks

One of the most interesting things about Turkey regarding Islam is the way in which this conception of life is implemented and realised, although 99% of the Turkish population are Muslims (cf. Geilfuß 2009, p. 5 et seqq. and hereinafter Abidemi and Foudalmoula 2015, p. 30 et seqq.). Islam is practiced in a more moderate way and is rather considered as a guide or as an advice to life followed by ethical conceptions.

Before focussing on Islamic Banking in Turkey and discussing about its application and realisation, it is of high importance to mention that Turkey is a secular state. That implies a judicial separation between state and religion. Through the Turkey's Directorate of Religious Affairs (Diyanet), the state is in the position to control the Islamic religious practice in the country (cf. and hereinafter Geilfuß 2009, p. 20). This fact is a profound difference between Turkey and other Islamic countries like Iran, Sudan or Saudi Arabia because the Sharia is not part of the Turkish constitution. That moderate way has an impact on Islamic Banking in Turkey and also on the Turkish Banks and credit institutes.

20.4.1 Islamic Banking in Turkey

Because of the separation of state and religion, an application of Islamic Banking is on a volunteer basis and that might explain why Turkey is not considered as a hotspot for the Islamic Banking industry yet and why the Turkey Banking system is mainly characterized by the conventional system (cf. Schuster 2013, p. 71; Schulze 2012, p. 31; Karl 2012, p. 29).

Nowadays, Turkey is headquartering four Islamic Banks, but is also a window operator for conventional banks. The operating Islamic Banks which are The Albaraka Turk Bank, Bank Asya, Turkiye Finans and Kuveyt Turk Bank have a total of assets at the amount of 96 billions by the end of 2013. Although Islamic Banking has grown all over the world, the growth in Turkey has been protracted, but is still stable and increased from 2.6% in 2005 to 5% of the Turkish Banking industry. The slow, but steady increase is also illustrated by the following numbers: The amount of branches operating with the Islamic Banking idea rise from 290 in 2005 to almost 966 in 2013 (cf. Geilfuß 2009, p. 6 et seqq. and hereinafter Abidemi and Foudalmoula 2015, p. 31 et seqq.).

As an example, the Kuveyt Turk Bank can be cited. The Kuveyt Turk Bank is the largest Bank in Turkey with about 360 branches and has expanded their operations internationally to Bahrain and Germany (cf. and hereinafter Geilfuß 2009, p. 6 et seqq. and hereinafter Abidemi and Foudalmoula 2015, p. 36 et seqq.).

According to several findings of studies within the last years, Islamic Banking is still a small fraction of banking assets in Turkey. But it has been growing faster than the whole banking assets. Moreover, findings indicate a promising future for the Islamic Banking Industry and are aspiring to build a 15% market share by 2023 which would be an industry size of about 180 billion Euro.

These facts demonstrate that Turkey has managed to create a growing banking industry operating in a line of stable growth and has good chances in becoming a new Islamic financial centre in Europe[2].

20.4.2 Market Potential in Germany

Interestingly, Islamic Banking has become the focus of greater attention in Western countries in the recent years.

In particular, the UK has pioneered a greater interest and growth in this sector so much so that it is now considered as the global hub for Islamic Banking in the West. The high demand has mainly been fuelled by the repatriated funds by Muslims living in the UK. Furthermore, it should be noted that the number of non-Muslim customers has been growing tremendously and the Al Rayan Bank has reported a considerable increase

[2] See above.

in applications for savings accounts by non-Muslims, accounting for 55% of applicants in 2012 (cf. and hereinafter Sadoveanu 2011, p. 19).

Nevertheless, despite the fact that Germany is home to the majority of Muslims in Europe with more than 4 million, it was not until 2015 that steps were taken to implement Islamic Banking in Germany.

The Turkish Kuveyt Turk Bank became the first Islamic bank to obtain a full banking license in Germany which enables it to provide complete Islamic banking services to its' clients. In the summer of 2015, it opened an associate branch in Mannheim and Berlin and it plans to expand its operations in Germany and the EU (cf. Heb 2015, p. 45 et seqq.).

Nevertheless, the implementation of Islamic Banking has a huge potential of success in Germany. This is due to the fact that a big market potential in Germany exists due to different target groups.

Firstly, Muslims in Germany have been demanding Islamic Banking products and can finally satisfy their appetite for Sharia compliant banking. Moreover, an Islamic Bank itself and the financial advisors are Muslims and the mutual comprehension and cultural background creates trust between the customer and the banker which might foster their relationship and increase the customer's willingness to invest.

Secondly, the ethical banking sector is an emerging industry and is increasing in importance and popularity in Germany. Since the criteria for ethical banking bear resemblance to Sharia compliant products, German non-Muslims who have lost trust in conventional banking and demand sustainable and ethical investment practices can identify with the principles of Islamic Banking.

Thirdly, the main target group which explains a considerable market potential in Germany are the Turkish community: The majority of the Muslims in Germany are of Turkish origin (2.5–2.7 million) of whom 85% describes themselves as religious. Thus, they form the largest and most religious group of all Muslims in Germany.

Furthermore, approximately 720,000 Turkish households exist in Germany with an average of 3.8 persons per household and an average income of €1917 per household. German households, on the other hand, have 2.4 persons with an average income of €2596 (cf. Chaboune and El-Mogaddedi 2008, p. 719).

Nevertheless, Turkish households generate a remarkable saving rate of about 17.7% which is almost double that of the saving rate of German households (10.8%). Consequently, these numbers result in a potential annual saving volume of €3.4 billion for all Turkish households (cf. Alexander 2010, p. 90).

Furthermore, the Turks show a high demand for and affinity to Islamic banking products and, according to a study conducted by the consulting company Booz & Company, the highest demand is for real estate financing, followed by Islamic insurances (Ijarah) and Islamic funds (cf. Gassner and Wackerbeck 2010, p. 250 ; Ernst, p. 113).

20.5 Becoming Alive: Fragments of a Marketing Concept

The Islamic Marketing Conception combines the traditional marketing elements with the discussed requirements of Islamic Banking (cf. and hereinafter Geilfuß 2009, p. 6 et seqq.; also e.g. Meffert and Burmann 2014, p. 75 et seqq.). The goal is to create an ethical marketing conception for a holistic implementation and realisation. In order to ensure a smart overview, the five elements of the marketing mix (product, price, communication and distribution policies) are presented separately, although the marketing mix is in real a holistic instrument. The individual marketing policies presented in this section will be discussed by their general and specific requirements that occur in combination with the use of Islamic Banking. These explanations will be completed by examples of practical design options and some critical assessments. The descriptions have the intention to work out the opportunities for the German Banking industry.

20.5.1 Product Policies

Questions regarding product policies become more important through the emergence of new customer markets and products. The AAOIFI (Accounting and Auditing Organization for Islamic Financial Institutions) has currently developed 41 Sharia standards for Islamic financial products (cf. Schulze 2012, p. 31 et seqq.). Islamic Banking is nowadays more than ever in competition with conventional banks. Therefore, the main focus is of course to follow up the principles of Islamic Banking. But on the other side, a bank cannot be so far away from conventional structures and traditional operations because they need also non-Muslim customers. Coming up next basic requirements and selected products will be discussed and illustrated with examples (cf. Schuster 2013, p. 71; Schulze 2012, p. 31; Karl 2012, p. 29).

20.5.1.1 General Requirements

For product policy the guiding principle is the following (cf. and hereinafter Geilfuß 2009, p. 6 et seqq.; also e.g. Meffert and Burmann 2014, p. 75 et seqq.): The product must completely fulfil the needs of the customer. Starting point for a development of new products is firstly the unique customer benefit that will be generated by the product and secondly that it will not be offered at the same time by any competitor. In this context, the term “USP” is often stated and is about the differentials of the product from its competitors and about the reasons why it is in focus of the sales pitch. Based on the identified specific customer benefits, the product can be designed. Elements of the product designs are characteristics e.g. performance, quality and brand name. There is a risk of imitation of the products by the competitors especially regarding financial products because those are not very unique and easy to copy. The specific nature of banking services and the increasing competition situation questions regarding quality and brand management become more and more important. That is why the product policies task is to increase the customer’s loyalty and to decrease the price senility of the customers. For a successful implementation of product policy, the discussed requirements need to be fulfilled. Especially the legal compliance of Sharia-products is a huge challenge in non-Islamic countries (cf. Chahboune and El-Mogaddedi 2008, p. 32 et seqq.).

20.5.1.2 Specifications for Turkish Banks with Examples

Compared to conventional product policy, moral factors need to be incorporated to Islamic Banking in order to realize the ethic ideas. Based on Damirchi and Shafai (2011) carved out the following five important characteristics to create successful products: (1) Legality, (2) Ensuring wealth preservation, (3) Availability, (4) Identification of all additional costs and (5) operating in the belief of God and respecting the principles of the Islamic understanding of justice and equality (see also Alexander et al. 2010, p. 10 et seqq; Abduh and Ramjaun 2015, p. 71 and/or Catociv 2014, p. 198).

Account Management, Payments, Cards and Saving Accounts (cf. and hereinafter Geilfuß 2009, p. 6 et seqq.; also e.g. Meffert and Burmann 2014, p. 75 et seqq.)

Account management, payments and cards are the basis of all transactions in conventional banking as in Islamic Banking. Classic current accounts are offered in two kinds: the Wadiah- and the Qard-Hassan model:

Wadiah-Model, Qard-Hassan Model and Murabaha Model[3]

Within the Wadiah model, deposits are received and administered by the bank in trust. After approval through the customers, the bank invests in Sharia compliant asset transactions. Risks arising from the use of funds are paid by the bank. Instead of getting a credit interest rate, customers mostly get small gifts from the bank. That is the main difference from the Qard-Hassan model. There is no compensation for the non-held interest payment. The basic idea of Qard-Hassan model is based on the idea that the bank customers provide deposits as an interest-free loan to the bank. Savings accounts are also offered in Islamic Banking. The objective of that offer is the safe custody of assets with very low interest. Furthermore, the Murabaha model is an option: The bank is working with the deposits and the customer will receive a defined revenue share. Special feature is that the customer can at any time withdraw its deposits and both participate in profits as well as the losses.

Cards

In addition to the various accounts, debit-cards (EC-Cards) and credit cards are offered (cf. and hereinafter Geilfuß 2009, p. 6 et seqq.; also e.g. Meffert and Burmann 2014, p. 75 et seqq.). Due to the rising level of wealth and the growth of online business, those cards have become more attractive for customers and banks. The customer balances his payments without cash and receives a monthly bill. No interest is required. The invoice amount can be paid off in instalments or in one single payment.

[3] See above.

Murabaha

Murabaha is the most well-known credit product in Islamic Banking (cf. and hereinafter Geilfuß 2009, p. 20 et seqq.; also e.g. Meffert and Burmann 2014, p. 80). The Murabaha contract is about a sale with an announced profit markup. In most cases, with the Murabaha a deferment of payment is integrated which is comparable with a regular instalment transaction. The bank in this case acts as a third party between buyer and seller in that business. Compared to ordinary business practices in conventional banking which are about sales contracts and loan agreements, in Islamic Banking the financing part is also part of the deal.

Sukuk

Sukuk are defined by the AAOIFI as certificates representing equally ranking, undivided shares in ownership of tangible assets, usufruct and services or ownership of assets of a particular project or a particular investment activity (cf. Geilfuß 2009, p. 25 et seqq.). They were created as a replacement for conventional bonds. The basic idea behind Sukuk is in co-ownership of the underlying assets. These are acquired by the issuer trustee for the Sukuk holders, the issuer refinanced thus its payment obligations arising from the hedged item. These are acquired by the issuer for the Sukuk holders; the issuer refinanced ran thus its payment obligations arising from the hedged item.

Takaful

Takaful is about an Islamic insurance business which is Sharia-compliant[4]. The essential feature of this insurance is the common liability which is in contrast to conventional insurance products because those are comparable with a "sale of life" or gambling and so are not compliant with the Islamic idea. The main feature of an Islamic insurance product is the income and loss-participation of all members. In general, earnings and not required contributions get distributed directly back to the members. Takaful is Sharia compliant because it does not work with interest, gambling and uncertainty; profits and losses get shared and the funds are invested in Sharia compliant assets by the banks.

20.5.2 Communication Policies (cf. and hereinafter Geilfuß 2009, p. 26 et seqq and Alexander et al. 2010, p. 10)

A few years ago, Islamic Banks had a high scarcity on the market (see also Alexander et al. 2010, p. 14 et seqq; Abduh and Ramjaun 2015, p. 74 and/or Catociv 2014, p. 201). But recently numerous providers have shown up which has changed the situation tremendously. That's why communication skills need to be strengthened, to develop and to be adapted.

[4] Cf. and hereinafter Geilfuß 2009, p. 25 et seqq.; also e.g. Meffert and Burmann 2014 on several pages.

20.5.2.1 General Requirements

The specific characteristics of banking services need to get attention to the communication policies because some products require more explanation and special needs to be communicated (cf. Geiluß, p. 30 et seqq.). Regarding a communication policy on one hand, economic goals are important e.g. sales volume, market share and revenues. Furthermore, on the other hand, non-economic psychological goals are important, e.g. improving the image and awareness of the products. We distinguish several forms of communication tools. These instruments are used with the aim to influence the opinion of the customer.

Some general principles need to be fulfilled within the communication policies in Islam:

1. Prevention of false and misleading advertising
2. Rejection of the manipulation of customers and other deceptive sales tactics
3. Waiver deceptive promotions[5]

When it comes to business, purchase-relevant documents will be exchanged only if they contained all information about specifications, quality, quantity, price, type of delivery and payment. The access to that information can be defined as a fundamental right in Islamic Banking.

20.5.2.2 Specifications for Turkey Banks with Examples

In the middle of communication the customer as an **exclusive, modern person** (see also Alexander et al. 2010, p. 15) is the focus of advertising in respect to the basic Islamic values. By using Islamic symbols, the sense of belonging to the Islamic community is trying to be highlighted: honesty, trust, right choice, pure source, legality of even the best of both worlds. These keywords are often used in combination with graphs and drawings.

The **family** (cf. and hereinafter Geilfuß 2009, p. 31 et seqq.) is also quite often a factor of advertising messages. To create family-friendly feeling, advertising messages with children, happy people and wealth will be presented e.g. by using symbols like family houses with garden.

In the **public**,[6] the image of a modern bank in conditions with the principles of Islamic Banking has to be communicated. That's why the religion is one important cornerstone of advertising messages. To close a gap between modern life and traditional religion, Islamic symbols are used e.g. the Islamic crescent, the Islamic prayer beads Tashibh or quotations from the Quran. To represent the modernity, the Islamic symbols are often combined with modern symbols like laptops, mobile phones or even modern televisions.

Even **colours**[7] are used in advertising messages symbolically. Thus, the colour green is prevalent in Islam and often mentioned in the Quran as the prophet Muhammad preferred this colour for his clothes. In addition, the famous mosque in Medina has a green roof.

[5] See indirect above.
[6] See here and hereinafter above.
[7] See here and hereinafter above.

Thus, the green colour has become a catchy symbol for Muslims and is therefore often used as a colour for logos.

As **advertising media** (cf. and hereinafter Geilfuß 2009, p. 40 et seqq.) the same **channels** for conventional banks can be used for Islamic Banking, e.g. television, radio, newspaper, magazine, posters (e.g. bus stops etc.) or Internet.

Publicity and sales promotion (cf. and hereinafter Geilfuß 2009, p. 41 et seqq.) are also available as communication policies in the banking sector e.g. seminars, exhibitions or classical sponsorship can be used. Also donations for public welfare purposes are a popular measure in Islam compliant banks.

20.5.3 Distribution Policies

Under distribution policies, a bank needs to make decisions about where, how and when a service is offered.

20.5.3.1 General Requirements

Also for the distribution policy the basic principles are presented:

1. Not tamper the availability of a product to exploit customers.
2. Avoidance of marketing activities that include any means of coercion.

Unethical practices in the distribution policies are e.g. the choice of packaging design which does not protect the product. Unsuitable packaging is banned accordingly (cf. and hereinafter Geilfuß 2009, p. 52 et seqq.). It is also forbidden to transport dangerous or toxic products on public highways. From an Islamic point of view, such practices are hazardous, not forgivable and are considered as an unfair marketing process.

20.5.3.2 Specifications for Turkey Banks with Examples

The **negotiation** (cf. Geilfuß 2009, p. 55) between the bank and customer must follow a specific logic and needs to meet the requirements of distributive justice. To close a deal, it is essential to ensure that the customer is valued as an individual and could make his decisions freely. Yavuz (2011, p. 26) also found out that in small talk personal issues like family or lineage will love to be in dialogue with Muslims. Religious and political issues, however, are avoided.

The **establishment of branches** (cf. Karl 2012, p. 66.) for distribution can be designed similarly to the distribution of conventional services. These can be designed classic or modern. Islam-compliant banks in Turkey often use two-story facilities for their branches in order to ensure a high level of discretion.

Online Banking is gaining as a complement to traditional branches-business in Islamic Banking (cf. Karl 2012, p. 70). By offering online services to complement, the retail shop in the sores, the advantage is in the cost savings. Elbeck and Dedoussis (2010, p. 273) quantify the potential savings by 25 to 30% in relation to the cost of the bank branch.

Lady Banking is an innovation in Islamic Banking (cf. Karl 2012, p. 72 et seqq.). The Dubai Islamic Bank (DIB) as the pioneer intends to expand with special offers (e.g. Credit Cards and Insurances) for the female target group. Because of the special status of women in Islam, banking transactions are performed usually by men. Lady Banking is an exclusive service which is offered to celebrate the contribution of women to economic life and to offer the opportunity for women to participate in individual business and own decision-making. The aim of the introduction of Lady Banking is the fair distribution of resources in society. That's why Turkish Banks create several new Offices in Turkey exclusively for the female population.

Conclusion

From several point of views, the Islamic Banking system is a new perspective not only regarding the design of new products, but also in terms of the presence on the market. Aspects, especially from the marketing view, should be recognized und provides new chances and challenges, but at the same time risks for conventional banks regarding their corporate governance. Especially for Turkish banks, the market in Germany seems to be very attractive because of the moderate application of Islamic Banking which allows interesting opportunities. The consideration of design patterns for marketing seems to be highly recommended and useful before an application.

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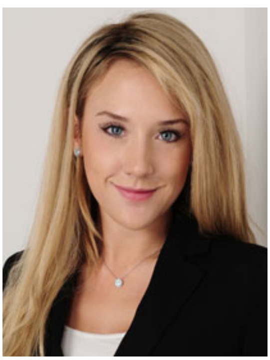

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Social Impact Bonds as a Financial Innovation – an Evolutionary Economic Approach

21

Thomas Holtfort

Contents

21.1 Introduction

Social Impact Bonds (SIB) – also called "pay-for-success" financing – offer a new, innovative way to finance preventive measures in the social sector with the help of private investors. The repayment of the capital investment depends on the success of social action (also called impact investing). The term "Bond" is misleading in this context. In fact, it is not to be a bond, but an intersectoral cooperation, so-called multi-stakeholder partnerships. Involved in a SIB are usually at least one or more social service providers, private investors and the state. The aim of this cooperation is to alleviate a specific social problem through preventive measures (also known as intervention) or to prevent this problem (Weber and Petrick 2013).

The aim of this article is on the one hand to depict the structures, market development and also chances and risks of this financial innovation. On the other hand, an evolutionary economic analysis of this financial instrument is made, with a focus on the terms "social entrepreneur", "knowledge" and "emergence of new infrastructures".

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_21

21.2 Structures of Social Impact Bonds

The impact-oriented financing with the help of SIBs is distinguished from the traditional form of financing (Table 21.1). While in the traditional approach, the return of a project depends on the economic viability of the investment recipient, so is profit based, the rate of return in the impact-oriented financing is dependent of the achieved social impact of the measures. Here, the state plays an important role. The paid return is therefore not directly from the investment recipient (the social service, which undertakes to provide an already proven intervention), but is paid by the state if the funded intervention has proven to be effective and thus can be generate savings in public funds (Scheuerle et al. 2013). The intervention itself is financed by private investment capital. If the intervention achieves the fixed social impact, the investors will receive the invested capital and a return that depends on the impact of the social measures.

Basically, there are five players at a SIB financing (Weber and Petrick 2013):

- The favored target group for whom social services are provided (e.g. long-term unemployed, young people with behavioral problems, short-term prisoners)
- The social service (social entrepreneur) who provides the service. This may occur as a non-profit organization or as a professional supplier in the market
- The investors who finance the intervention and take the risk. The investors are interested in both the social impact as well as on a financial return
- The state cut costs in case of success and guarantees the payment of the investors. It therefore takes no financial risk for a possibly failure of the SIB
- The task of the so-called intermediary (e.g. a foundation or a bank) is to examine the feasibility of a SIB and to negotiate with the parties. Furthermore, it comes to the modeling and creation of the financial instrument as well as the supervision of the investment over the term

In addition, an independent evaluator who monitors and refines the intervention during the implementation phase, and an expert who checks in how far the agreed action was achieved, may be involved.

Table 21.1 Traditional versus impact-oriented financing

Traditional form of financing	Impact-oriented financing
Parties involved: investor and social service	Parties involved: investor, social service and the state
Objective of social service: works with the capital and generate returns which will be paid to the Investor	Objective of social service: financed measures should have a measurable social impact
Role of the state: no relevance	Role of the state: pay a portion of the savings back when the social measures achieve the agreed effect

21.3 Market Development

The interest in SIB's is great worldwide. Above all, it is the governments of the UK, USA, Australia and Canada, which have in recent years increasingly deal with impact-oriented financing in the Third Sector (Weber and Scheck 2012). Meanwhile, however, also countries such as Germany, Belgium or the Netherlands are involved. In fact, so far the launch of 41 SIBs (end of 2015) was announced – alone 28 in the UK (Table 21.2). There is, however, no complete listing of all worldwide SIB projects that are still in development or being tested.

The first SIB was launched in March 2010 in the UK by Social Finance (an organization which seeks new approaches to entrench social problems) and the Ministry of Justice in order to finance a rehabilitation program of prisoners of the Peterborough prison with 5 million pounds (Social Finance 2010). This was followed in 2012 by the launch of a further SIB by the municipality of Essex – also currently developed by Social Finance – with 3.1 million pounds. In the same year, the Greater London Authority launched another SIB. He should conduct 5 million pounds in social measures to reduce the number of homeless and their hospitalizations in London. Finally, the SIB model is also applied by the Department for Work and Pensions. The investors will be paid out of 10 impact-oriented financing models from his 30 million pounds Innovation Fund if the social services succeed to support vulnerable young people in the transition from school to work and to avoid the threat of unemployment. In addition, several projects were evaluated, such as a nationwide project for adoption of children who are considered "difficult to place" which was initiated from the Consortium of Voluntary Adoption Agencies (advised by Social Finance UK).

In addition, in the UK various governmental and philanthropic organizations have taken measures to increase the liquidity of the market. The 20 million pounds Social Outcomes Funds launched by the Cabinet Office in November 2012 provides co-financing of SIBs. The Commissioning Better Outcomes Fund initiated by the Big Lottery Fund in July 2013 also invests SIB projects and supports the development of SIB projects financially. In April 2013 the Bridges Social Impact Fund was also launched by various philanthropic

Table 21.2 Number of SIBs worldwide

Country	Number of SIBs
UK	28
US	7
Australia	2
Canada	1
Germany	1
Belgium	1
Netherlands	1

investors (Bridges Ventures 2015). This 14 million pounds large SIB funds has been already invested in four SIB's in the UK.

Social Impact Bonds have also caused interest in the US. In February 2010, President Obama suggested to provide 100 million dollars from the household budget of 2012 for the testing of impact-oriented financing instruments (McKinsey 2012). His proposal was rejected by the Congress, however, he made an attempt again and requested 109 million dollars for 2013. At the same time, several new activities at the local and state level have been made. The first SIB in the US was commissioned in 2012 with a volume of 9.6 million dollars from the city of New York to reduce recidivism by ex-prisoners. Another SIB in the field of early childhood education over 7 million dollars was launched in Salt Lake City, Utah from Salt Lake County. The state government of Massachusetts announced in August 2012 the development of two SIB pilot projects in the areas of homelessness and recidivism of ex-prisoners. In addition, several SIB projects are in the development phase (for example those that take care of unemployment and asthma). In June 2013, six states and municipalities were selected through a competition of the Rockefeller Foundation which are supported by the Harvard Kennedy School SIB Lab in the implementation of SIBs.

In Australia, the Financial Authority of New South Wales implemented a SIB (in Australia also referred to as "Social Benefit Bond") of more than 7 million Australian dollars in the field of avoiding foreign care of children (Weber and Petrick 2013). Two other projects which are affecting the foreign care of children and the reintegration of ex-prisoners are still in the pilot phase. Finally, since September 2013, there is a SIB project in Germany which is called Eleven Augsburg. The whole endeavor is made possible by the Juvat gGmbH, founded by the Benckiser Foundation. Until the beginning of 2016, the project must manage to bring back at least 20 young people from the Augsburg region to work who have been unemployed for more than two years. It is intended to mediate these young people not just a job or an apprenticeship place, but they must be left there at least nine months.

Considering the market developments in the different countries, it is clear that each country is in different market phases, with regard to the volume of SIBs, the experience so far and the number of investors. This will be still important later in the framework of evolutionary economic analysis.

21.4 Chances and Risks

The introduction of SIBs has considerable potential. Subsequently, the most significant chances and risks will be explained (Schäfer and Höchstötter 2015; Weber and Petrick 2013). The first advantage is the opening of a new source of funding for social projects. So far the donation is the only form of financing for social services by private investors. With the help of SIBs also private investment capital can now flow in social projects. Thus, even those social organizations, which would otherwise not be investable because they generate no direct financial return, receive access to new financial resources. In addition, for the social service the funding is available long term (for the lifetime of the SIB). This provides more safety for the social organization and saves ongoing resource-intensive fundraising activities.

A further advantage is the impact-oriented use of public funds. The effectiveness of public funds is often not guaranteed because the funds depend on the "outputs" (e.g. the number of people who have participated in a specific integration program) and not on the impact or the "outcome" (e.g. improving the educational level of the social disadvantaged target group). SIBs make it possible that public funds can only be issued if the effectiveness of a social measure has been proven. At the same time, they contribute to offer more such social services which actually work.

As well, SIBs represent a risk transfer from the taxpayer to the investor. The risks of "rethinking" of the performance-related to impact-oriented allocation of funds must not bear the public sector (and therefore the taxpayer), but these risks are outsourced to the private investors. If the social service, which is to be provided under a SIB, has no effect, the state does not have to pay for it. At the same time, investors and social service providers are motivated to achieve maximum impact since the amount of repayments depends on that.

Furthermore, resulting from SIBs, investments take place in prevention rather than in repair measures. In the social sector, capital is often spent reactive rather than preventive. The money goes into repair measures such as prisons or emergency medicine. Supposedly costly preventive measures such as reintegration programs that reduce recidivism by ex-prisoners come out on the short end. SIBs are helping that more resources flow into prevention. Many social problems, which can only be solved with high financial costs, can be avoided. This produces savings in the public coffers. The money saved can be used for the implementation of other social measures.

Finally, SIBs produce increased efficiency through cooperation. Non-profit organizations, the providers of the social services, often work fragmented and are competing to each other. Thus, holistic, problem-oriented approaches will not be funded. SIBs usually finance concerted actions of several partners. The combination of several independent social service increases the chances of success.

Aside from the presented opportunities, also complex risks arise from SIBs, because there is only little experience with impact-oriented financing instruments. In analyzing the social measure and its effects as well in modeling the financial flows and the management of stakeholder interests, a lot of expertise is needed to avoid misinterpretations. Preparations can be costly and time consuming. Once the contract is negotiated, operational shortcomings can occur to the social service, the manager or the evaluator (e.g. if he/she does not check the agreed performance indicators, but also develops his/her own key indicators). Political and budgetary risks can not be excluded: A change of the political majority relationships or a blocking of expenditure in the concerned public sector can lead to the cancellation of already concluded contracts. Other risks are associated with the use of non-meaningful indicators, an inappropriate comparison group or if a too short period of evaluation is scheduled for efficacy proof.

21.5 Evolutionary Economic Analysis

Evolutionary Economics is a research field which emerged in the 1980s and deals with the role of knowledge, its transformation and its limitations for the economy (Herrmann-Pillath 2002). On the one hand, it is related to the theory of entrepreneurs of Schumpeter, accordingly innovation, technological progress and entrepreneurship are responsible for the processes of transformation of the economy (Schumpeter 1997). On the other hand, the evolutionary approach is based on the ideas of von Hayek, whereby knowledge of actors and populations is relevant for change within the economy (von Hayek 1936).

Central concepts of Evolutionary Economics are knowledge, actor, population and network. Rules that reflect patterns of behavior and relationships, represent knowledge that coordinates the relationship of a system to its environment. This knowledge can be obtained directly (conscious) or indirectly (intuitive) and signifies often traditional patterns, which are more or less reflected (Nelson and Winter 1982). Instead of the individual within the meaning of homo economics of the classical economics, the actor (economic subject as a fundamental actor or an organization as a derivative actor) occurs as a doer. The actor has neither the ability to act immediately and perfectly rational, nor does he or she have absolute knowledge. Due to existing uncertainty simple rules such as the maximization of profits are useless which is why the actors are not looking for an optimal solution, but they act routinely based on previous experience. A huge number of actors form a population. Within a population the actors generate networks through the relationships that each actor maintains to the others.

The process of evolutionary economic paths within the economy can be described as follows (Fig. 21.1). The first step is the emergence of knowledge by an actor with a new combination of existing resources. This is followed by a transfer of knowledge towards a new product or service (innovation). After that processes emerge as a market evolves by coordination and networks. Then structures are created by intermediaries and processes are standardized on the basis of experience. Likewise robust market data will be formed by the new structures. Finally, these processes and structures change the economy (e.g. creation of organizations, sectors, jobs and income).

Following the approach of evolutionary economics will be transferred to the topic of SIB's. In contrast to the Schumpeterian Entrepreneur term that refers to a new combination of production factors on the part of the entrepreneur, attached to a displacement of old structures within the economy, is meant by the social entrepreneur an entrepreneurial activity which is used innovative and long-term to solve social problems. The range of subjects in which the social entrepreneur is committed, are, for example, education, environmental protection, job creation for people with disabilities and poverty reduction. The profit idea is in the background for the social entrepreneurs which is why many of

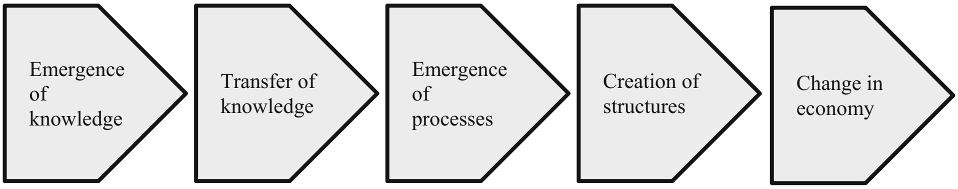

Fig. 21.1 Evolutionary economic process

these entrepreneurs are organized in nonprofit organizations. Thus, the social entrepreneur can be seen as a conceptual expansion of the Schumpeterian Entrepreneur term. While Schumpeter addressed his focus mainly on technical innovations, SIB's stand for a social innovation.

SIB processes have on the one hand similarities with private equity relationships and on the other hand they are an innovative form of a donation. Thus, in terms of Schumpeter SIB's combine existing structures like private investors (relevant for donations) and intermediaries (relevant for private equity processes) to a new product and knowledge. Only the involvement of the state is different. Since the contractual relationships and structures at risk of SIB's differ from other financial instruments, the classification as a financial innovation is obvious (Schäfer and Höchstötter 2015).

The development of a SIB market and the establishment of knowledge in the sense of von Hayek needs in the next step coordination and networks. In some countries (for example US or UK) financial experts are already working with state actors and the third sector to establish a functioning SIB market (supply and demand; intermediaries) and thereby allowing the inflow of capital into social project (Weber and Scheck 2012). The most foundations that make Impact Investing in the US, are also members of the Mission Investors Exchange (MIE), an information and advanced training platform (studies, webinars, training) and a network of foundations. The MIE enhanced awareness of Mission Investing (inter alia through PR campaigns) and also acts as a lobby organization (Weber and Scheck 2012).

In the UK Social Finance was founded 2007 with the aim to develop the market for social investments. The nonprofit organization was funded by various philanthropists and foundations and has an interdisciplinary team of experts which consists of investment professionals, strategy consultants and experts from the social sector. The mission of this team is, on the one hand, the development of new innovative financial products such as the launch of the first SIB or other vehicles in the form of venture capital funds or funds of funds. On the other hand, Social Finance should act as adviser to investors, product providers, socially-motivated companies and the government and publish publications (Social Finance 2010).

In Germany, some players (e.g. Bertelsmann Stiftung, BMW Stiftung and GLS Bank) are already active and prove that SIB's and Impact Investing in this country have the potential to contribute to social change (Weber and Scheck 2012). However, it still lacks in the necessary infrastructure (standardized investment products, investable social projects and intermediaries) compared to US or UK and to investors in order to achieve a significant market size and thus a market penetration in terms of Evolutionary Economics.

Furthermore, in 2013 the Social Impact Investment Taskforce (SIITF) was established transnational which has been filled by each state and civil society representatives of the Member States (Social Impact Investment Taskforce 2014). At the national level of the G8 countries were thereby National Advisory Boards established. This consist representatives of social economy, finance, foundations, academia and the public sector.

The final stage in the context of an evolutionary process is the scalability of the social idea. After the market entry, the social organization should expand their offer on a few, selected locations to refine the approach. By scaling and potential imitators the social organization can ultimately solve the social problem systemically.

Conclusion

The mobilization of private investment capital for social purposes and social innovation is no longer a wish but reality. In this article various examples from the international and domestic markets have shown the support of an existing impact investing market in form of SIB's. Nevertheless, the markets in US and UK (35 of 41 existing SIB's), on the one hand, and Germany, on the other hand, are in different stages of evolutionary development. The necessary know-how, the evidence for the feasibility and the first practical experience in Germany but exist, as described by the example of Eleven Augsburg. In terms of Evolutionary Economics but applies to all markets that the product SIB has a chance for social change by further promotion of social entrepreneurship, establishment of market structures (mainly intermediaries) and knowledge sharing. Likewise, states are encouraged worldwide, as shown by the example of SIITF, to set the appropriate framework.

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Success Factors of Crowdfunding Projects on the Kickstarter Platform

22

Jörg Gutsche and Sabrina Sylla

Contents

22.1 Introduction

Since the mid-2000s, we have witnessed the rise of a novel approach to funding innovative projects and start-ups called crowdfunding. The core idea of crowdfunding is to pool small amounts of funds provided by a very large number of potential backers, the crowd, via specialized, appropriately designed websites (Leimeister 2012). To entrepreneurs and founders seeking funding, these websites provide a platform to present their project to an

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_22

interested audience – potentially on global scale. To potential backers, these websites offer a convenient way to find and explore a vast number of alternative projects. And finally, crowdfunding platforms offer an efficient infrastructure for handling payments from the backers to the entrepreneur and for facilitating the later payout of rewards, be it money or benefits in kind, to the backers. Thus, the key value provided by crowdfunding platforms lies in the reduction of information deficits and processing frictions, both of which are essential for the viability of crowdfunding.

In practice, the services described above are provided by several competing crowdfunding platforms with different emphases. While some platforms such as ArtistShare focus on collecting funds for creative or even artistic projects in exchange for benefits in kind, others such as SeedInvest and Seedmatch aim specifically at raising equity in exchange for company shares. Currently, the biggest crowdfunding platform is Kickstarter, covering a wide range of projects and start-ups from the fine arts to software and hardware gadgets providing benefits in kind as a reward. Thus, Kickstarter is offering a way to use the cash of future customers for funding purposes, an approach increasingly popular in the start-up community (Mullins 2013). By the end of 2015, Kickstarter has collected over $2bn in funds from more than 10 million backers worldwide (Kickstarter 2016). For its service, Kickstarter charges a fee of 5% of the collected funds plus 3–5% for payment processing.

The importance of the crowdfunding approach for financing innovative projects and start-ups can hardly be underestimated. Ripsas et al. (2013) estimate that approximately 16% of start-up founders in Germany have already used crowdfunding at least once. And according to Rugo (2015), the German crowd-investing industry has already provided more than 100 start-ups with over €30 m in capital – an important contribution to closing the venture capital funding gap that has impeded entrepreneurial activity in Germany for years.

Findings for Turkey, a country which does not offer sufficient funding for start-ups, are also very similar. Based on semi-structured interviews and secondary data about crowdfunding, Oba (2016) judges crowdfunding a potentially powerful tool for the provision of financial resources to entrepreneurs and small- to mid-sized companies. However, crowdfunding appears not to have developed its full potential, yet, particularly due to legal hurdles and a lack of relevant knowledge and computer literacy. Sancak (2016) comes to very similar conclusions and also outlines several policies and regulations for Turkey to overcome existing barriers to full crowdfunding success. All in all, crowdfunding must be viewed as an important addition to the traditional set of instruments for venture funding particularly in the early stages of new ventures in developing economies such as Turkey and mature economies such as Germany.

A closer look at individual projects presented on platforms such as Kickstarter reveals a spectacular divide between success and failure. On the one hand, there are projects such as the one for the smartwatch “Pebble Time” that have been able to raise funds well over $10 m via crowdfunding campaigns, lately (Kickstarter 2015). On the other hand, there are countless projects that do not receive any noteworthy funding at all. Inspired by this discrepancy, this article explores success factors of crowdfunding projects using a highly quantitative empirical approach. To the best of the authors' knowledge, this study thereby closes a notable gap in the existing academic literature on crowdfunding.

22.2 Empirical Foundation

All data used in this study was collected on the Kickstarter platform itself in the fourth quarter of 2014. As described above, Kickstarter hosts projects from many different categories. It was decided to focus solely on the category "technology", as almost all projects in this category appear to be the intended starting point for genuine, continued entrepreneurial activity, whereas projects in other categories such as "art", "fashion" and "journalism" mainly seem to be of a temporary, sometimes even non-commercial nature.

Within the chosen category, 200 representative projects were selected, 100 of them successful and 100 unsuccessful. The decision for equal shares of successful and unsuccessful projects was made in order to facilitate statistical analysis of the data, particularly the development of explanatory models for funding success. However, as the overall success rate in the technology category is only 20% (Kickstarter 2016), this decision does also introduce a certain bias, which will have to be kept in mind in the interpretation of some of the subsequent quantitative analyses: Particularly, if a model predicts a success probability close to 100%, this estimate may be too optimistic in absolute terms. In these cases, a more careful interpretation would just focus on the lift that is the increase in success probability relative to that in the overall data set. E.g. the lift corresponding to a success probability of 90% is $90/50=1.8$.

For each of the 200 projects considered, a total of 59 descriptive variables were collected. These variables can be divided into the following six groups dealing with different aspects of the area of investigation:

1. Project initiators
2. Essential project characteristics
3. Project presentation and communication
4. Rewards offered
5. Course of the campaign after its launch
6. Funding success

All variables were collected and encoded in a fully manual process, which is completely unproblematic for those variables which can be measured objectively. However, a substantial portion of all variables required an encoding based on subjective judgement. Although subjective variables were encoded with the greatest care, the existence of some inconsistencies regarding these variables cannot be fully ruled out. From the authors' point of view, this disadvantage of the data set is outweighed by the opportunity to study the impact of presumably important qualitative aspects of Kickstarter projects on funding success.

In the following subsections all variables contained in the data set will be briefly described as this helps to clarify the scope and the limitations of this study.

22.2.1 Project Initiators

It is an obvious conjecture that characteristics of the project initiators influence funding success. Thus, the following eight binary variables (0 = no, 1 = yes) were collected:

- The initiator has already collected experience from a previous Kickstarter project (0/1).
- The initiator comes from the US (0/1).
- The initiator provides a detailed personal CV (0/1).
- The initiator provides a link to his or her personal website (0/1).
- The initiator provides a link to his or her Facebook profile (0/1).
- The initiator has more than 500 friends on Facebook (0/1).
- The initiator has backed Kickstarter projects initiated by others (0/1).
- The project is being initiated by more than one person (0/1).

Note that for projects with more than one initiator all variables given above were set to the value of 1 if the respective condition was satisfied by at least one initiator.

22.2.2 Essential Project Characteristics

Essential characteristics of the projects were described by the following variables, 23 of them being binary, again, and one being metric:

- The project pursues a me-too idea (0/1).
- The project has been assigned to a subcategory (0/1).
- The project subcategory is ... 3D printing (0/1), apps (0/1), camera equipment (0/1), DIY electronics (0/1), fabrication tools (0/1), flight (0/1), gadgets (0/1), hardware (0/1), makerspaces (0/1), robots (0/1), software (0/1), sound (0/1), space exploration (0/1), wearables (0/1), web (0/1).
- The project addresses a well-defined, established community (0/1).
- The project's target audience are businesses rather than consumers (0/1).
- The project is a relaunch of a previously unsuccessful Kickstarter project (0/1).
- The project is already on the market with a version of its product (0/1).
- The project is not for profit (0/1).
- The project seeks funding in more than one country (0/1).
- The project's monetary funding goal (in EUR).

22.2.3 Project Presentation and Communication

While the previous section comprises all project-related variables that are inherently linked to the project idea itself and the go-to-market strategy, the following twelve variables related to the presentation and communication of the project on the Kickstarter platform can be optimized freely by the project initiators:

- A link to a standalone project website is provided (0/1).
- A proper product introduction is provided (0/1).
- A well-made functional product explanation is provided (0/1).
- The value proposition of the product is well explained (0/1).
- A precise description of the intended use of collected funds is provided (0/1).
- The project presentation includes photos (0/1).
- The project presentation includes professionally produced photos (0/1).
- The project presentation includes videos (0/1).
- The project presentation includes professionally produced videos (0/1).
- The project presentation includes demos or prototypes of the product (0/1).
- The project has its own project logo (0/1).
- The project presentation addresses emotions in a pronounced way (0/1).

22.2.4 Rewards Offered

Moreover, Kickstarter is offering a high level of flexibility regarding the design of the rewards offered to the backers. As it is an obvious conjecture that this aspect has significant impact on a project's success, the following seven binary variables were collected:

- The project uses several, tiered rewards (0/1).
- The reward levels follow a clear structure and are well differentiated (0/1).
- The project offers benefits in kind as a reward (0/1).
- The project offers personal contact to the initiator as a reward (0/1).
- The project offers influence on its future direction as a reward (0/1).
- The project offers a lasting bond or impact as a reward (0/1).
- The project offers the product it seeks funding for as a reward (0/1)

22.2.5 Course of the Campaign After Its Launch

Kickstarter projects usually try to raise funds over a campaign period lasting several weeks. The following six variables are only known at the end of the campaign period and capture general interest of the Kickstarter community and the public in the project as well as the willingness of the initiators for continuous interaction with potential backers:

- The project received user comments on the Kickstarter platform (0/1).
- The project was featured as a Kickstarter Staff Pick[1] (0/1).
- The project received more than 500 likes on Facebook (0/1).
- The project received noteworthy press coverage (0/1).
- Number of exact Google hits for the project's name (number).
- The project was updated by the initiators on the Kickstarter platform (0/1).

In particular, being featured as a Kickstarter Staff Pick should greatly aid any project in achieving its goal, as this achievement results in a prominent placement on Kickstarter's website.

22.2.6 Funding Success

Finally, the following two measures for success were collected to potentially serve as the explained variable in most of the subsequent analyses:

- Funding goal achievement (percentage).
- The project reached its funding goal (F = failure/S = Success).

22.3 Analysis and Key Results

Prior to the core analyses, it is crucial to select the most reasonable of the two success measures presented in Sect. 22.2.6. Fig. 22.1 shows the distribution of the percentage funding goal achievement with all values having been capped at 100% for enhanced readability.

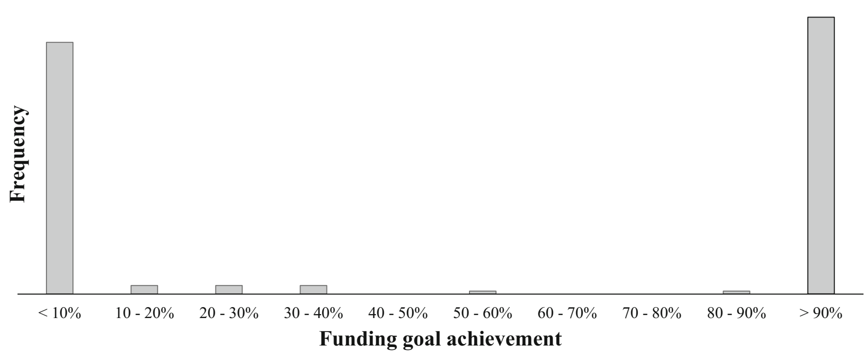

Fig. 22.1 Distribution of funding goal achievement

[1] By the time of writing, the "Kickstarter Staff Pick" has been rebranded to "Projects We Love".

The bimodal shape of the distribution substantiates the anecdotal evidence presented in Sect. 22.1: Projects are either fully successful or receive hardly any funding; there seems to be almost no middle ground. Therefore, all the following analyses will focus on the binary success measure. This decision is also reflected in the chosen methods: classification tree algorithms and logistic regression.

22.3.1 Success Factors Determined Before Campaign Launch

The foremost goal of this study is to identify success factors that can be influenced prior to the launch of the Kickstarter campaign. Thus, in this section all variables described in Sect. 22.2.5 were excluded from the analysis.

As an initial step, variables with high explanatory power were identified using a suitable classification tree method. Specifically, it was decided to use the implementation of the C4.5 algorithm proposed by Quinlan (1993) from the popular KNIME data mining software, as it is widely acknowledged that this algorithm reliably produces good results for all kinds of different data sets (Schauerhuber et al. 2008). The algorithm was parameterized as follows:

- As the impurity measure, the Gini index was chosen.
- As a pre-pruning strategy, the minimum number of cases per tree node was set to 10.
- Finally, reduced error pruning was applied in order to prevent overfitting phenomena.

The result from the application of the C4.5 classification tree algorithm is depicted in Fig. 22.2. The node on the left-hand side of this figure represents the entire data set with 100 failed and 100 successful projects and a success rate of 50%. Moving further to the right, one sees that the variable to which the algorithm attributed the highest explanatory power captures the differentiation of the reward levels. Of all 200 projects, a total of 49 did not offer well differentiated rewards, 45 of which failed and 4 of which succeeded resulting in a success rate of only 8%. However, the remaining 151 projects used well differentiated reward structures and exhibited a total success rate of 64%. The corresponding tree node was broken out further as shown using the variables describing if the value proposition of the project was well explained, if the initiator had backed other Kickstarter projects in the past, if the project addressed more than one country market, and, finally, the funding goal.

The interpretation of these findings is already highly insightful. The first variable selected indicates that well differentiated rewards are key to funding success. This suggests a high variation of the "willingness to fund" within the crowdfunding community that can only be addressed by offering different reward levels corresponding to different funding amounts. The selection of the second most important variable clarifies that an established truth of all marketing also holds true for winning crowdfunding backers, namely the relevancy of a clear value proposition. Moreover, one can see that a project without such a value proposition only has a high probability of success (67%) if its initiator backed

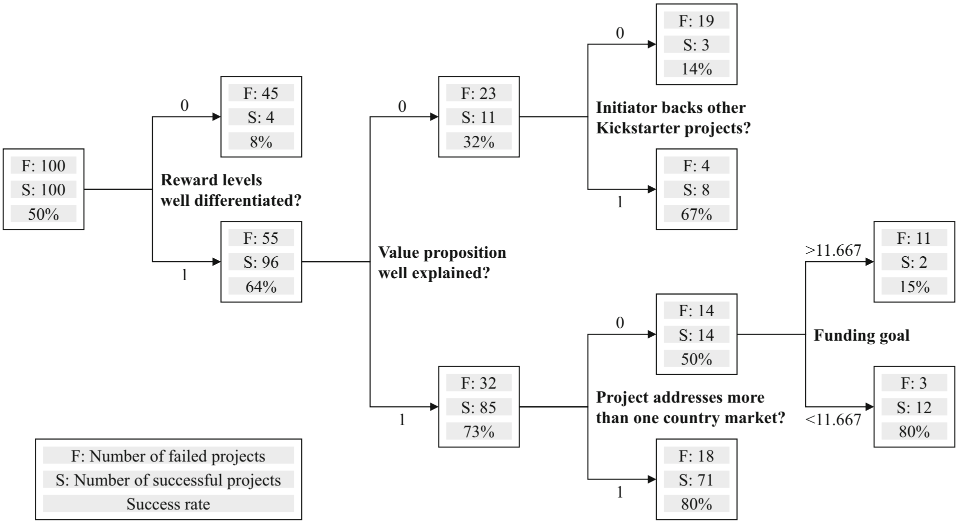

Fig. 22.2 Classification tree model for funding success excluding variables determined after campaign launch

other projects in the past. This indicates that reciprocity is a relevant social norm within the crowdfunding community.

From the 117 projects in the data set with well differentiated reward levels and a well explained value proposition, 73% have been successful, a lift of 1.46 compared to the overall success rate of 50%. Furthermore, the classification tree reveals that the success rate does increase to 80% corresponding to a lift of 1.60 either if the project addressed more than one country market or if the funding level were relatively low. Contrary to that, projects that pursued relatively high funding goals in just one target market only had a success probability of 15%. Overall, this implies that a project must align its geographic scope to its funding goal.

As a second step, all the variables identified in step one were used as the starting point for a logistic regression model. Then, the removal of included and the addition of excluded variables was explored in order to further enhance the model and gain additional insights into drivers of funding success. During this manual process, great care was exercised to only use variables with sufficient significance as measured by their p-value. The resulting model is given in Table 22.1; as indicated by the p-values, all included variables are highly significant.

As variables 1 to 7 in the logistic regression model depicted in Table 22.1 are all binary, a comparison of the corresponding variable coefficients is straightforward. Again, well-differentiated reward levels have the strongest positive impact on the probability of funding success. Also, the success factors captured by variables 3 and 5 retain their importance and require no further discussion; at this point, it is also noteworthy that the logistic

Table 22.1 Logistic regression model for funding success excluding variables determined after campaign launch

#	Variable	Coefficient	p-value
1	Reward levels well differentiated = 1	2.71	0.000
2	Functional product characteristics well explained = 1	2.07	0.002
3	Project addresses more than one country market = 1	1.73	0.001
4	Link to a standalone project website provided = 1	1.52	0.002
5	Value proposition well explained = 1	1.23	0.022
6	Initiator has no experience from a previous project = 1	−1.81	0.002
7	Project has its own logo = 1	−2.21	0.001
8	Funding goal (in EUR)	−4.11e-6	0.034
9	Constant	−3.93	0.000

regression did not find a significant connection between funding success and reciprocal behavior. Variables 2 and 4 are new, comprehensible additions to the model compared to the classification tree, emphasizing the relevance of proper project presentation and communication. Interestingly, the inclusion of both variables reduced the impact of the value proposition, probably due to the high correlation between all three variables. Another new success factor identified by the logistic regression model is the experience of the initiator from previous projects (variable 6). This suggests the importance of tacit knowledge about the Kickstarter platform and about crowdfunding in general for funding success. Finally, the high significance of variable 7, capturing the use of a project logo, can only be regarded as an oddity, as the model states that a logo has a strongly negative impact on success. Possibly, the use of a logo indicates that the project initiators were distracted from focusing on more fundamental communication aspects such as clarifying the value proposition.

The interpretation of the coefficient for variable 8, the funding goal, requires a little more attention, as it is metric rather than binary. For an average funding goal of €42,476, the impact is equivalent to that of a binary variable with a coefficient of −0.17, for the maximum funding goal of €942,000, the impact is equivalent to that of a binary variable with a coefficient of −3.87. Overall, this implies a surprisingly small impact of the funding goal on funding success. A project that is strong with regard to all other success factors included in the model can confidently aspire to raise funds above €100,000.

Of course, the reliability of all findings described above is highly dependent on the quality of both models which are depicted in Fig. 22.3. The figure shows the confusion matrix, the accuracy, the sensitivity and the specificity for the classification tree and the logistic regression model. As one can see, the accuracy of both models is high with 83 and 84%, respectively. The classification tree model turns out to be more sensitive, meaning that it excels in correctly identifying successful projects. However, this advantage comes at the cost of lower specificity, meaning that the logistic regression model is better at correctly identifying failed projects.

		Classification tree model: Actual project outcome – Failure	Classification tree model: Actual project outcome – Success	Logistic regression model excluding campaign variables: Actual project outcome – Failure	Logistic regression model excluding campaign variables: Actual project outcome – Success	Logistic regression model including campaign variables: Actual project outcome – Failure	Logistic regression model including campaign variables: Actual project outcome – Success
Predicted project outcome	Failure	75	9	81	13	88	7
	Success	25	91	19	87	12	93

	Classification tree model	Logistic regression model excluding campaign variables	Logistic regression model including campaign variables
Accuracy	83%	84%	91%
Sensitivity	91%	87%	93%
Specificity	75%	81%	88%

Fig. 22.3 Evaluation and comparison of model quality

22.3.2 Additional Success Factors Determined After Campaign Launch

Building on the logistic regression model described in the previous section, another model also including variables described in Sect. 22.2.5 was developed. In this process, the decision to include new and exclude old variables was taken based on the variables' p-values, again. On the one hand, this process resulted in the exclusion of three variables from the model, those related to the functional product characteristics, the link to a standalone website and the value proposition. On the other hand, four new variables were included in the model which is shown in Table 22.2.

Table 22.2 Logistic regression model for funding success including variables determined after campaign launch

#	Variable	Coefficient	p-value
1	Reward levels well differentiated = 1	3.37	0.000
2	Project was updated during the campaign = 1	2.93	0.000
3	Project was featured as a Kickstarter Staff Pick	2.25	0.018
4	Project received comments on Kickstarter = 1	2.03	0.002
5	Project addresses more than one country market = 1	1.80	0.006
6	Initiator has no experience from a previous project = 1	−1.74	0.019
7	Project has its own logo = 1	−2.25	0.002
8	Number of exact Google hits (number)	0.015	0.007
9	Funding goal (in EUR)	−1.36e-5	0.000
10	Constant	−5.00	0.000

Obviously, all four new variables included in the model can only be partially influenced by the project initiator. To a large extend, they are just logical early indicators of funding success, which limits their usability as levers for a systematic improvement of the success probability. Nonetheless, one can extract some additional success factors from the model via careful and somewhat creative interpretation.

Variables 2 and 4 both capture the existence of ongoing interaction between the project initiator and the Kickstarter community over the course of the entire campaign; both have a strong positive impact on funding access. This emphasizes the importance of high community engagement and ongoing dialogue between potential backers and the initiator. Thus, it is advisable for project initiators to actively foster this interaction rather than to remain passive while awaiting the final outcome of the campaign.

A similar interpretation gives meaning to the inclusion of variable 8, the number of exact Google hits for the project's name. The impact of this variable can be quite substantial: For an average number of Google hits of 180, the impact is equivalent to that of a binary variable with a coefficient of 2.70, for the maximum number of Google hits of 6050, the impact is even equivalent to that of a binary variable with a coefficient of 90.75, which hints at success being as good as certain. It can be inferred that project initiators should utilize common search engine optimization techniques to increase their odds.

Finally, it also can be of tremendous help to be featured as a Kickstarter Staff Pick, which results in a more prominent placement of the project on the Kickstarter platform. It therefore is interesting to analyze project-related drivers for the decision of the Kickstarter platform to award a "Staff Pick". Using the classification tree approach already described in Sect. 22.3.1, the model depicted in Fig. 22.4 was developed.

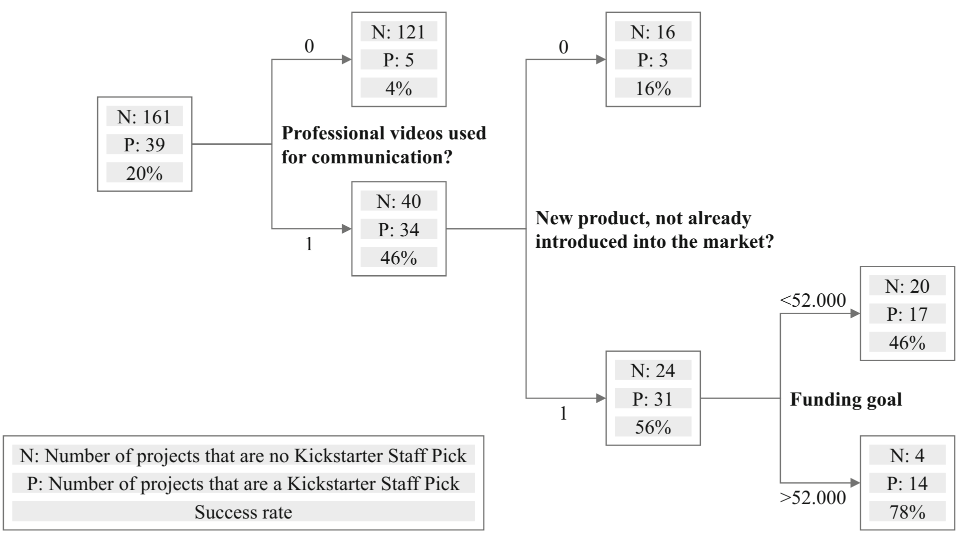

Fig. 22.4 Classification tree model for being featured as a Kickstarter Staff Pick

As one can see, Kickstarter appears to have a preference for promoting projects with the following properties: They must be sufficiently ambitious, as measured by the funding goal. They should strive for innovation, i.e. try to develop a product that has not already been introduced to the market. And, finally, the project should employ professionally produced videos for presentation purposes, possibly as this supports the user experience Kickstarter seemingly tries to build for its platform.

A caveat in the interpretability of the model lies in its moderate quality. While its accuracy and specificity are high with 86 and 98%, respectively, sensitivity is quite low with only 36%. This suggests that Kickstarter's decisions are positively influenced by other factors not included in the model.

Contrary to that, the quality of the logistic regression model presented in this section is very high. As Fig. 22.3c shows, the accuracy of the model is extremely high with 91%, an increase of 7 and 8 percentage points compared to the models that were not allowed to use variables that are only determined during the campaign. Moreover, sensitivity and specificity are both very high with 93 and 88%, suggesting that the model shown in Table 22.2 has no statistical weaknesses to speak of. Of course, the statistical superiority of the last model is not surprising, as it was allowed to use more variables than the two models presented in Sect. 22.3.1.

Conclusion

Taken together, the four models described above provide a strong foundation for some clear-cut recommendations with practical implications relevant for anyone trying to raise funds on Kickstarter and, presumably, other crowdfunding platforms:

1. **Offer a well differentiated reward structure.** The ability and willingness to fund appear to vary significantly within the crowdfunding community. Thus, differentiated reward levels corresponding to different funding amounts play an important role in the extraction of a sufficiently high total funding amount from the entire community.
2. **Have a strong value proposition and communicate it clearly.** This old truism of marketing appears to be equally relevant for crowdfunding projects. An explanation of the functional product characteristics and a supplementary website with additional information on the project may help in this regard.
3. **Do not only focus on your national market.** Particularly those projects with a high funding goal must target more than one country market from the outset, as this gives access to a much larger overall funding potential needed for success.
4. **Tap into the experience from prior crowdfunding projects.** Initiators who have already gathered experience from previous crowdfunding projects appear to possess tacit knowledge which makes them more successful. If an initiator lacks that kind of experience, he should seek it from others.
5. **Actively foster an ongoing dialogue with the crowdfunding community.** Although proper preparation of a crowdfunding project is essential for success, an

ongoing dialogue with the crowdfunding community appears to increase the odds by a notable amount. The communication instruments offered by the crowdfunding platforms themselves appear to be the appropriate starting point in this regard.

6. **Back other projects.** To some extent, initiators may be able to trigger reciprocal actions by others by being friendly and supportive members of the crowdfunding community.
7. **Be bold and try to build something ambitious.** The disadvantage from the necessarily higher funding requirements will most likely be outweighed by the increased attention to the project, as the crowdfunding community appears to prefer innovative and startling projects that strive for delivering true value over me-too projects. Moreover, a bold vision may help with being featured as a Kickstarter Staff Pick, which will result in significantly more attention and traffic.

Moreover, this study also points to some promising starting points for future research. Firstly, it appears to be worthwhile to further solidify the results from this study via a larger data set covering a longer time span and more project categories. Further, data would also facilitate the analysis of intercultural differences regarding crowdfunding. However, for reasons of practicality, this route of research would require the use of automated web scraper software. Secondly, further consideration needs to be given to what really constitutes a well differentiated reward structure. And finally, the chosen quantitative research approach could be supplemented with qualitative methods, such as in-depth interviews with individual project initiators in order to learn even more about what drives success.

That notwithstanding, the authors of this study are convinced they have already discovered some success factors for crowdfunding that any project initiator ignores at his peril.

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Part V

Education

Measuring the Effectiveness and Innovative Capability of Bingöl University and Atatürk University

23

İmran Aslan and Orhan Çınar

Contents

23.1 Introduction

Universities' main responsibilities are to educate qualified human resource by improving their social and technological innovative capabilities. Innovative cultures have direct relationships with new innovations by searching and perceiving something different or new by considering human needs to improve the standard of living. Countries with more innovations have better economies and low unemployment rates. To have an innovative culture, people are to be educated with technological and mathematical tools. The innova-

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_23

tive experience of a country can make it quicker as German people have great eagerness to making new researches and dealing with positive sciences with enough supports.

Eren (2010) has developed a model based on individual capabilities (creativity, innovative, proactive, controlling capability, being independent, desire for successes, trust and avoiding risk) and environmental properties (supports and obstacles). These factors correlate with social innovation directly. Social innovations support technological innovations in the same manner. From individual properties of model, creativity and controlling capabilities do not have any effect on social innovation (SI). However, it is found that all individual capabilities have a direct effect on technological innovations. According to Eren (2010) to analyze innovative cultures is to analyze competitive university and researches centers based on knowledge. Factors affecting country development as resources, capabilities, costumes and behavioral models are to be found for determining the innovative situation of a country in order to use resources effectively. Determining methods and models are main steps. Government implications for policy making and evaluation are institutional spheres overleaping and taking the role of others to make both universities more innovative. The universities can assist firm formation, R&D (Research and Development) functions and technology transfer. From their patents, publications, students' numbers and quality, the innovativeness of universities can be measured. The structural necessary changes required to make both universities more innovative are to be found in that study. The model developed by Eren (2010) used to measure innovative, creative and entrepreneur capabilities of Atatürk University and Bingöl University students under their social and technological innovativeness is empirically tested. Factors affecting individual's social and technological innovativeness tendency were tried to be validated by him for university students from 10 universities at different faculties to 767 students in 2010. All items are taken from Eren's (2010) PhD study and the reliability and validity of questions were carried by him (İskender and Batı 2015; Jackson 2014).

Creating entrepreneurial business ideas is to be the main purpose of universities to make innovations, commercialization, entrepreneurship and the creation of economic value for their society by building new companies and a science, technology, engineering and math field workforce. Turkish universities do not work for researches of commercialization but to educate students as a manager for business and a staff for governmental departments and they are the weakest circle of the entrepreneurship ecosystem in Turkey. Graduates of universities are to be more opportunity-focused than risky-focused or being pessimistic. New products, markets or processes are to be developed by inventors. With the increasing role of social media, a diverse team of social science academics and computing science specialists is needed to analyze huge amount of data. Atatürk University is 39th according to Sentiment Analysis (SA) and 39th according to TUBITAK's Innovative University Index (EIUI) from 50 universities of EIUI and SA of the related university's students or graduate student's social media messages in the context of entrepreneurship and innovativeness words – searching in tweets with the help of support vector machines and naive Bayes classifier data mining algorithms. According to SA, Ankara University, Çankaya University, İstanbul Medeniyet University, TOBB University and Istanbul Şehir Universities are the top five universities. However, they are 29th, 22th, 40th, 8th and 36th according to EIUI which shows that some universities are more deeply politicized than being science oriented whereas Sabancı University, Istanbul Technical University and İhsan Doğramacı University having high international fame are the most successful universities according EIUI. Bingöl University could not enter in first 50ties universities in this ranking (İskender and Batı 2015). Bingöl University is currently in the last quartiles of ranking in Turkey from 192 universities.

Countries with high innovation scores have a higher gross domestic product per capita like United States, Australia, Denmark etc. while countries like Turkey have negative governance affect on gross domestic product per capita. The development of the "innovation system", the quality of "governance", the character of the "political system" and the degree "openness" to technology/knowledge from abroad are main determinates of innovation successes from a factor analysis on 25 indicators and 115 countries from the 1992–2004 periods. Lack of absorptive capacity in poor countries prevents to get benefits from foreign investments in long term and make them a market for developed nations (Fagerberg and Srholec 2007). Production process not damaging the environment, advanced knowledge and providing solutions for problems people face are satisfactory goods of developing and developed countries by using knowledge utilization produced at home country or another country to exploit it. The concept of learning economics is referred as "in which knowledge is the crucial resource and learning is the most important process". A new acronym, LICS, for "learning, innovation and competence building systems" is developed from that definition. A "developmental university" is known by its democratization of access to higher education, democratization of research agendas and democratization of knowledge diffusion. Being knowledge based and action-oriented are main concerns in developed societies, meaning applying both for theory and for practice. The expansion of individual and collective freedoms and capabilities are found normative and the core of developments as seeing people not as patients but as agents. This results in growth plus innovation named as a knowledge-based and innovation driven economy and directed by a knowledge-based and innovation-driven economy shaped by capitalist-type relations. In peripheries and marginalized regions few people have access to higher education and less people work in conditions fostering new science, technology and innovation with low incomes, productivity, low quality jobs, informal occupations and benefits and possibilities of knowledge. They are mainly concentrated in some regions and some social groups. This causes inequalities as well as social exclusion. Demand stemming from internal economic dynamics and meeting internal suppliers' knowledge need from demand – the 'need' for science and technology are key drivers for innovative economies. A well behaved innovation system creates a social cohesion-interaction in society. Social demand of knowledge and innovation is high in some countries and politics are organized to meet these needs with advanced knowledge capabilities to solve problems. In a democratic strategy towards structural change, creative industries like automobile, the music industry, the film industry, leisure, sports and arts are the engine of growths. Not just with technological innovations but also with social innovations by connecting firms, academic teams and public organisms. Cultural capital golden eggs of research, global university rankings, committing universities to the democratization of knowledge, shifted labor demand towards high-skilled labor, a more holistic perspective, a Humboldtian vision of making students true protagonists of the learning process, the source of reliable knowledge, mega-mining, the way of contributing to the public comprehension, integrating the knowledge produced into workable solutions, and the knowledge produced into workable key topics in innovations and universities play key roles in reaching the goals and developments of a region (Arocena et al. 2015). Some cities like Bingöl and Erzurum have faced the situation explained in paragraph by cutting off knowledge developments and knowledge-based and innovation driven economies. However, Atatürk University established in 1957 with help of Nebraska University from USA could not be an engine for the development of the city and nearby cities or innovations, but it is named as status quo ideology spreading university and educated many university staffs in 59 years by becoming the main establisher of Erzincan University, Erzurum Teknik University, Ağrı University etc. It has had many graduates involving in politics and many of important religious leader have been educated at Erzurum city for special missions. Bingöl University is in the middle of four old universities named Atatürk University in Erzurum, İnönü University in Malatya, Fırat University in Elazığ and Dicle University in Diyarbakır. These universities all try to control the university staff-groups to make the university as a dependable university on them. Hence, most of staffs employed at Bingöl University come from these four universities and they do not have long term plans to be a part of this university but coming for special missions or due to not having employment opportunities in their home university.

23.2 Theoretical Background

The term innovation can be defined as "the application of better solutions that meet requirements or needs" I with a project related to "helping everyday life" or connect market needs and innovations with product development (Johnsson et al. 2014). According to Pot and Vaas (2008), social innovations are more important than technological innovativeness by explaining 75% of innovations and while technological innovations explain 25% according to a study done at Rotterdam University as seen in Table 23.1. One of the main aims of this study is to compare TI and SI and their relationships to check the model in Fig. 23.1.

Social innovations are defined first with defining social topics and developing them with new products, services and projects. Later, they are spread to the country to take their attention with marketing tools and social projects. New living styles: living without autos, eco villages, networking: new transportation methods, new series: renting cars, mobile services, new and developed organizations and community innovations: sustainable city planning models are examples of social innovations (Pot and Vaas 2008).

A new growth theory is suggested by many authors for new innovation system. Technological capability named as effective use of technology and using it commercially and

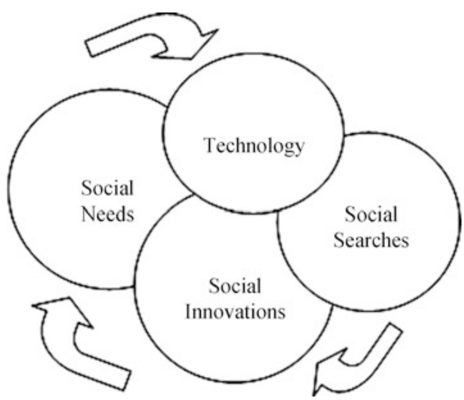
Table 23.1 Comparing technological and social innovations. (Source: Pot and Vaas 2008)

Technological Innovations (TI)	Social Innovations (SI)
Technological Knowledge	Management Knowledge
Investments in IT and technology	Investment in Education and experience
Research and developments	Organization and management
Creating information	Getting new knowledge, integration and application
Explain 25% of innovations	Explain 75% of innovations

social innovations like social values or quality of governance can create a profit national innovation system strategy with governments supports. The quality of governance and the political system degree of westernization are critical factors broadening the innovations theory. The degree “openness” having positive correlation between openness and growth for trade and foreign direct investment are important factors affecting innovation system. It is found that geography, nature and history do not have a strong effect on Gross Domestic Product (GDP) per capita. Some measuring capabilities shown in Fig. 23.2, developed by Fagerberg and Srholec (2008) are used. They have not found a category for civil rights and democracy. However, some measuring capabilities can be categorized under both innovation types. Moreover, the social structure of many countries affects the application of international standards. For example, German people are prone to obey rules while Spanish people like to live more differently by not obeying all standards.

Teaching, research, knowledge transfer and global outlook are key pillars to rank universities in global environment. Considering staff awards, highly cited researchers papers published in nature and science, papers indexed in Science Index-Expanded and Social Science Citation, quality of education, per capita performance of an institution, (Pavel 2015) Global Innovation Index (GII), Network Readiness Index (NRI), Global Information Technology Index (GITI), and Global Talent Competitiveness Index (GTCI) are international indexes used to measure the competiveness degree of a country. Determinants like creative output, knowledge creation, employee skills and enablers like political

Fig. 23.1 Social Innovation circle



Aspect	Measure	Capability
Science, research and innovation	Scientific publications, patents, *R&D (total/business), innovation counts*	Technological
Openness	Openness to trade, foreign direct investment, *technology licensing, immigration*	Technological
Production quality/standards	International (ISO) standards	Technological
ICT infrastructure	Telecommunications, internet, computers	Technological
Skills	Primary, secondary and tertiary education, *managerial and technical skills*	Technological and social
Finance	Access to bank credit, stock-market, *venture capital*	Technological and social
Quality of governance	Corruption, law and order, independence of courts, property rights, business friendly regulation	Social
Social values	*Civic activities, trust, tolerance*	Social
Type of political system	Civil (political) rights; checks and balances; democracy or autocracy	?

Fig. 23.2 Measuring capabilities. (Source: Fagerberg and Srholec 2008)

stability and economy are main parts in these indexes. Brain drain of the talents going from less developed countries to developed countries like the USA have also an important effect on the innovations of countries and their rankings (Buracas and Navickas 2016).

Innovation capability is divided as theory of creativity defining as the creative psychology, thinking and techniques, creativity development science named as education, psychology, thinking, environment, techniques and assessment and creativity engineering like creative design, decision consulting, tracking analysis. Thus, innovative capability is found by Chen et al. (2013) where K refers to human's creative potentiality: Individual innovation capability = K × (creative personality + creative thinking + creative techniques) × knowledge & skills. Extension methods using qualitative presentation and quantitative analysis consists of information & knowledge collection, innovation path choosing, transformation and find primary solutions and integration and evaluation of primary solutions (Chen et al. 2013). "In the Renaissance, creativity might have been a luxury for a few, but by now it is a necessity for all." (Jackson et al. 2006) This statement is a must for graduates to find a job or to be an entrepreneur in community. The problem-solving skills, personal development and intellectual motivation are main sources of development of creativity. University Technology of Malaysia Mara University has increased the number of classes related to creativity by increasing the passion for science, technology, engineering and mathematics. Activities outside the normal classroom can provide students with a positive outlook, trust and confidence by finding solutions to problems around them (Mahdi et al. 2015). Creativity, innovation, R&D support and quality systems are the main parts of successful strategies for new economies by using efficient utilization of newest knowledge. Students know that creativity and innovation need hard work and they consider themselves as creative and talented at the university survey. Teamwork and work independently are not much preferred on innovation. They support that teachers encourage them for creativity and academic achievements while the importance of innovations is not recognized in school students. There is a need of a new curriculum to improve creativity and innovative skills. They agree that university management supports any activities related to innovation. However, students think that university is not successful at spreading innovation culture at university and the role of it is crucial at improving innovation capabilities. Brainstorming, mind-mapping, six thinking hats technique, morphological analysis etc. can be added to university curriculum (Aichoni, et al. 2015). Academic challenges like not shaming students and behaving inappropriately and the outcomes of curriculum and teaching analysis, cultural challenges like encouraging trust and openness and being positive, personal challenges like creating environment of safety, trust and confidentiality to express their opinions can help students to improve their innovative strategies and capabilities (Joyce-McCoach et al. 2013).

Knowledge + skills + global professional skills = good jobs. Thus policy, licensing, funding, curriculums, some industry-academic connection programs and qualifications, more specializations, multi-disciplinary and trans-disciplinary education, advances in information communication technology & internet supports using Advances in information communication technology & internet supports, governed by the principles of participation and transparency, internationalization to attract foreign students and diploma courses are to be prepared based on that need (Aithal and Kumar 2016). Personal attitude and social influence are important factors affecting the adoption of technology. Costs, security problems, privacy problems, necessity of follow new versions and need for technical support are major barriers preventing the adoption of technological innovations (Tinmaz and Yakin 2015). Competency is defined as measureable motives, traits, self-concepts, attitudes or values, content knowledge, or cognitive or behavioral skills to determine the performance. Personal skills (criticism to tolerance, activity, creativeness and responsibility sense), conceptual skills (goal understanding, ability to plan, analyze results; analytical thinking and ability to solve problems), interpersonal skills (self-reliance, team working, communication ability, ability to show own opinion, ability to contract, self-presentation) and technical skills (application experience, specialty experience and subject knowledge) are students' skills for evaluation. Moreover, environmental conditions are to be included in evaluations with personal motivation (Čiarnienė et al. 2010). It is found that Lithuanians students are better at analytical thinking, goal understanding, ability to plan and analyze results and Turkish students are better at self-presenting than Lithuanians but they are less criticism tolerant than Lithuanians students – states a study conducted with 162 students of Erzincan University/Turkey and 203 students of Kaunas Technological University/Lithuania. Moreover, education, experience and economical situation of a country are important for Lithuanians students while government policies of a country are important for Turkish students (Kumpikaitė et al. 2011).

Absorptive capacity is referred to as "as a firm's ability to recognize the value of new information, assimilate it, and apply it for commercial purposes" and divided as potential absorptive capacity and realized absorptive. Combinative capabilities like socialization, coordination and systemization affect directly all learning types to create strategic innovations as seen in Fig. 23.3. Past experiences and the collected knowledge and capabilities of staff have a strong impact on innovations (Gebauer et al. 2012).

Interdependence of various specialties helps students to improve their innovative capabilities. The new university model is to bring many different specialties together to create innovation and broaden the perspective of participants. To explain a topic or a problem within one field is not possible and there is a need of multidisciplinary teams (Sullivan and Rollins 2012). Diversity amongst the students with different backgrounds and different curricula and not having little to exchange with each other and their freedom can promote the innovations by giving International Patent Rights (IPR), offering administrative or financial help concerning patent applications, giving entrepreneurship and start-up support, etc (Johnsson et al. 2014). Mental models, language and meaning, social identities, power and status, pre-existing intergroup conflicts and creativity are challenges in diverse teams. Multicultural and multidisciplinary diversity in creative teams are to be analyzed from individual properties to team level with moderating factor and be controlled (Paletz et al. 2015). Social capability properties are related to technical competence, experience in the organization and management, financial institutions and markets, honesty

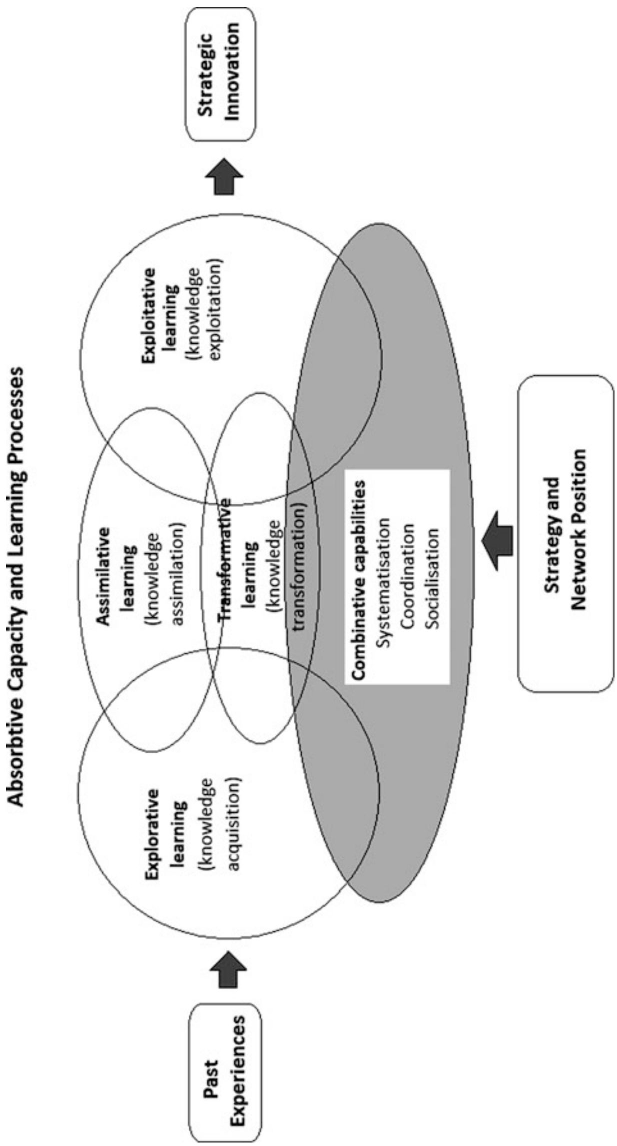


Fig. 23.3 Conceptual framework of Learning. (Source: Gebauer et al. 2012)

and trust, and the stability of government and its effectiveness in supporting economic growth as seen in Fig. 23.4 with measurements items.

The level of integration of education, science and industry – cross-national or supranational – results in international cooperation, global information environment, integrated educational space, use of different innovative techniques and teaching methods by changing staffs, international internships, joint inter-university research, exchange of scientific information, teaching technologies, post-graduate programs, international centers and branches of universities, employment of foreign citizens as teachers, learning foreign languages, joint competitions, olympiads and tournaments to improve the quality of life and innovations in society and create modern democratic society (Kartashovaa et al. 2015). The Communities of Practitioners (CoPs) model was applied by Páez-Avilés (2015) and was found very effective by creating a collaborative innovation system in a multi-stakeholder ecosystem to transfer knowledge. Commercializing array-based sensor products can create economical value for society (Páez-Avilés 2015). Co-publications with industry partners and setting up offices for technology transfer to industry become effective

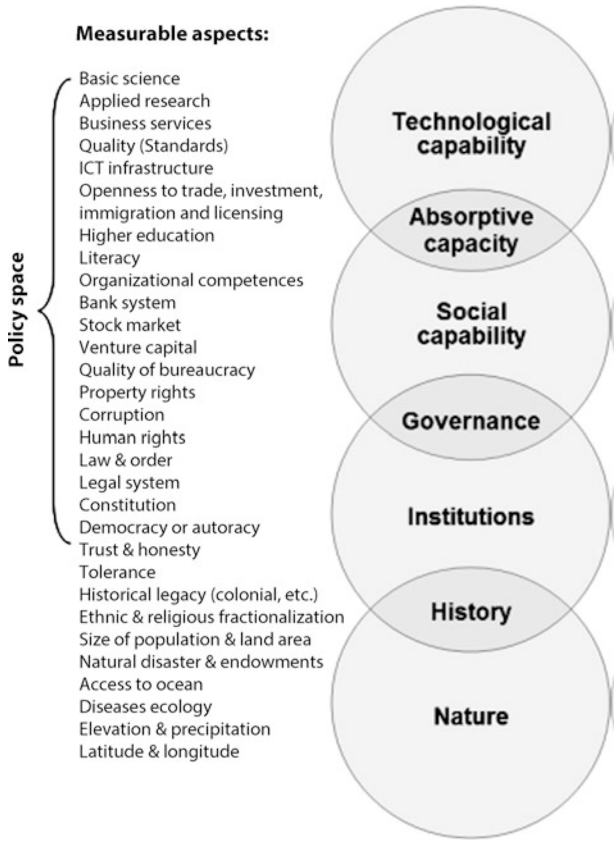


Fig. 23.4 Capabilities and development – an integrated framework. (Source: Fagerberg and Srholec 2008)

factors of change. The degree of using universities as innovation supporters is accepted as a new logical development way for new innovation projects in ICT (Information and Communication Technologies) and R&D service activities with intellectual property rights: copyrights, patents, trademarks and industrial layouts from 967 service firms in Portugal (Janeiro et al. 2013). Having long-term relationships with universities is the best way to get knowledge from universities according to the study the Madrid Science Park, named as technological interaction (Díez-Vial and Montoro-Sánchez 2015). Multi-dimensional universities have a slowness of adoption significantly associate with low price preference and resistance to innovation associated with high preference for simple products. Innovators, early adopters, early majority, late majority, and laggards are main key steps of the innovative curve. Late adopters allocate less financial resources to certain products and prefer simple products. Late adopters' requirements can be designed with simpler design and low costs to increase profit by firms with high correlation between low price preferences and slowness of adoption, resistance to innovation, and skepticism (Jahanmir and Lages 2015). Socio-behavioral adaptation along with technological innovation is required to change the mind of people. Partnership experiments like Masdar city, a planned city being developed in the United Arab Emirates to understand the short and long term impacts of innovative interventions, university community partnerships, international partnership projects from Brazil, India etc. for creation of new research/academic knowledge and university-based research centers, and knowledge transfer centers between community and universities are new models developed to create sustainable and quick innovative strategies for eco cities (Ramasubramanian and Pincetl 2015). Massive online open courses a new educational tool have cause–effect relationships between innovation and the supply of university courses with respect to cause–effect relationships between innovation and the supply of university courses and was found successful at applying innovation systems (Ospina-Delgado and Zorio-Grima 2016).

23.3 Material and Methodology

Total 450 surveys were carried out at Bingöl University and Atatürk University in 2015–2016 winter semester. 275 respondents are from Bingöl University and 175 respondents are from Atatürk University. Business and Administrative and Engineering faculties having about 1500 students at Bingöl University and about 10,000 students at Atatürk University are selected as the main population since they are more actively participating in innovation activities. Respondents of Atatürk University are mainly from Labor Economics and Industrial Relations department having about 600 students and Industrial Engineering department having 400 students. There are business administration and economics department at Business and Administrate faculty and mechanical, civil and electronic engineering departments at Engineering Faculty at Bingöl University whereas Atatürk University faculties have almost all related departments at their faculties. Atatürk University was established in 1957 and Bingöl University was established in 2008. Bingöl

University and Atatürk University are compared considering their age and being close to each other geographically.

To analyze the data Descriptive statistics, ANOVA and Regression methods are used. Descriptive statistics are used to compare both universities based on means of items and groups and with international standards. One Way-ANOVA is used to find significant differences among universities according to age, faculties, universities, departments and gender. Regression analysis is used to create a model affecting innovations. Moreover, correlation analysis is carried out to find relationships among groups. Groups are created by computing new variables by taking the mean of all items within group by SSPS 21 version.

Survey question are taken from Eren (2010). The reliability score of Cronbach Alpha is 0.95 and all items have high reliability. With 95% confidence level and 7 confidence interval to represent both universities, about 175 students sample size is enough for Atatürk University and with 95% confidence level and 5 confidence interval, about 322 students sample size is enough for Bingöl University (Survey System 2016).

Social Innovation (SI) with 9 items, Technological Innovation (TI) with 9 items, Risk with 5 items, Creativity (CER) with 6 items, Innovative (IN) with 6 items, Proactive (PR) with 5 items, Controlling Capabilities (CC) with 8 items, Being Independent (IN) with 5 items, Success Desires (SD) with 5 items, Trust with 4 items, Avoiding Uncertainty (AU) with 6 items, Supports (SU) with 12 items, Obstacles (OB) with 12items and Creating Innovations from knowledge collection (KC) with 7 items are main groups of the study and these all items can be gotten from Eren's (2010) PhD study.

Hypotheses

H_1 There are no differences among items according to age, gender, faculties and departments for both universities.
Each item measures some properties of each group, all items taken from Eren (2010) are analyzed separately to find similarities and differences among both universities. Neutral-moderate items have close means for both universities and are mainly 3–4 mean ranges. Moderate means can be used to compare with national and international means or Eren (2010) means in further studies. Most significant means with differences are analyzed in the findings and results section.

H_2 There are no differences according to each group as shown above by considering age, gender, faculties and departments for both universities.
Men are seen mainly more creative and innovative in East of Turkey due to cultural and religious effects. To find differences for genders, both universities within and with each other are compared with considering age. Moreover, faculties and departments differences can be used to measure the quality of universities.

H_3 There are significant correlations among groups: Which groups have the most significant effects on innovations are to be compared and improved in both universities in order to match innovative universities at international platforms and national rankings.

H_4 There are significant differences of each group on innovations: Which university has better means for each group make the university one step ahead.

23.4 Findings and Results

Means greater than 3.4 and less than 2.6 are falling in good and bad regions respectively from 450 sample size. Hence, SI1, SI3, SI9, IN1, TR1 and SN2 items have means higher than 4 and they have common agreement by both universities' students. While CC1–4 items, IN3, AU6, SU11, OB4 and OB7 have means less than 3.4 falling in not agree region. All other items fall between 3.4–4 neutral regions. The total mean of all items is 3.628 greater than 3.4 region when step size is 0.8 by starting from 1 (1.8–2.6–3.8–4.2–5). Students want to develop new things or becoming innovative to be beneficial to their surroundings through new techniques and methods. But they do not believe that their surroundings help them to get what they desire. That is determined by luck and powerful people as shown in Table 23.2. If they want to get something, they have to work hard for it. They support any kind of innovations useful for the community and trust their capabilities at both universities. Moreover, they want that people are employed according to capabilities but not torpedoes. However, they do not support that enough chances are given them to make innovations and thus they do not apply innovation tasks and projects. According to ANOVA test with 95% significance level and $p < 0.05$ value; SI1, SI9, SI3, CC2, CC4, IN1, SN2, OB4 items show differences according to universities and Atatürk University respondents have more positive means than Bingöl University students. For example, Atatürk University student have a mean of 4.4 at wanting to develop new products while Bingöl University students have a mean of 3.8. "Success depends on luck in life" item is rejected by both universities and Atatürk University students have a stronger objection to that with 2.45 mean against 2.79 mean of Bingöl University students. SU11 item cannot be generalized to both universities since Bingöl University students reject that hypothesis while Atatürk University students are neutral about that item. In summary,

Table 23.2 Evaluating both universities according to items

Item	University	Mean	Total Mean	Result	Differences According to Unv.
SI1: Wanting to develop products and services for better life quality of people	Ataturk Unv.	4.4114	4.0378	*Supported*	*Shows Differences*
	Bingol Unv.	3.8000			
SI3: To improve the innovation capacity of community, I am eager to develop new techniques	Ataturk Unv.	4.2514	4.0044	*Supported*	*Shows Differences*
	Bingol Unv.	3.8473			

Table 23.2 (Continued)

Item	University	Mean	Total Mean	Result	Differences According to Unv.
SI9: I want to be beneficial to my surroundings without expecting something	Ataturk Unv.	4.3143	4.0467	*Supported*	*Shows Differences*
	Bingol Unv.	3.8764			
CC1: If I get what I want that means I am lucky	Ataturk Unv.	2.7143	2.7978	*Rejected*	*No Differences*
	Bingol Unv.	2.8509			
CC2: No need to plan future myself since everything depends on luck	Ataturk Unv.	2.4743	2.6489	*Rejected*	*Shows Differences*
	Bingol Unv.	2.7600			
CC3: What happens in my life is determined by powerful people	Ataturk Unv.	2.9086	2.8956	*Rejected*	*No Differences*
	Bingol Unv.	2.8873			
CC4: Success depends on luck in life	Ataturk Unv.	2.4514	2.6600	*Rejected*	*Shows Differences*
	Bingol Unv.	2.7927			
CC6: If I get something wanted, it means that I work hard for it	Ataturk Unv.	4.1486	4.0289	*Supported*	*No Differences*
	Bingol Unv.	3.9527			
AU6: Accepting uncertainty as a part of my life	Ataturk Unv.	3.4457	3.3777	*Rejected*	*No Differences*
	Bingol Unv.	3.3236			
IN1: I try for accepting innovative methods and opinions	Ataturk Unv.	4.4286	4.1489	*Supported*	*Shows Differences*
	Bingol Unv.	3.9709			
SN2: I want that people are employed according to their capabilities but not friends or torpedo	Ataturk Unv.	4.2000	4.0533	*Supported*	*Shows Differences*
	Bingol Unv.	3.9600			
TR1: To be successful in job, I trust my capabilities	Ataturk Unv.	4.0800	4.000	*Supported*	*No Differences*
	Bingol Unv.	3.9018			
SU11: In my surroundings, the chance at innovation of new ideas, implementation and sharing them is allowed	Ataturk Unv.	3.4743	3.3844	*Rejected*	*No Differences*
	Bingol Unv.	3.3273			
OB4: Innovative people are not liked around me	Ataturk Unv.	3.2171	3.1644	*Rejected*	*Shows Differences*
	Bingol Unv.	3.1309			
OB6: Our managers and academicians are against all new things	Ataturk Unv.	2.7371	2.8733	*Rejected*	*No Differences*
	Bingol Unv.	2.9600			
OB7: Students trying to bring innovations in their fields are not supported at our university	Ataturk Unv.	3.0686	3.1778	*Rejected*	*No Differences*
	Bingol Unv.	3.2473			

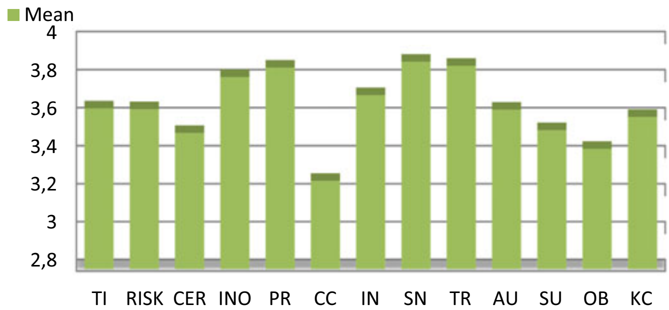


Fig. 23.5 Means of groups for both universities

items showing differences are to be evaluated according to each university. Thus, AU6 and SU11 cannot be generalized to both universities but analyzed separately.

About 44 items out of 99 items show differences according to universities. All results cannot be generalized to items showing differences. Items that show differences are SI1-9, TI1, TI5, TI7, TI9, Risk1, Risk4, CER1, CER5, INO3, INO5PR1, PR2, PR4, CC2, CC4-8, IN1, IN5, SN1-5, TR2-3, AU3-4, SU2-6, OB4, and OB9-12 items are to be evaluated separately to make a more accurate evaluation. However, high means are used above to tackle this problem.

Females have higher means at searching social collaboration, being beneficial to their surroundings, taking into account new opinions, believing more that at class new methods and techniques are taught at university, while males show higher means as shown in Table 23.3.

296 respondents are from Business and Administration Faculty (BAF) and 154 respondents are from Engineering Faculty (ENG). Engineering candidates find themselves more creative for new ideas while for other items BAF students gave higher scores/means. For other items, there are no significant differences according to faculties. Both faculties are to work together in order to improve projects and the quality of education. SI7, SU7 and OB8 items are not supported by both faculties. However, when the total mean is considered, they are supported. The total mean can give accurate and the same evaluation with significant differences according to faculties by ANOVA One-Way test as seen in Table 23.4.

23.4.1 Grouping Items

All groups means are greater than 3.4 except CC (Control Capabilities) group and the greatest mean comes from success needs (SN) group with 3.89 mean as shown in Fig. 23.5. Respondents do not agree with control capabilities about their life and future career or opportunities as they believe that employments and promotions are done according to torpedo and illegal incentives than capabilities and efforts. Luck and capabilities are main items of this group and they are not sure that positive things happen in their life are determined by these two items.

Table 23.3 Means comparing and ANOVA for Gender

Item	Gender	Mean	F-Value	Sig.
SI5: Searching for social collaboration and participating ways	Female	4.0179	Supported	0.036
	Male	3.7920		
	Total	3.9044		
SI9: I want to be beneficial to my surroundings without wanting any benefit	Female	4.1741	Supported	0.015
	Male	3.9204		
	Total	4.0467		
CER4: Trying to make connections related to different opinions	Female	3.2946	Supported	0.026
	Male	3.5487		
	Total	3.4222		
CER5: Trying to make connection among fields totally different	Female	3.2768	Neutral	0.034
	Male	3.5044		
	Total	3.3911		
CC2: For me, planning the future is not good since everything is related to luck	Female	2.4821	Not supported	0.014
	Male	2.8142		
	Total	2.6489		
AU2: Under uncertainty, I can work independently	Female	3.3125	Moderately Supported	0.027
	Male	3.5487		
	Total	3.4311		
SU4: New opinions of use are taken into account at new projects	Female	3.8571	Moderately Supported	0.006
	Male	3.5442		
	Total	3.7000		
SU5: University management and academicians are open to new suggestions and opinions	Female	3.7009	Moderately Supported	0.005
	Male	3.3717		
	Total	3.5356		
SU6: At classes, new methods and techniques are taught at our university	Female	3.5670	Neutral	0.003
	Male	3.2035		
	Total	3.3844		
SU11: In my surroundings, the chance at innovation of new ideas, implementation and sharing them is allowed	Female	3.5134	Neutral	0.021
	Male	3.2566		
	Total	3.3844		
OB6: Our managers and academicians are against all new things	Female	2.6920	Not Supported	0.005
	Male	3.0531		
	Total	2.8733		

There are significant correlations among all groups shown in Table 23.5. Technological innovation (TI) has the greatest correlation with Innovation, Creativity, and Proactive. Social innovations have strong correlation with Technological Innovation, Innovations, Successes Needs and Risk groups with significance level of 0.01 (2-tailed) and greater correlation than 0.5. Controlling capabilities of future successes and getting expectations by their abilities group has not any correlation greater than 0.5. Avoiding uncertainty has

Table 23.4 ANOVA for Faculties

Items	Faculty	Mean	Decision for both faculty	F-Value	Sig.
SI6: Creating new ideas bring value and effectiveness e to the community	BAF	3.7932	Supported	3.745	0.050
	ENG	4.0000			
	Total	3.8641			
SI7: I believe that without social, humanity and organization development, technological innovations cannot improve the economy and life conditions	BAF	3.3074	Not Supported	7.569	0.006
	ENG	3.6558			
	Total	3.4267			
SN5: I prefer to do my jobs soon than postponing	BAF	3.9054	Supported	4.694	0.031
	ENG	3.6558			
	Total	3.8200			
TR4: Even meeting many problems, I do not give up	BAF	3.9189	Supported	7.209	0.008
	ENG	3.6299			
	Total	3.8200			
SU7: University supports us for conferences, congresses and other scientific activities	BAF	3.6453	Not Supported	6.704	0.010
	ENG	3.3312			
	Total	3.5378			
OB8: Our community cares more about consistency than changes	BAF	3.6385	Not Supported	5.187	0.023
	ENG	3.3831			
	Total	3.5511			
OB10: In our community, it is expected that people deal with problems in known ways	BAF	3.8108	Supported	8.388	0.004
	ENG	3.5130			
	Total	3.7089			
OB11: In our community, we use proved and right ways	BAF	3.7703	Supported	3.846	0.050
	ENG	3.5519			
	Total	3.6956			

0.626^{**} correlation with Trust. Hence, if they trust in any kind of situation, they will avoid risks. In Turkey, students are risk averse due to being of afraid of bankruptcy at entrepreneurship projects or new ventures. This can be due to not having enough mathematical, decision and statistic courses to know more about risks and take counter measures. The new education system forces students to choose the department or university that they do not want but rank them according to scores of University Entrance Exam (LYS) taken by each one. Many students not having enough mathematical capabilities select departments having more opportunities of finding jobs in the future. However, they are not being successful in their study and future job life if they do not improve their analytical capabilities. Moreover, universities care about more about the number of students than their abilities and they have decreased the number of courses necessary to improve creativity like statistics, operation research, mathematic courses etc. to allow students to get a degree more easily and attract more students specifically for private universities. Also, successful and creative students during university study lose their capabilities due to not having necessary courses and low quality of education. As it is stated by Prof. Dr. Yekta Saraç (2015), Head of Turkey Higher Education Institute (YÖK), that some engineers graduate without knowing even some basic mathematical calculations since they are accepted with very low math score and courses are easy at both universities especially at Bingöl University. Supports do not have a strong correlation on other groups but Obstacles have strong correlation with the Knowledge Collection group. YÖK is planning to bring some min. score to some engineering fields in this year to improve the quality of education. However, BAF departments are not arranged in this manner and students with very little mathematical knowledge can study economics, businesses administration, and econometric departments needing high numerical abilities. These conditions and lack of education result in risk avoidance behaviors in their future life and they prefer more secure jobs like governments jobs with low risk of being fired.

OB, KC, CER, CC and IN groups do not show any significant differences. According to decision being greater than 3.4 (Agree decisions), there are no differences among groups for both universities. However, there are differences according to One-Way ANOVA test with 95% significance level as shown in Table 23.6 with sig value smaller than 0.05. Atatürk University (ATU) students have higher means in all groups below, which shows that ATU students are more optimistic about their future and feel better in innovations than Bingöl University (BU) students. Being old, having enough academicians, a better city image, better transportation chances, higher social activities, more job opportunities, less security problems and having better accommodation possibilities are main reasons of ATU being better than BU. However, being so old, grouping among staffs as in all universities in Turkey, ethnical problems among students and having another competitor university at city are other disadvantages of Atatürk University. Moreover, there are no significant differences according to faculties and age with ANOVA One-Way test.

Labor economics and industrial relations (1), Industrial Engineering Department (2), Economics (3), Business Administration (4), Civil Engineering Department (5), Mechanical Engineering department (6) and Occupational health and safety department (7) have 97, 74, 102, 96, 36, 44 and 1 respondents respectively as shown in Fig. 23.6. Hence we can exclude the last department from this study.

All groups except KC and CC groups have significant differences in terms of departments according to One-Way ANOVA test. For SI group, the largest differences comes from 1-4 and 1-6, 2-4, 3-4, 4-1, 4-2, 4-3 and 6-1 departments groups with sig value of less than 0.05 by multiple comparisons while other comparisons are not significant. In this part, 1-2, 3-4 and 6-5 department comparisons are more logical since first compression is for ATU, second one is for BAF and third one is for ENG faculty of BU. For TI group, 3-4 and 5-4 comparisons are significantly different. However, there are not logical significant differences among departments for innovation groups. 3-4 and 5-3 departments comparisons show significant differences for Supports group.

Table 23.5 Correlations among groups for both universities

	SI	TI	RISK	CER	INO	PR	CC	IN	SN	TR	AU	SU	OB	KC
SI	1	0.647**	0.512**	0.422**	0.558**	0.483**	0.261**	0.433**	0.515**	0.406**	0.433**	0.315**	0.287**	0.354**
TI	0.647**	1	0.541**	0.606**	0.658**	0.502**	0.313**	0.424**	0.443**	0.368**	0.411**	0.336**	0.251**	0.304**
RISK	0.512**	0.541**	1	0.537**	0.527**	0.559**	0.300**	0.498**	0.423**	0.413**	0.438**	0.235**	0.298**	0.314**
CER	0.422**	0.606**	0.537**	1	0.610**	0.470**	0.358**	0.375**	0.402**	0.376**	0.407**	0.296**	0.306**	0.280**
INO	0.558**	0.658**	0.527**	0.610**	1	0.613**	0.289**	0.411**	0.510**	0.418**	0.386**	0.331**	0.258**	0.316**
PR	0.483**	0.502**	0.559**	0.470**	0.613**	1	0.330**	0.503**	0.510**	0.439**	0.402**	0.336**	0.250**	0.320**
CC	0.261**	0.313**	0.300**	0.358**	0.289**	0.330**	1	0.403**	0.317**	0.299**	0.423**	0.389**	0.385**	0.278**
IN	0.433**	0.424**	0.498**	0.375**	0.411**	0.503**	0.403**	1	0.541**	0.488**	0.545**	0.356**	0.369**	0.364**
SN	0.515**	0.443**	0.423**	0.402**	0.510**	0.510**	0.317**	0.541**	1	0.626**	0.527**	0.360**	0.273**	0.359**
TR	0.406**	0.368**	0.413**	0.376**	0.418**	0.439**	0.299**	0.488**	0.626**	1	0.533**	0.352**	0.297**	0.349**
AU	0.433**	0.411**	0.438**	0.407**	0.386**	0.402**	0.423**	0.545**	0.527**	0.533**	1	0.431**	0.434**	0.351**
SU	0.315**	0.336**	0.235**	0.296**	0.331**	0.336**	0.389**	0.356**	0.360**	0.352**	0.431**	1	0.227**	0.218**
OB	0.287**	0.251**	0.298**	0.306**	0.258**	0.250**	0.385**	0.369**	0.273**	0.297**	0.434**	0.227**	1	0.523**
KC	0.354**	0.304**	0.314**	0.280**	0.316**	0.320**	0.278**	0.364**	0.359**	0.349**	0.351**	0.218**	0.523**	1

** Correlation is significant at the 0.01 level (2-tailed)

Table 23.6 ANOVA according to Universities

		Mean	Decision	F	Sig.
SI	ATU	4.0656	Support	26.367	0.000
	BU	3.6974			
	Total	3.8406			
TI	ATU	3.7543	Support	6.980	0.009
	BU	3.5790			
	Total	3.6472			
RISK	ATU	3.7566	Support	5.521	0.019
	BU	3.5702			
	Total	3.6427			
INO	ATU	3.9181	Support	5.675	0.018
	BU	3.7436			
	Total	3.8115			
PR	ATU	3.9749	Support	5.812	0.016
	BU	3.7891			
	Total	3.8613			
SN	ATU	4.0411	Support	9.237	0.003
	BU	3.7978			
	Total	3.8924			
TR	ATU	4.0114	Support	8.278	0.004
	BU	3.7818			
	Total	3.8711			
AU	ATU	3.7295	Support	4.576	0.033
	BU	3.5836			
	Total	3.6404			
SU	ATU	3.6338	Support	5.264	0.022
	BU	3.4682			
	Total	3.5326			

23.4.2 Regression

The model created for technological innovation is found as below with highest coefficient coming from social innovation. This shows that technological innovations depend highly on social innovations and innovations group. Moreover, creativity has a high coefficient on technological innovations. Even Risk group has significant effect on Technological innovation, the effect is not that high. The model has sigma less than 0.05 with ANOVA test and 0.773 R value, which makes the model significant.

- *Model 1*: $\mathrm{TI} = 0.467 + 0.240\mathrm{INO} + 0.315\mathrm{SI} + 0.222\mathrm{CER} + 0.075\mathrm{RISK}$
- *Model 2*: $\mathrm{INO} : 0.342 + 0.278\mathrm{PR} + 0.329\mathrm{CER} + 0.216\mathrm{SI} + 0.105\mathrm{SN}$

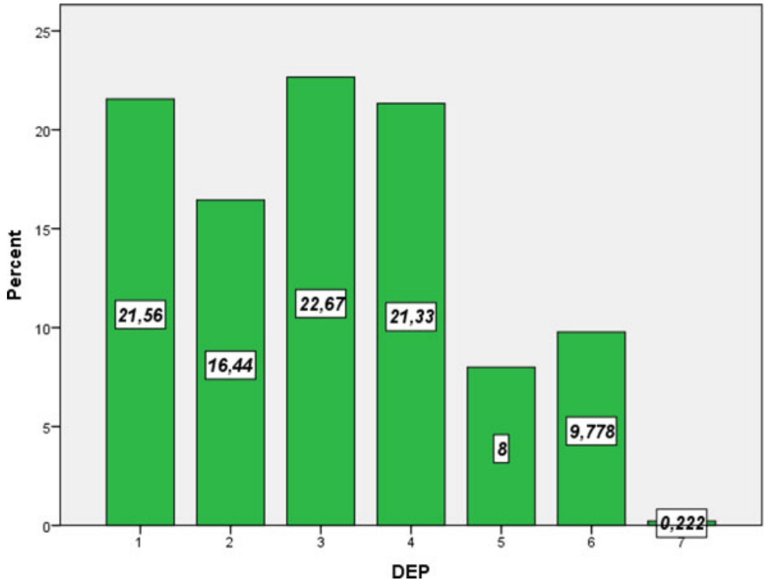


Fig. 23.6 Percentage of students according to departments for both universities

In the second model with sigma less than 0.05 and 0.75 R value, the groups of proactive, creativity, social innovations and needs of success groups have significant effect on Innovation group. Creativity is the most effective group (CER) in this model and Success Needs (SN) group has the lowest significant effect. In summary, creativity, proactive, risk understanding abilities and desires for success capabilities are to be improved at both universities if they want to increase the number of innovations from their students.

23.5 Discussion and Future Studies

Atatürk University has many master and PhD students thus a survey covering them is to be carried out. Bingöl University has few PhD and some master students. Hence, Atatürk University has a critical role of educating future academicians for new universities and many universities academicians were graduated from this university. Moreover, a study based on current and graduated staffs of both universities are to be carried out to learn how they are capable at innovations and analyzing their successes can be a another applied result of innovative degree of universities. If the academicians are not well capable and have concentrated on just ideology but not science, it is not logical to wait for innovative graduates from universities. Also the successes of graduated students are to be investigated and modeled in different time ranges for both universities. At 1957s, there were few universities and Atatürk University had good students at this time. However, there are about 200 universities in Turkey now. The competition to get students will be harder in the next 5–10 years and being close to each other makes both universities more competitors than collaborators. Hence, new opened universities have the problem of finding qualified staffs in East and South of Turkey. Many universities like Atatürk University are eager to give staffs in order to spread their ideology and control these universities to use their not employed academicians. Even though, governments have started academicians programs named as Educating Academicians (ÖYP) for new universities and decreased torpedoes, they have not been widely graduated until now. The program criteria are based on ranking applicants according to their capabilities like language and exam scores and educate them in Turkey or abroad. Later, they will return these new universities. But, ideologically established universities are trying to block that improvement by creating problems with program and not allowing them to be graduated in expected time in order to make the ÖYP program useless and take academicians based on their requirements and torpedo.

"New product success and failure is often decided before the new product project even enters the product development phase" (Cooper 1988). If you have capable academicians, graduates, an innovative ecosystem and follow the needs of people, innovations can be a part of daily life. However, our people are at last stages of innovation named as users and adoption phase. If the needs and success platforms are created with incentives, the development of new products can be successful with knowing market potential. Being pessimistic with not qualified education and not having enough supports are major problems at Bingöl University. Many students are educated in programs having high rate of unemployment like BAF or ENG and later, these graduates work in unrelated jobs in Turkey.

"In the Renaissance, creativity might have been a luxury for a few, but by now it is a necessity for all" (Jackson et al. 2006). New courses to increase the capability of creativity are to be added to new curricula like mathematic, statistics, physics, chemistry, design classes, trainees and workshops at both universities to help students finding new jobs and creating work opportunities. International education mobility like taking language courses, exams, interdisciplinary searches, exchanging staffs and students, helping for visas, doing co-conferences, organizing joint programs, sharing databases etc. is gaining importance in order to improve capabilities of students.

Conclusion

It is clear that both undergraduate programs of Atatürk University are better institutionalized and are expected to be more innovative both socially and technologically. Bingol University cannot hide itself behind being a new university because many new established universities like Erzincan University, Rize University, Yozgat University etc. have caught other developed universities in 8 years and are being to compete at national and international level. Being new and use that chance is missed in last 8 years, it is clear that there is a need of reorganization at Bingöl University and there is a need of opening new departments in English and Turkish languages with more qualified and enough academicians. Circulating rate of staffs are to be decreased by making both universities more attractive with decreasing grouping and increasing team works among students and staffs.

More innovative social activities are to be organized by university with some financial supports like workshops, competitions, sport organizations etc. Forcing students to memorize courses and not giving enough creative supported classes are two main deficits of Bingöl University. Students believe that they will be employed not according to their capabilities but torpedo and luck. This causes students getting the diploma without gaining enough requirements for the job market. Having about 3.7 mean average shows that both universities' students believe that they are not innovative and they blame governments and university managements for that. Creativity, proactive (preventing measures ability), risk and successes needs are found the most critical groups affecting innovativeness.

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An E-conversion Project in Turkey's Education System: the FATİH Project 24

Daha Orhan, Embiya Çelik, and Arif Daş

Contents

24.1 Introduction

E-state and e-conversion have been among the most important strategies of countries in their official government policies in recent years. In this context, many European countries have made rapid progress in this field by putting e-conversion action plans into practice. The issues of e-conversion and e-state are involved within the frame of "information society and media" that Turkey, aiming to join the European Union, has been faced with during the negotiation process (Akses 2011).

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Turkey, especially in recent years, has started to apply e-conversion strategies in many different areas in order to comply with the European Union e-government plan and convert itself into an economy based on information. One of these strategies is FATİH, promising to bring great innovation to the Turkish education system. The main target of this project which is supported by the Ministry of Transport and conducted by the Ministry of National Education is to provide equality of opportunity in education by encouraging effective use of information technologies (IT) in the classroom during the teaching-learning process and to present more effective teaching in learning environments equipped with advanced technology (FATİH Project 2012).

Studies and impressions related to the FATİH Project that is expected to be a great e-conversion movement are conveyed within the context of this study. In the study, an introduction is presented on the main features of the FATİH Project in which large investments into educational technologies have been made and information given about the greatest e-conversion project in the field of education in Turkey.

The study consists of three parts; in the first part, the development of the Turkish education system is briefly introduced. In the second part, the FATİH Project is described in general terms and the way in which e-conversion of traditional methods has been carried out is explained. Finally, a general evaluation of the project is presented and various suggestions are made about possible implementation in similar international projects.

24.2 FATİH Project

With the development of computer and communication technology, the increase of computer literacy and the widespread use of personal computers, the use of technology in education and training activities has become unavoidable. Modern societies are trying to use information and communication technology in various fields including education so as to be able to have a voice in the new order known as the "Information Society" (İmer 2000). Therefore, most developed countries have by now carried out the integration of technology in education with large scale projects. Turkey, similarly, is following these trends and investing in education technologies. The greatest of these investments is undoubtedly the FATİH project.

The project "Movement to Enhance Opportunities and Improve Technology", known in abbreviation as FATİH, basically seeks to increase student success through using technology influentially in classrooms by expanding the equality of education.

The goals of the FATİH project carried out by the Ministry of National Education are chiefly these;

a. to provide equal opportunities in education irrespective of regional differences,
b. to develop and enhance technology in schools,
c. to support student learning by putting the media of ICT (information communication technologies) in the center of the learning environment (MEB 2014).

In accordance with the stated goals, the project aims to fulfil e-content requirements by providing approximately 700,000 teachers and 17,000,000 students with tablet computers and 570,000 classrooms in 42,000 schools with LCD interactive boards, web infrastructure, multifunctional printers and visual presenters (MEB 2014). According to Ministry of National Education data, in the second term of the 2011–2012 education year, 2259 teachers and 9435 students were given tablets in 17 provinces and in 52 schools (48 secondary education and 4 primary education) within the pilot scheme of the project. At the same time, the classrooms of students in 5th and 9th grades in the corresponding schools were equipped with interactive boards (MEB 2014).

The FATİH Project consists of five main components:

- Providing hardware and software infrastructure,
- Providing and managing educational e-content,
- Using effective ICT in teaching programs,
- In-service training of teachers,
- Using manageable, measurable ICT consciously and safely

Even though FATİH is a project that has been developed for students, it involves various stakeholders including students, teachers, managers, parents and suppliers. Hence, it will be useful that this project is evaluated not only from the perspective of students and teachers but also of all stakeholders. For this purpose, as a result of the literature review, original studies have been examined and their results have been shared in our study.

24.3 Literature

Literature references that lead our work have been collected under two titles: these are similar studies in Turkey and in the world.

24.4 Similar Studies in the World

Growing qualified man power is among the main goals of all developed countries in the age of information. To achieve this goal, it is necessary to create an education environment in which ICT is used effectively from primary school to higher education. For this purpose, in recent years many large scale projects have been carried out in many countries and extensive budgets have been reserved to ensure their success.

With regard to investments in education, Russell et al. (2007) stated in their study that the expenditure of the USA on education technologies between the years 1995–2001 rose from 21 million dollars to 729 million dollars. In another study, it has been put forward that America invested a total of 7.8 billion dollars in the 2003–2004 education year (Quality Education Data Report 2004).

Studies on providing technology integration in education are not limited to only the USA but are also being conducted by many small or large countries on many continents. For example, in Portugal, one of the midsize countries of Europe, thanks to a project called Macellan Magalhaes, 480,000 laptop computers were handed out to primary school students throughout the country in 2008 (Fourgous 2010). In South Korea, a project that is still being conducted as a pilot scheme is aimed to turn school books into electronic ones. Additionally, by 2015, 7.5 million primary and elementary school students were to be given tablets within the context of this goal.

Many scientists have started to study and comment on effects and functions of these projects when large countries have accomplished them. The E-conversion movement in education is progressing day by day with both studies on on-going projects and with individual projects of researchers. For example, when the results of the study on the views and attitudes of teachers and students on the use of smartboards conducted by Kennewell and Morgan (2003) was examined, it was revealed that teachers will welcome this technology in the future. Interactive board use in education has now taken shape and become functional in educational activities with the contribution of similar studies carried out by different authorities.

24.5 Similar Studies in Turkey

Many academic studies have been carried out in Turkey about the use of technology in education and e-conversion with the FATİH project, as well. When the size and goals of the project are taken into consideration, it can be seen that these studies contribute to literature. Some of the studies related to the FATİH project are described below:

In a study by Kayaduman et al. (2011) with regard to the applicability of the FATİH Project, teacher proficiencies and their use of information communication technologies in classrooms were examined. According to this research, it was observed that teachers have significant deficiencies in the use of ICT. It was therefore decided that the education of teachers in the above-mentioned area must be improved.

In the study by Öztan (2012) which interactive board, one of the essential tools in the project, was evaluated on the basis of course was carried out for student success. The study which produced positive results, it was explained that the course was more enjoyable and thus achieved better learning results. Furthermore, an increase was observed in lesson attendence and when compared to traditional practises, it was said to be more enjoyable.

In the study by Kurt et al. (2013), as we have mentioned above, teachers' opinions on components of the FATİH project were examined. According to teachers' positive views on the use of interactive boards: interactive boards saved time, they made lesson transfer faster so they gained time for different activities, teachers got less tired physically, they had more and diverse materials; their negative views were that: tablets had negative effects on class management as they decreased eye contact. Moreover, in the research, interaction and unity culture between teacher-teacher, teacher-student, student-student were observed within the context of the use of the project and technology.

According to the study by Şad and Özhan (2012) in which the situation was evaluated in terms of the perspective of the students, the use of interactive boards not only saved time but also provided better learning results by using visualization and multimedia. Thus, interactive boards were found to have achieved positive results from the viewpoint of both teachers and students.

With a proper perspective, Ekici and Yılmaz (2013) intended to interpret the Project within the frame of project management criteria and they investigated the web page, related works and workshop reports that were made by the Ministry of Education for the Project. As a result of this study, the project was revealed to be unsuitable for the logic of project development and not able to be integrated into the education system.

When Albayrak (2014) examined the findings of the study that appraised the use of information technologies in terms of classroom management in the schools in the scope of project, his findings were as follow: interactive applications with smartboards provided more positive contributions in terms of classroom management than conventional teaching models; tablet computers were not be able to be used for the purpose of them; appropriate contents fitted with lesson gains should be designed and presented according to attentions of students in order to make tablet computers activate were put forward. In addition, the study showed some positive aspects of classroom management with regard to interaction in the classroom and some negative aspects with regard to wasted time due to technical problems.

24.6 Results

FATİH, when compared to other similar studies all over the world, has come to the fore as a project that aims to achieve revolutionary innovation. When studies in literature are investigated, the changes that the FATİH project has brought about during the education process can be said to create both positive and negative differences for teachers and students as the most significant stakeholders of the process.

As a result of the findings obtained from pilot studies in the scope of the project, a communication medium that develops through mutual knowledge sharing such as technical assistance for teachers and students is one of the favorable points of the project (Pamuk et al. 2013)

Additionally, various learning materials developed in the context of the project by many students and the presentation of these materials using tablets and smartboards have indicated that the lessons become more enjoyable and fun.

The technical equipment is one of the issues that received the most negative feedback. Particularly, it has been stated that teachers have had technical problems with smartboards and tablets and they have not had enough support, and parents who are among the important stakeholders have not been sufficiently informed about the project.

When the studies were investigated, another outstanding point in the project were the suggestions of teachers, students and managers with the aim of improving the functionality of the project. Enriched e-books (r-book) and other educational sources especially, have been expressed as being insufficient and requiring improvement in terms of the support for learning activities.

Finally, restrictions within the provided technologies (internet password, non-use of memory stick etc.) have been seen to be another problem of the use of technologies by teachers and students.

Studies show that above all the technical infrastructure and support services ought to be improved in order for the FATİH project to be practiced effectively. It is also thought that increasing the interaction between interactive boards and tablets and shaping the restrictions of use of these devices in accordance with the suggestions of stakeholders will influence the technological acceptance of the project and usage attribute positively.

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Turkish Aacademics and Students in the Context of Skill Shortages in Germany

25

Winand Dittrich and Natalina Reuffurth

Contents

25.1 Introduction

Although known since the 1960s, the realization that German society will prospectively overage and then shrink has prevailed and led to an intense public debate with increasing interest in the last decade in Germany. At the other side of this debate, Turkey has actively promoted a change in demographic development by backing family policies and birth rates. This demographic change is an all-pervasive social change process that will change the socio-structural fabric of both the German and Turkish society radically as fundamentally. And this change is not found faint: Not set in stone, the demographic challenge seems to show a customizable, pre-political dimension. Nations' task is to provide

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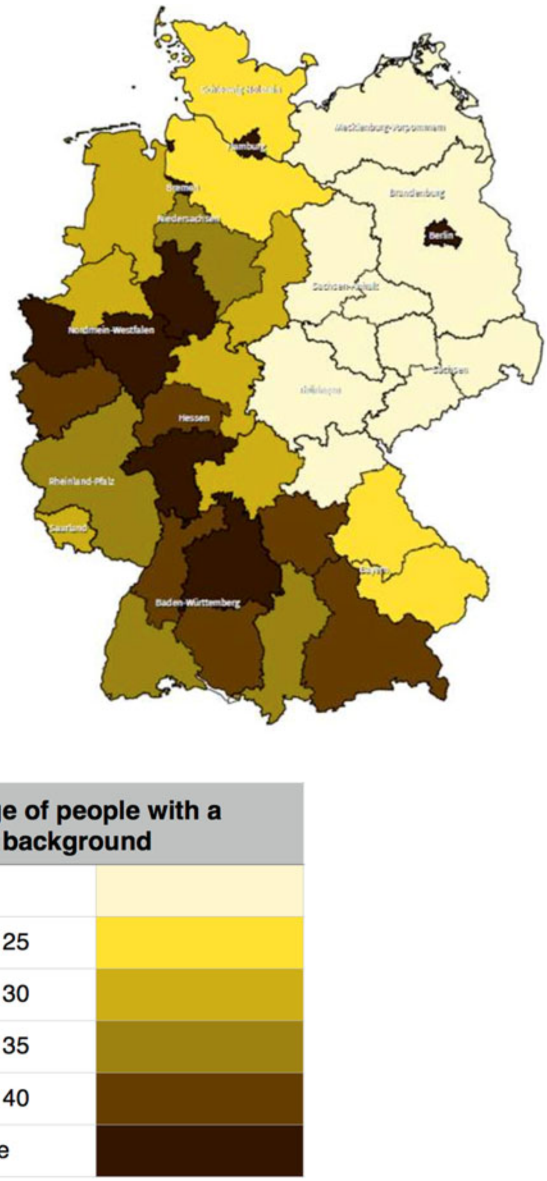

Fig. 25.1 Geographical distribution of people with migration background living less than 10 years in Germany. (Source: Statistisches Bundesamt (2009, S.19))

sustainable and long-term welfare. In more and more globalized societies, welfare depends on their competitiveness at an international level. A crucial factor seems the potential for innovation and knowledge transfer that heavily again seem to depend on the skill level and education of the workforce. In this sense, in every country the high demand for academic and highly qualified specialists to create value in new ways is a challenge for each society.

One of these customizable political issues represents the potential of students and academics with an immigration background that is inherent in German society, but is hardly discussed in a systematic way. One systematic approach has been adopted in the social study of Turkish Academics and Students in Germany (Futureorg 2009, TASD study).

The Federal Statistical Office reports that over 15 million people have a migration background. This corresponds to a share of more than 18% of the total population. Particularly in some regions in western Germany (and Berlin), the proportion of persons with immigrant backgrounds less than 10 years is at least 30% and in some regions more than 40% whereas in the eastern parts the proportion seems consistently less than 20%, in some regions (e.g. Dresden area) even fewer than 5% (see Fig. 25.1).

Evaluated from the perspective of human capital, the German society will have a large pool of workers with a migration background in the coming years that will determine the labor supply of the future – especially in the cities. Recent studies seem to indicate, however, that the country will utilize this potential insufficiently (see Veith et al. 2009).

"Only 4 of 100 high school students are foreigners and 8 of 100 middle school students have a non-German nationality. Are foreign students so underrepresented in those types of schools that allow good to very good prospects for an apprentice position or study place? So their share of those schools is particularly high that open up considerably less opportunities: lower secondary schools, one in five students is a foreigner, at special-needs schools there are 16% foreigner" (see Veith et al. 2009).

Please note, recent political developments on migration in Europe and the Turkish-German relations took place after finishing the article in June 2015. Nevertheless, the main topic of brain drain and skill shortages in both countries seems more important than ever.

25.2 Shortage of Skilled Labor as a Result of Demographic Change

One of the consequences of demographic developments is the so-called shortage of skilled workers. Skills shortage exists when positions in the economy and society that require specific qualifications and skills cannot be filled by persons who possess these skills and competences. This condition can lead to a reduction of performance and innovation of an economy and the quality of the business location. Therefore, the concern about the consequences of the shortage of skilled workers not only seems entirely justified, but also points to a huge challenge for personnel selection and vocational training rsp. higher education.

In fact, in economic sectors or geographical regions, it can be observed that there is a serious lack of professionals necessary to secure economic success. This concerns for example the regions of Baden-Württemberg, Berlin/Brandenburg and Saxony as well as certain industries (see Kettner and Spitznagel 2007).

Job	Unemployed per registered office (Federal Agency for Employment)	Bottleneck
Humanities scientists	19,4	
Artists	12,4	
Cashiers	10,8	no
Office workers	9,0	
Legal representatives, -consultants	7,7	
Doctors	1,1	
Electrical engineers	0,7	
Machine and vehicle construction engineers	0,7	yes
Nurses, midwives	0,6	
Electricians, Monteurs	0,5	

Fig. 25.2 Unemployed per registered office. (Source: Based on data of the ANBA 2012)

As shown in Fig. 25.2, an overview of the shortage on the German labor market by occupation indicates an uneven distribution. It turns out that in some cases in technical-scientific and health-related qualifications a pronounced labor shortage exists. Under the labor market aspects, Germany should strive for primarily these qualifyied groups of workers on a more active recruitment from abroad and vice versa improve the emigration of German trained foreigners through appropriate retention schemes.

The time until a vacant job can be occupied by a suitable work force has risen enormously. Thus, it is evident that for companies it is becoming increasingly difficult to find suitable workers. Obviouly, this condition can be seen as no risk to the general economy.

However, it should be noted that the cause for the earlier described lack of labor and professionals is not only grounded in the demographic development. Rather, it can also be attributed to deficits in the German education policy and, partly, to the compartementalization of the education system. It has failed in the past to cover the foreseeable needed skills in the economy and society by developing the economically needed and relevant skills and trained knowledge (see Reinberg and Hummel 2003).

The full impact of the skills shortage – caused by the demographic development – is going to hit the economy at full strength from the year 2020 onwards. For example, the baby-boom generation are gradually leaving the active working life and going into retirement. The average age in the labor force will increase. The proportion of 50 to 64 year old people will grow from currently 24% to 32% in the year 2050. At the same time, the number of younger workers decreases: While 1990 more than 14 million workers were younger than 30 years, the number decreased in 2005 to about 10 million. 2020, this age group will count about 9 million workers. And according to estimates by the Institute for Employment Research (IAB), from 2050 onwards there will be 7 million workers under the age of thirty (see Fuchs and Reinberg 2007).

25.3 Academization Enhances Skill Shortages

Beyond the age structure of the labor force, the future and foreseeable shortage of skilled workers is enhanced by the qualification structure (see Fig. 25.3). Economic structural

Fig. 25.3 Qualification structure of the population between 1976–2000 according to age in West Germany (formerly BRD and West Berlin; age groups: 15–24, 25–34, 35–49, 50–64). (Source: Based on data of the IAB of the Federal Employment Agency)

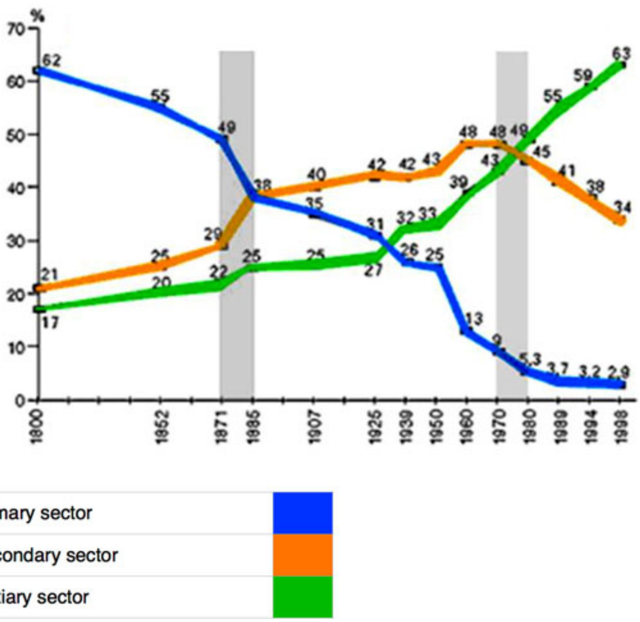

Fig. 25.4 Proportion of employees according to production sectors in Germany from 1800–1998. (Source: see Geißler 2007, p. 29)

change in Germany means that with a simultaneous decrease of the need for people without a vocational qualification, the demand for university graduates will increase.

However, the academization of modern societies is unsurprisingly: Jean Fourastié has set out in his three-sector theory that an economic system develops from an agrarian society through the industrial society to a service economy (tertiarization). The proportion of employees in the tertiary sector (service society) has overtaken from the 1970s the secondary sector (industrial society). Also in the services sector, low-skilled workers are still needed. But the trend is increasingly towards upskilling (see Seyda 2004). The planning and logistics of goods and services has become a higher priority than that of production. This actual demand can also be traced as a kind of historical trend when comparing the three production sectors, as shown in Fig. 25.4. Since the 1990s, the tertiary sector has overtaken the secondary sector strongly, not the least through the ever increasing influence of IT technologies.

25.4 The Myth of Deindustrialization

In recent years, there have been complaints that an increasing number of jobs from Germany is shifted to the so-called "low-wage countries". In fact, it is a painful process through many jobs are no longer available to the German labor market. However, it is not taken into consideration that the location-relocation often concerns simple activities of production which are mainly performed by semi-skilled labor. However, activities which require a qualification of labor and skills such as marketing, sales, planning, research and development, remain in Germany (see Hohensee et al. 2009). The location-shift thus represents a process of reallocation of resources in favor of the service sector in advanced economies that achieve comparative advantages in an international division of labor. From this shift, it can be predicted that further displaced low-skilled jobs will be shift to developing and emerging countries whereas highly qualified activities will remain in Germany, and even become more important (see Daglar-Sezer 2005).

25.5 Towards a Knowledge-based Society

Another approach, which explains the growing importance of highly skilled workers in modern economies, is also subsumed under the concept of so-called knowledge society. This is both: a structural economic change as well as a whole development of modern industrialized countries to an economic system in which the knowledge outflanked the productive forces land, labor and capital and is recognized as fourth productiveness.

In this context, the term of the knowledge worker is often introduced which will alter sustainable the product range, the mode of production, labor and innovation capacity of a society (see Böhret and Konzendorf 1997; Willke 1998).

The main task of the knowledge worker is – to put simply – to process information and knowledge in the elaborate organization such as that by interpretation and analysis and use of creativity, a value is achieved by generating and communicating new knowledge (see North and Güldenberg 2008). "Organised knowledge work, that can be seen today, will be a centrepiece of the transformation of the working and industrial society to a knowledge society" (see Willke 1998).

The three-sector theory of Jean Fourastié as well as the diverse works to the knowledge society demonstrate both that in the context of the transition from an industrial to a knowledge society, the demand for university graduates and highly trained professionals will grow in the near future. While it is expected that the supply of skilled labor will rise higher, it will not be enough to meet the needs of the economy (see Reinberg and Hummel 2003; OECD 2008). Moreover, less developed countries lack sufficient resources to perform research & development in new technologies. Consequently, they rely on knowledge transfer from more developed countries to assist their growth (see Smith 1999).

The OECD study "Education at a Glance 2008" comes to the conclusion that despite the increase in student numbers the professionals-offer in Germany is insufficient, both in international comparison and in terms of the needs of the German economy. Conclusion of the study: The German (further) training system is required to train more highly qualified persons (see OECD 2008).

25.6 Immigration and Emigration in the German Society

The increase or immigration of highly qualified foreign personnel to Germany has been discussed as an approach to tackle the skills shortage. The recently published figures from the Federal Statistical Office show that previously practiced immigration policy of the federal government has not achieved the desired effects. Although, the number of immigrants to Germany has remained constant, but the number of migration has increased over the same period. The 682,000 inflows to Germany are faced with 738,000 departures towards abroad. This trend even seems more prominent when focussing on German nationals only. Between 2009 and 2013 there were 710,000 departures and 580,000 returns (Expert Council 2015a).

The Expert Council of German Foundations for Migration and Integration has noted that there is a migratory loss account in Germany. For over 15 years, the number of departures of Germans outweighs the returnees.

Furthermore, it was disclosed that a large proportion of German emigrants are at the peak of their careers. The result seems clear: More than 75% of German emigrants are 18 to 65 years old and thus in working age; over 50% of emigrants are 25 to 50 years and so even in the core area of their working life (Expert Council 2015b).

According to a study of the Prognos AG to emigrate and return willingness of German emigrants, only 7% of German exiles plan to return to Germany. About 46% are disclosed towards a return to their homeland whereas about 46% of the emigrants do not want to return in the foreseeable future. It seems interesting that especially the highly qualified or academic emigrants take returning into consideration (see Prognos AG 2007, 2008).

Regarding migration in the science sector, the available data is not conclusive since there is still no institution in Germany that collects the data for research abroad centrally. An analysis must therefore focus on the single evidence. For this purpose, the German Research Foundation (DFG), which supports the national scientific research elite with scholarships on the implementation of long-term research stays abroad, analyzed the

Fig. 25.5 Proportion of German scholars abroad depending on duration of stay. (Source: Enders and Mugabushaka 2004)

Duration of stay	German scientists abroad	
	absolute	in percent
1 to 6 months	1.494	36,7
7 to 12 months	983	24,2
1 to 2 years	432	10,6
2 to 3 years	115	2,8
Over 3 years	67	1,6
Without indication of length of stay	976	24,0
Foreign countries in total	4.067	100,0

backgrounds and migration patterns of more than 1300 funded scientists (see Enders and Mugabushaka 2004, p. 13). The average residence time in the framework of such a foreign production was about one year, as shown in Fig. 25.5. Regardless of the examined cohort, only 15% of scientists to realized a permanent emigration in the sense that scientists still lingered abroad for 48 months later. 85% of supported scholars are described as temporary migrated. They returned within four years to Germany – and a majority in the local research environment (see Enders and Mugabushaka 2004, p. 13).

25.7 Highly Trained Foreign Nationals as an Option

A third aspect that influences the impact of the already foreseeable shortage of skilled workers seems strongly associated by the existing population of immigrants rsp. people with migration background. The fact that Germany is an immigration country is now recognized as a political and social reality.

When discussing a growth of knowledge in science, it has to be taken into account that Germany also benefits to a substantial extent by the influx of top international researchers. Thus, for example at the Max Planck Society, which not only measured on the obtained Nobel prizes leads to the most successful top-level research facilities, in 2006 53.8% of all junior and visiting scientists and half of appointed junior research group leader were foreign nationals (see Max Planck Gesellschaft 2007). A detailed analysis of in the science sector prevailing motives for migration abroad shows that the overwhelming majority of researchers want to improve their chances on the German labor market by the temporary stay abroad – as a result of the reputation of a particular foreign research institution. "Overall, Germany is rather an import than an exporting country – regarding highly skilled workers" (see Jahr et al. 2002, p. 61).

An essential addition to language skills a prerequisite decision for the migration of highly qualified represents the recoverability of their own qualification in the destination country. In this respect, there are very large differences between individual disciplines. Essentially, very low barriers to migration, qualifications are faced that purchased knowledge in one country A is almost one to one available for the exercise of the target profession in country B. Among these are primarily technical and scientific qualifications and health professionals, as the same scientific-technical and anatomical laws apply in every country around the world. Therefore, in this group there is – largely independent of the situation in the country – due to global recoverable qualifications in principle a large number of employment opportunities abroad, provided an adequate linguistic competence level.

Most interestingly, Silicon Valley has significantly benefited from 'transnational or commuting specialists' which transferred competences from the highly developed to peripheral regions. In this case, transnational or commuting entrepreneurs are well educated people from India or China who left their home country due to poor economic or political conditions in order to study in the Unites States (see Saxenian 2006). After conditions in the home country had improved, those people returned and founded knowledge-intensive companies benefiting from their experience and linkages with the highly developed regions. As a consequence, special skill networks are set up where knowledge is transferred that emerges due to local and international linkages of transnational or commuting highly skilled experts. Similar developments are likely to occur between Turkey and the EU if exchange options are in place.

High barriers to the labor market side recoverability abroad exist in contrast in a second group: The acquired knowledge in country A seems severely restricted in or not available for the exercise of the target profession in country B.

This is particularly the case with lawyers because they have different laws and case law from country to country. But the vast majority of teachers, administrators and linguist acquire within the study skills that are strong (national) specific nature respectively faced with a country-specific concentration of demand.

In summary, in Germany, knowledge-intensive qualifications are sought after given labor market shortages. In this case a high potential for migration is given. However, this applies both for supply and for migration.

25.8 Turkish Academics and Students in Relation to Germany

Considering the developments as illustrated, Germany seems to be in a good position in respect to integrating and accommodating the TASD, i.e. the Turkish-born adolescents and young adults who were able to escape the suction forces of the downward spiral in the educational problems of the German-Turkish community and successfully passed the German education system. They undoubtedly belong to the educated elite of this country. As a (future) university graduates, they are highly qualified which is why they have skills and qualifications that are needed today, and especially in the future at the German economy.

With that said people in Germany also tend to attest this population that they are well integrated and feel at home in Germany (see SVR 2009). Thus, a migrant seems to be integrated when the person masters the German language. Education and associate qualifications can also be seen as a kind of entry step for successful integration into the German society. Consequently, in principle, there is no need for it to worry about this highly skilled part of the population with migration background.

But a social study on Turkish Academics and Students in Germany (see TASD study 2009). shows that in this population group the above described social and economic development strands (shortage of skilled workers, migration readiness of highly qualified specialists, academization the economy, migrants qualification to mobilize a hidden reserve) and the shortcomings of integration policies are mirrored: Asking about intentions, more than a third of highly educated TASD plans to leave Germany in the direction of Turkey in the midterm.

The following data reported about TASD are based on this study.

For example, in 2011, in Germany were 27,855 inflows confronted with 27,471 departures of Turkish people. However, whether the migration balance is actually compensated and how it is differentiated by skill level, cannot be conclusively assessed due to a lack precise data. So especially in the German migration statistics, qualification and occupational parameters are captured insufficiently. Furthermore, the official statistics in general collect neither the legal basis nor the nature of supply and period about whether this is a permanent or temporary emigration. Finally, the counting in the context of immigration and emigration statistics takes place not personal, but case-oriented. Therefore, it can come – not least in circulated migration – to seriously flawed double counts. Statements about the precise scope of a net migration of highly skilled professionals in the segment can therefore only been made to a very limited extent.

The TASD study is one of the few sources on the numbers of returns and the underlying motivation. However, the study's results are merely based on intentions and attitudes as well as methodological shortcomings have to be noted. For example, the sampling strategy led to great difficulties when describing the group of participants in detail. More seriously, the motives of the highly-qualified TASD who have actually returned to Turkey were not taken into account.

The successful integration of migrants in Germany will depend on several factors: As the most frequent subject, the TASD indicated the "lack of a sense of home to Germany". Second, ranked were given "professional reasons". The "economic reasons" and "family reasons" take a lower position at the TASD. Although, this result is significant, it would be too short sighted to see the main reason for the high migration readiness of TASD in their low identification with Germany. A differentiated analysis of the data shows that the emigration motives vary greatly depending on the housing area's environment and social perspective.

For TASD men "missing sense of home to Germany" seem a stronger motive for emigration than for women. Although, the women have given the lack of a sense of home as an important migration base, but in contrast to the men, this is just as important as professional reasons. The women are more willing to emigrate within the first five years towards Turkey, whereas the men are planning long-term.

Also for students, the lack of the sense of home is an important, but not the most important emigration factor. Professional reasons have a great importance. However, almost every second academic justifies his/her emigration readiness with missing some kind of home feeling.

These results lead to the question whether the emigration intention of TASD is influenced by other factors. In the study, obviously parents play a very important role. Master the parents the German language poorly and have a low level of education, they are dissatisfied with their life in Germany or even regret their migration to Germany, so this negative attitude of parents seems to rub off to their highly qualified children. This assumption is also supported by the strong family orientation from the TASD that are confirmed by the empirical data.

Religion also explains the emigration trend of the TASD: Religion has an important role for the TASD, and if they have the opinion that they cannot freely exercise their faith in Germany, the migration readiness is very high. However, it hast to be pointed out that the TASD live their faith in a variety and individual way. Religion is for this population quite important, but in the exercise and interpretation of religious precepts they are inconsistent. Regular attendance at Friday prayers, the five prayers a day, the observance of Lent or consistent compliance with the so-called halal regulations when consuming meat products is apparently under the proviso of compatibility with the requirements of the modern working world. It is interesting that the TASD can reconcile their faith very well with a secular system.

Another important sector for studying links between Turkish academics and Germany is funding level of on-going joint projects at the European level in EU research programs. It seems the strongest partner for Turkish universities for EU funding opportunities seem to be German research institutions such as the German Fraunhofer Society or top universities at Berlin and Munich (see Heller-Schuh et al. 2011). Since Turkey has been given the status of a EU candidate in 1999, the research funding and cooperation opportunities, involving at least one Turkish partner, in EU Frameworks 6 and 7 (FP6–7) have seen a continuous increase. These established connections between the two countries might support Turkish research institutions in their development towards European integration and interactions, e.g. regarding funding networks. At the same time, there seems still a potential and great opportunities to further develop new and extensive links with education or research institutions in Germany or the EU considering that German research institutions or universities seem to have a central role in many projects or networks supported by the EU Frameworks. In this respect, political support in both countries to explore and strengthen bilateral institutional connections between academic and research partners would seem beneficial in addition to migration and knowledge transfer at a personal level.

Conclusion: Make Generation Germany from Generation homesick

These findings highlight factors of immigration for- and backwards, so to speak from an inner view in respect to Turkish academics and students in Germany. The potential seems impressive and shows that the successful integration of migrants depends from more factors than language skills and educational qualifications. These include an improved educational and vocational situation and also in the broadest sense a "culture of recognition and acceptance" that the migrants in general and the TASD in particular can identify with Germany.

It should be clear that a profiting integration policy does not start at the TASD but with their parents. The attitudes of their parents towards Germany, their educational situation and language skills seem to have influence on the attitude and loyalty of their highly qualified children against Germany.

At this point, the question arises what makes sense to integrate enhanced that parents who belong mostly to the first generation of immigrants. The analysis of the data from the parents shows that with a particular qualification a potential exists for the mothers which can be activated even at an advanced age (see Futureorg 2009; 3rd substudy TASD).

Even religion is a customizable action dimension that has a positive effect on the attitude of the Turkish highly qualified. Religion is obviously an important part of one's identity. In the majority of the TASD are religious, but in the exercise of their faith, they are pragmatic. Even though the TASD are inconsistent in the exercise of their faith, promoting a more tolerant approach and acceptance of their religion, promotes the identification with Germany.

The TASD are also keen to identify career opportunities. In particular those TASD want to move that were associated with the high-achiever type. They want to occupy leadership positions and achieve career advancement. Because of that, the diversity management is given a major importance to providing incentives to a return of TASD. For example, it has become evident that the influx of foreign doctoral and post-doc students to Turkish universities seems highly underdeveloped in recent years, also applicable to TASD students.

The analysis of the career biographies has revealed that the majority TASD are employed in large companies. Taking into account that the demand for highly qualified will increase in the future in particular in small and medium-sized enterprises (SMEs), it is obvious how important it is that diversity management is implemented in more SMEs.

That TASD, nevertheless, attach great importance to Germany can be seen that the interest in the political process is very big in Germany, civic engagement is remarkable and the satisfaction with life in Germany as a whole is assessed as well. The chances are very good for the players of German integration policy in order to transform the generation homesick into a generation "Germany" and to use their full potential in terms of German society.

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Part VI
SME

Risk Controlling in SMEs – a German-Turkish Perspective

26

Basic Considerations for the Design of an Empirical Investigation

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Contents

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26.1 Introduction

26.1.1 Background

Small and medium enterprises (SMEs) both in Turkey and Germany are particularly important for the national economy. This is especially true for the provision of jobs and training places and the innovative power (Alptürk 2008; Müftüoğlu 2002, p. 51 ff.; Haşit 2009; Rehn 1998, p. 36 f.).

Especially due to their lower internal bureaucracy, SMEs are commonly regarded to be more innovative than large enterprises. However, this is not reflected, for example, by patent applications or product/process innovations (Maaß and Führmann 2012). When organizational innovations are additionally considered, this image changes: 78% of companies with 10 to 49 and 84% of companies with 50 to 249 employees participate in the innovation process, compared to large corporates with 95%. Therefore, SMEs are more innovative than previously reported (Rammer et al. 2014). One always has to keep in mind, that a stable innovation process is a "condition sine qua non" in the global competition.

In both countries, SMEs are faced with growing challenges (see Fig. 26.1):

- The transformation of the society leads to an increasing pressure of various stakeholders (Christopher and Towill 2002, p. 3). Examples are environmental protection, ethics, "mature" consumers etc.
- The economic world in general is newly-minted by New Economy and internet-based concepts and solutions gene (Emre and Budak 2006).
- The competition increases in the wake of internationalization and globalization. This is accompanied by:
  - a complex and dynamic competitive environment (Chapman and Ward 2003, p. 1053; Giddens 2003; Miller 1998, p. 500; Rahman and Kumaraswamy 2002, p. 49 f.),
  - the globalization of markets,
  - shorter product life cycles, and
  - complex linkages within corporate networks (Mäder and Hirsch 2009, p. 179 ff.).
- Uncertainties of supply and demand often bring companies in risky situations (Craighead et al. 2007, p. 132; Harland et al. 2003, p. 53; Hult et al. 2004, p. 244): Even events in distant regions can influence persons and organizations who are otherwise completely uninvolved (Beck 1992, p. 29).

In this increasingly complicated environment, it should not be forgotten that, for companies, there is no alternative to risk taking. Addressing the challenges involves and requires taking entrepreneurial risk. Control of risks requires risk management which is supported by risk controlling.

Failures within risk management and risk controlling can affect companies severely or even ruin them. Striking cases for this were:

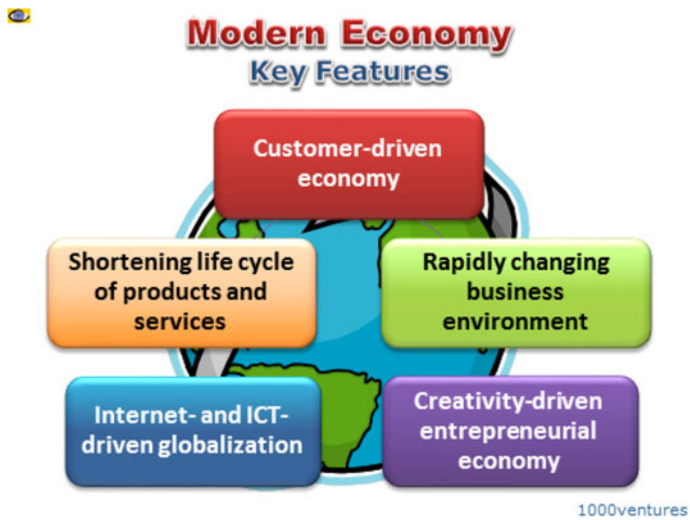

Fig. 26.1 Key features of modern economy

- in Germany: Metallgesellschaft, Daimler, Schlecker, and currently Volkswagen,
- in Turkey: Golda, CBS, Rodi Mood, Orion Holding, and Fi Yapı.

Due to the cases mentioned above and their consequences for the entire national economy, the regulators have reacted. Consequently, newly introduced rules limit the entrepreneurial freedom in the design of risk management and risk controlling.

26.1.2 Content and Approach of the Overall Project

Within the environment outlined above, the research project consists of gathering insights into risk controlling at German and Turkish SMEs. The project aims at increasing the penetration of controlling skills and by this, improving the resistance against risks of this economically very important group of companies. The approach of the project can be described by the following three steps:

1. Analysis of the current state-of-the-art risk controlling in SMEs in both countries through literature analysis and derivation of challenges.
2. Usage of the findings of the literature review for the generation of issues as part of an empirical study with a focus on the socio-cultural aspects of risk controlling.
3. Derivation of options for action from the results of empirical study of German and Turkish SMEs.

As part of the project, in this article we reflect the following central questions:

1. What are the external (legal) requirements for risk controlling in SMEs in Germany and in Turkey?
2. What are the differences between large companies and SMEs in relation to the design of risk control?
3. In what ways are there socio-cultural differences in terms of risk controlling in both countries?

26.2 The Importance of Risk Controlling

26.2.1 Risk Management and Risk Controlling

Risk management as an ongoing process is usually divided into three phases: risk analysis, risk planning/risk management, and risk monitoring. Due to the variety of tasks and the complexity of decision problems in these phases of the risk management process, risk management is in need of support and advice on the provision of the necessary methods and systems (Löhr 2010, p. 65). Considering the leadership supportive, system-forming and system-connecting task of controlling, it is undisputable that risk controlling takes over the functions mentioned. In order to operate the risk management system systematically and throughout the whole company, information arising from the risk management system has to be connected with the controlling activities. As an integral part of controlling, risk controlling supports risk management in fulfilling its targets by providing the appropriate tools to identify, assess, and manage risks and by supplying risk-relevant information based on a hierarchy overarching risk reporting (Diederichs 2013, p. 21).

26.2.2 Design of Risk Controlling

Many features characterizing a company such as structure, company size, industry, etc. affect the design and implementation of risk controlling. One must also keep in mind that each national culture is an important determinant of the design of organizational and controlling systems and their effectiveness (Hoffjan and Boucoiran 2008, p. 66). Cultural, social, legal and political sub-differences affect the strategic and operative business. Apart from these mentioned factors that have an impact on the design and implementation of the controlling function, the specific risk factors – such as risk culture, risk strategy and risk governance also have an impact on risk controlling.

While risk management initially focussed on the financial perspective (Seshadri and Subrahmanyam 2005, p. 3; Sodhi et al. 2012, p. 7), the realization now has prevailed that all areas of the company are to be involved and particular risks arising from human error must be focussed (Specht et al. 2006, p. 529). Additionally, one must be aware that each national culture is an important determinant in the design of organizational and controlling systems and for their effectivity (Hoffjan and Boucoiran 2008, p. 66).

26.3 External Requirements on Risk Controlling

26.3.1 Similarities and Differences of Regulation

In general, companies are free to decide whether or not to build up a risk management and risk controlling. As a consequence of massive losses arising from the lack of risk management, legal provisions have been introduced both in Germany and in Turkey that oblige certain companies to implement risk management. However, there are differences regarding the timing:

- In Germany, the inclusion of risk management requirements in legal rules began in 1998 with KontraG.
- In Turkey, the rules on risk management within the framework of the Capital Market Act were established later, in 2003. A more fundamental change which brought significant progress steps in terms of risk management, was carried out with the new Commercial Code in 2012 version.

26.3.2 Legal Regulations on Risk Management in Germany and Turkey

In both countries, a set of rules for regulating risk management was issued concerning different types of companies. Table 26.1 summarizes the legal foundation and the major contents of regulation for companies in Germany and Turkey which are relevant for risk controlling.

As a resume, in both countries public companies and companies with limited liability are explicitly obliged to establish a risk committee and a risk management system. In Germany, violations of the obligation count as an undutiful behavior of the Executive Board. However, in both countries rules and principles do not contain any minimum requirements for such an early warning system.

Additionally, the statutory regulations on risk management exclude private companies in both countries. In Germany, however, the explanatory memorandum of the KonTraG contains a statement that the rule applicable to corporations with regard to the early detection of risks may also have a ripple effect on the scope of managers in the other company forms.

Table 26.1 Legal regulations on risk management at a glance

	Germany	Turkey
Legal regulations leading to changes in risk management	KonTraG (1997), BilReG (2004), BilMoG (2008)	–
Law containing provisions on risk management	German Commercial Code, German Stock Corporation Act	Turkish Commercial Code, Turkish Capital Market Act
Risk management in public companies	– Public companies which are listed on organized markets are obliged to report on their risk management system in their management reports (German Commercial Code). – All public companies are obliged to assess the expected development with its essential opportunities and risks in their annual management reports (German Commercial Code). – "The board of the public company has to set up appropriate measures, especially a monitoring system, to ensure that developments which could endanger the existence of the company are detected early." (Risk early-warning system) (German Stock Companies Act).	1. Public companies whose shares are traded on the stock exchange are obliged to set up an early detecting risk-committee (Turkish Commercial Code, Turkish Capital Market Act). 2. Public companies should report on the expected risks in their annual management reports (Turkish Commercial Code).
Risk management in limited liability companies	– Companies with limited liability whose securities are dealt on organized markets are obliged to report about their risk management system in their annual management report (German Commercial Code). – Companies with limited liability which set up a management report are obliged to provide information about the risks and opportunities of their company (German Commercial Code).	– With the exception of small companies, all limited liability companies are obliged to set up a risk committee (Turkish Commercial Code). – Companies with limited liability should provide information on the expected risks in their management report (Turkish Commercial Code).

26.4 Differences Between SMEs and Large Corporations Concerning the Design of Risk Controlling

26.4.1 Opportunities and Risks of SMEs in Comparison to Large Companies

As mentioned above, small and medium enterprises (SMEs) both in Turkey and in Germany are of particular importance to the national economy for providing employment and ongoing innovation. In both countries, SMEs have to respond to the growing challenges they are facing due to the increasing competition because of internationalization and globalization, the transformation process especially in the Turkish society or by the New Economy, internet-based concepts and business world solutions newly embossed. SMEs have size-specific advantages and disadvantages in comparison to large enterprises which are relevant for the design of risk controlling: On the one hand, the smaller size of SMEs can be of specific advantage because they usually have flat hierarchies which enables a more flexible decision making process. On the other hand, SMEs often face:

- taxation discrimination (Sarısoy and Sarısoy 2008),
- disadvantages of scale as in the field of securing the financial resources,
- difficulties with export activities (Kılıç 2011), and
- problems enabling corporate governance.

The main barrier for SMEs consists of lack of financial resources which are required for investments in new technologies (Rautenstrauch and Müller 2005).

In general, the lack of investment affects the adaptability of SMEs to the new business world. The lack of financial resources also influences the extent of implementation of controlling systems which enable preparing informed decision (Kummert 2005, p. 155 ff.) Consequently, many SMEs in Turkey as well as in Germany are far from complete reporting systems.

Apart from financials aspects, the dissemination of controlling instruments in SMEs has been hampered because these were originally geared to the needs and resources of large companies and therefore not suitable for applications in SMEs (Dintner 1999; Dethlefs 1997, p. 40 ff.; Benz et al. 1999). However, controlling instruments have meanwhile been developed for the specific needs of SMEs and they are ready for use in companies (Funk et al. 2009; Gleich et al. 2006; Hegglin and Kaufmann 2003; Müller 2009; Schade 2007; Schulze 2010; also Kramer and Valentin 2009, p. 89 ff. for an overview). Nevertheless, preliminary studies show that the extent of the practical use of these controlling methods in German and Turkish SMEs still is full of gaps. This is unfavorable, both from an individual (company-orientated) and from an overall economic perspective, since potential and existence-threatening risks remain undetected.

26.4.2 Opportunities and Risks of SME-specific Leadership Models

It is important to recognize that SME-specific leadership models include both opportunities and risks.

In SMEs, decisions are often made by the company owner/owners "from the gut" i.e. without adequate situational foundations (Rehn 1998, p. 116 ff.; Dahms and Siemes 2005, S. 230). This aspect is also connected with the concentration and centering of the entire corporate management on the owner(s) who oftentimes is/are closely linked to the corporate formation and evolution. Thus, successful entrepreneurs often have founded companies or expanded them without adapting their management structures to the growing company size. Such patriarchal or autocratic leadership cultures are distinctive feature of many SMEs.

In general, such a leadership culture can be favorable for the implementation of visionary ideas. Therefore, these leadership structures have led to a brilliant rise of companies in Turkey as well as in Germany. Striking examples for Turkey are Koç or Sabancı, and for Germany SAP or AWD.

However, SME-specific management models also bear risks. Management structures which are oriented on one or a few people are prone to rapid collapse due to seriously wrong entrepreneurial decisions (Rautenstrauch and Müller 2005). The history of companies is filled with spectacular examples such as Schlecker or Grundig. The analysis of company failures indicates that in addition to company-external events (such as a drop-out of substantial customers or suppliers), primarily corporate causes are responsible for failures. *Mitroff and Alpaslan* (2003, p. 111) and *Coleman* (2006, p. 5) show that exceptional problems that interfere with the organizational routine and based on human errors are more common than in the past. Especially general management shortcomings and wrong decisions as a consequence of serious false assessments in areas like strategic planning, production planning, supply planning, sales planning, human resources planning or financial planning (Hoogen and Lingnau 2009; Elsweier and Nickel 2010) are typical causes of corporate imbalances.

Especially in owner-managed companies, emerging crisis symptoms are often detected too late or not at all (Rehn 1998, p. 121 f.). An important reason for the emergence of risks and the delayed introduction of countermeasures must be seen in an insufficient foundation of business decisions. As stated before, this is connected with the fact that in SMEs, controlling instruments designed to support decisions are oftentimes only partly implemented (Hoogen and Lingnau 2009, p. 112 ff.; Feldbauer-Durstmüller et al. 2012; Berens et al. 2007). In companies that have experienced rapid growth, the foundation of decisions especially reflects the situation in small enterprises. Thus, the need for a controlling process is only seen in part and additionally, the results of the existing instruments are ignored.

Besides financial constraints, the fact that crises do not fit into the self-image of the entrepreneur is in many cases responsible for this (Schindlbeck and Diringer 2004, p. 112). Entrepreneurs tend to ignore that human beings make mistakes, especially because previous economic success seems to be the proof and guarantee that severe mistakes will not occur in the future. Against this background, it is purposeful to question why people (and hence also entrepreneurs) error. This also serves as a foundation for the further research: Are there differences between German and Turkish entrepreneurs due to intercultural differences?

26.5 Why do Entrepreneurs Error?

26.5.1 The Error Model of the Dirty Dozen as a Basis for the Identification of Human Sources of Error

Ever since it has been found that human beings are responsible for triggering errors in complex systems, theory and practice have been dealing intensively with the question of how errors occur and how they can be minimized or avoided. In science, there are various fault classification models, but so far, a standard classification is missing. In particular, the contributions of *Reason* (1990) and *Senders and Moray* (1991) have found a high level of awareness and formed the theoretical basis for the research on misjudgments and error. Nevertheless, many error classification models lack practical relevance and applicability.

The Dirty Dozen model of *Dupont* (1997) describes several factors that can lead to human error on all corporate levels. In particular, the model seems to be suitable for analyzing the causes of human error related to decision making. According to the model, human errors can be classified in twelve aspects (see Fig. 26.2.). With regard to risk management/risk controlling in the context of SMEs, some aspects are particularly relevant (marked with arrows).

26.5.2 Contents of the Error Model of the Dirty Dozen

Former investigations have shown that in aviation human factors are the main causes of accidents and near misses. In this sector, therefore, extensive research with respect to the mistakes made by people was conducted. Practically, there is not any error (not only in aviation) that is not somehow initiated by people. The error model of the "Dirty Dozen" of Dupont can be seen as an explanation approach for fault causes. It was deduced from practice and includes twelve different possible psychologically motivated causes and conditions for making mistakes in aircraft maintenance. Based on this, accident researchers developed, in cooperation with airlines, trainings to reduce errors in the field of aircraft maintenance. In addition to the development of Human-Performance-in-Maintenance Workshops (HPIM), another result of Duponts' work was the concept of the Dirty Dozen which today is an integral part of Human Factors training in the aircraft maintenance of many airlines.

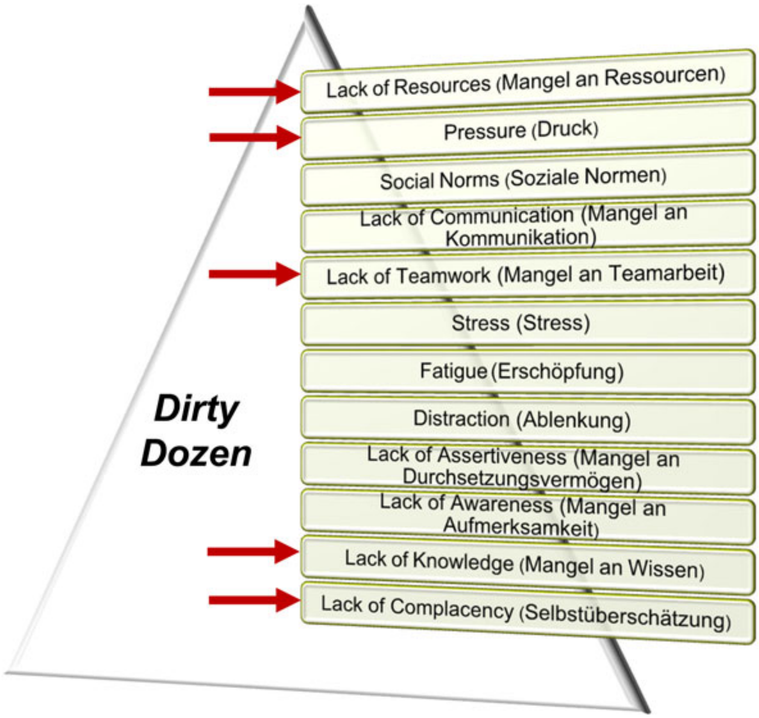

Fig. 26.2 Dirty dozen Model of Gordon Dupont

The model distinguishes the following factors which are explained shortly (Schöning et al. 2014):

1. *Complacency* (hybris) is reflected in an overestimation of one's own ability to make decisions in an increased self-confidence, in an excessive risk-acceptance and an underestimation of those problems that seldom occur. Moreover, persons with marked complacency often show a carefree attitude towards technical security and automation which manifests itself, for example, in a superficial and less careful carrying out of work tasks or negligent supervision of automated processes.
2. *Lack of knowledge* may result partly from arising, for example, from a lack of vocational training and partly from a lack of job experience.
3. *Lack of awareness* can be caused by a lack or loss of continuous attention. As a result, danger or warning stimuli are not recognized. A lack of or insufficient risk consciousness that manifests itself in a lack of awareness of potential danger potentials also falls under this category. In addition, a lack of situational awareness is an indication of a lack of attention which means that both the estimation of possible consequences for work areas as well as a foresight of failures is missing.

4. *Lack of assertiveness* manifests itself in the lack of self-confidence. Thus, security deficits are not addressed, confrontations are avoided and problems due to uncertainties are not revealed.
5. *Distraction* leads to the interruption of work. This can lead to errors when the tasks are continued. They can arise when workers are distracted by their colleagues (external factors). But personal issues/concerns and a lack of motivation (internal factors) may also be responsible for distraction.
6. *Fatigue* (tiredness) can be attributed both to personal factors such as a general physical conditions as well as to organizational factors such as overtime or shift work.
7. *Stress* as a cause for the emergence of errors can have various triggering factors. Reasons connected with the carrying out of work are for example excessive demand by too many different tasks. But social components such a bad working environment or excessive responsibility may also contribute to the emergence of stress. In addition, environmental factors like noise and heat can promote stress.
8. *Lack of teamwork* manifests itself in a lack of readiness to cooperate within a team or with other teams. But even competitive behavior, role conflicts and tensions among colleagues and superiors, and a lack of understanding on cooperation are signs of this error category.
9. *Lack of communication* is reflected on the one hand in poor written communication, and secondly, in a lack of oral communication. Accordingly, fully formulated written working manuals may be missing and labor and handover protocols are produced inadequately. Within a team or group, information, for example, is passed inadequately at shift handovers.
10. *Social norms* evolve through a prevailing deficiency in safety culture within the company. Signs can, for example, establish safety-critical group norms for the creation of open spaces and a lack of innovation and willingness to provide information. Work safety often has a low priority within a company, thus, security interests are neglected.
11. *Lack of resources* such as tools, human resources, infrastructure or lack of information and knowledge.
12. *Pressure* can have various causes: Besides, pressure caused by short deadlines or just-in-time production, a predominant economic pressure arising from competition and cost pressures can lead to excessive workloads.

Although a scientific foundation of the error factors formulated by Dupont is missing, the categories can once more be found in a similar or only slightly different form in other concepts. This can serve as a token of verification of the existence of the error factors.

The analysis of SME-specific leadership cultures shows that especially factors 1, 2, 5, 11 and 12 seem to be important aspects in relation to risk management and the introduction of risk controlling in SMEs (Keuper et al. 2009, p. 58 ff.). The further research will therefore concentrate on these aspects.

26.6 Differences in Risk Control in Both Countries

26.6.1 Result of this Preliminary Investigation

Recent research shows that the scope of the practical use of risk-control procedures at German and Turkish SMEs is still incomplete:

- *Hatunoğlu* et al. (2013): In the study, the authors have questioned 350 SMEs from the areas Kahramanmaras and Gaziantep about the usage of controlling information. 69.4% of the companies surveyed believe that the controlling data is important or very important for planning. However, results from the study show that controlling reporting supports the management significantly more in the area of financing activities (67.6%) and less in the area of production activities (37.1%).
- *Mizrahi* (2011): In this empirical study, the author has asked 80 SMEs from the industrial district of İzmir (İzmir Atatürk Organize Sanayii Bölgesi) about the effectiveness of their controlling system. From the results of the study, it can be deducted that 65% of the companies surveyed do not use controlling as a source of information for management decisions. The study shows a strong positive relationship between the company size and the intensity of the use of controlling data.
- *Tak and Eroğlu* (2010): In this study, the authors have interviewed 470 small and medium sized companies from the district of the Bursa Chamber of Commerce referring to the application of strategy-oriented approaches to corporate governance. The authors found out that the lack of basing strategy decisions was one of the most serious conceptual weakness of corporate governance in SMEs. The study showed that only 30% of companies surveyed had strategic planning.
- *Ossadnik* et al. (2004): The authors surveyed 155 companies, each with less than 500 employees, on functional, instrumental and institutional design of controlling. 64% of the companies claimed that they had self-controlling filters. This form of institutionalization is present especially in companies with over 200 employees. In 31% of the companies surveyed, controlling tasks are done part-time. Only in companies with more than 100 employees, the implementation of comprehensive standard controlling instruments can be observed.
- *Wilken* (2007): The study of SMEs in North West Germany shows that controlling now has indeed a firm anchorage in SMEs. However, at the same time the range of modern controlling instruments and systems still is comparatively low.
- *Schindlbeck and Diringer* (2007): This study covering 235 companies shows a strong connection between the assessment of the performance of an existing risk controlling system on the one hand and the company's success on the other: 72% of companies that assess the performance of their risk controlling as high have an above-average corporate success. On the contrary, 49% of companies that assess the performance of their risk controlling as low, only have an average business success.

Thus, all analyzed studies show the high relevance of a well-designed risk controlling. Often, the degree of implementation of risk controlling increases with the growing size of companies (Mäder and Hirsch 2009, p. 173). In some areas such as investments, controlling instruments are already quite commonly used (Rautenstrauch and Müller 2006, p. 101 ff.). However, the studies do not consider the linkage between risk taking, implementation of risk management and risk controlling, risk attitude of owners and risk management "culture". This management culture – and consequently – the implementation of risk controlling are possibly affected by socio-cultural differences.

26.6.2 Content and Design of Research

26.6.2.1 Content

The research project in general aims at closing the research gap pointed out in the field of socio-cultural influences on risk controlling in SME. The project consists of two parts:

Part 1: Analysis of the status quo of the usage of controlling instruments in German and Turkish SMEs.
Part 2: Comparative analysis of SMEs in Turkey and in Germany and of German-Turkish companies.

The project has two major objectives:

Objective 1: Elaboration of socio-cultural idiosyncrasies about the controlling understanding and controlling practices of SMEs in the two countries as well as by business characteristics.
Objective 2: Derivation of measures to improve the understanding of risk and the implementation level of risk management and risk controlling.

26.6.2.2 Study Design

After an intensive analysis of the existing research literature, the project will contain the development of a questionnaire, the execution of the survey and an analysis and interpretation of the results. The authors intend to send out identical questionnaires to three groups of companies:

- SMEs in Germany,
- SMEs in Turkey,
- SMEs in Germany with owners of Turkish origin.

The background of this approach is to gain comparable information in order to identify similarities and differences.

In order to get the required information, the questionnaire will consist of the following contents:

1. General company information (size, industry, age),
2. Existing organizational structure, formal and real time leadership and decision-making structures,
3. Self-image of the entrepreneur,
4. Existing recognized future risks,
5. Risk management and risk-controlling procedures applied in the company,
6. Attitude of the owner to risk and risk management.

The survey will be conducted in collaboration with the German and Turkish national chamber of commerce. Students of the German Business Faculty of Marmara University Istanbul and of the SRH University for Applied Sciences Heidelberg, Campus Calw will be integrated for the evaluation of data and for further inquiries.

Intermediate Conclusions

SMEs are called the "innovation engine" of an economy and therefore risk management in these companies must be determined as a microeconomic and macroeconomic necessity: In a microeconomic context, it is necessary to keep in mind the limited resources of SMEs for risk management on the one hand and the limited risk coverage on the other. From a macroeconomic point of view, SMEs are faced – even more than large companies – with the increasing global competition.

Unlike in the past, deficits in SMEs in the fields of risk management can no longer be explained (and excused!) by the lack of risk management and risk controlling tools which are adapted to SME needs. Therefore, there must be other explanations for the rather low degree of implementation of these tools in SME. Insufficient risk awareness and carefree attitude to risk are likely to be key obstacles to implementation. Additionally, socio-cultural differences might also be a possible explanation. The research project will probably provide interesting information in this regard.

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Study of the Obstacles and Motivational Factors of Innovation in SMEs 27

Osman Demirdöğen and Farid Haddadzadeh Hendou

Contents

27.1 Introduction

Today, small and medium enterprises – in terms of their own advantages and characteristics, as well as their contribution to job creation – deserve to play an important role in the economy. A glance at the industrial economy in many developed countries and the newly industrialized world shows that support of small and medium enterprises is one of the main priorities of the economic development programs of their countries. These firms, despite the reduced need for investment, have greater economic efficiency and also play an important role in preparing for innovation and job creation. In different countries of the world small and medium enterprises are very similar and they are defined mainly based

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_27

on quantitative criteria, such as the number of employees or turnover rates. The European Union defines firms with 1 to 9 employees as micro sized enterprises, those with 10 to 49 employees as small sized enterprises and those with 50 to 249 employees as medium sized enterprises. In addition, their annual turnover respectively must be less than 2 and 10 and 50 million euro (The European Commission 2015). The development of science and technology, globalization and increasing competitive approaches influence the performance of enterprises, and business environments increasingly are dynamic, complex and unpredictable. Because of these changes, many companies are looking for new ways to conduct their business to create the most value. Not only is the need for change not detrimental but it can also create opportunities that enterprises must seek to exploit. What is important is the innovation of a firm compared to that of its rivals. Achieving effective innovation is complex work. The ability of SMEs to meet the needs of customers mainly depends on their capacity to innovate and offer new products with competitive prices. Innovation is an important stimulus to have a sustainable competitive advantage and also one of the challenges of small and medium enterprises (O'Regan et al. 2006). It is important to know that small and medium enterprises are not smaller versions of large firms. Their needs and decision making processes are significantly different and small firms also usually grow faster than large firms (Humphreys et al. 2005).

Scozzi et al. (2005) means that these firms have advantages due to their size. With their flexibility, many of them have strong relationships with their customers so they can respond rapidly to changing market and technology needs. Small businesses usually have good internal communication and a dynamic and entrepreneurial management style. In literature on innovation, the important role of small and medium enterprises in innovation is recognized and studies show their contribution to important innovations of the century. Because of the higher technical ability of employees in these firms, innovation can be less costly. Thus, in developed countries, SMEs and entrepreneurs are, beside universities, in the center of innovation and research and development policies (European Commission 2003).

27.2 Literature

Innovation is not a solitary occasion or action; it is a procedure. In terms of business, innovation is the era of new thoughts, the constant progression of items, organizations and forms and their business application. Two definitions for innovation are important:

- Product innovation: the introduction of a new product, or an important qualitative change in a current product.
- Process innovation: the introduction of a new procedure for making or conveying products and services

Inventiveness is the significant part of being innovative as it starts the process. Inventiveness is about making new ideas and the procedure of innovation includes making these ideas an actuality. Inventiveness is squandered if there is no procedure set up to take thoughts and transform them into something that has market potential (Doh and Kim 2014). The idea of innovation is in some cases mistaken for the term creation. While innovation and invention both are firmly related, invention particularly refers to revelations and plans or coming up with better methodologies for doing things. Creation is the technical part of innovation, including the improvement of a thought or finding a way in which it can work hypothetically (Raymond and St-Pierre 2010). It has been proposed that innovation involves a certain degree of luck in order to occur. While some innovations are made by luck, without the information to perceive that a thought has potential, opportunities can be missed. In most cases, even chance discoveries happen after a significant amount of effort has been put into inquiring about or creating related ideas.

In business, innovation is basically the commercial exploitation of reasonable thoughts. It includes the management of idea generation, technical development, manufacturing and marketing of a new product, process or service. Innovations can be categorized as one of three classifications; incremental, complementary or disruptive (Lööf et al. 2001). Incremental innovations are small changes, additions and improvements that are added to current products and services. Incremental innovations are added to products to develop the length of their lifecycle and keep them up to date.

Complementary innovations are new products or services that can be added to current product lines. They add value to your product lines without having a negative effect on your current products and services. Conversely, disruptive (or radical) innovations replace current products by being essentially better than anything currently offered in the market. They make current products redundant and are accepted by the majority or even the whole of the market.

Previously, various associations have possessed the capacity to survive even with extremely limited measures of innovation (Vaona and Pianta 2008). They focus on providing quality items and basically upgrade them to a level that maintains their aggressiveness in the market. This technique still applies to a few items with long lifecycles and some chances for innovation.

Recently, a few patterns have emerged that drive the innovation process. In view of the variables globalization and outsourcing, for example, there is an expanded push to improve efficiency and adequacy of associations (Ibid 2003). Associations require more than great products to survive; they need imaginative procedures and administration that can drive down costs and improve productivity.

Consumer desires additionally to drive the measure of innovation in the market. Clients are used to products that consistently enhance their lives and make them less demanding. Modern consumers are more educated and have more alternatives as far as what they purchase and who they purchase it from. Basically, clients won't accept mediocrity because they know they can simply go somewhere else. Innovation is vital as it is one of the essential approaches to differentiate your product from the competition. If you can't compete on price, you'll need innovative products and thoughts to make your business stand out from the crowd.

Innovation in your business can also be driven by the amount of innovation your participants are doing. Being the first on the market with a new product can offer you significant benefits in terms of building a customer base. It is difficult to compete if your products are seen as old or outdated (Krishnaswamy et al. 2014). When putting resources into innovation, however, remember that numerous organizations get by replicating and adjusting the innovations of others, and can benefit from your hard work.

In a broader sense, innovation is significant to the advancement of culture around the globe. New and creative products can improve individuals' way of life and give them opportunities to enhance their lives (Linder 2003). Developments in medicine and technology have meaningfully improved living standards around the world. Innovation has also led to important improvements in the way businesses operate and has closed the gaps between different markets.

27.3 Research Model

Based on the purpose of the study, the research model is plotted in Fig. 27.1.

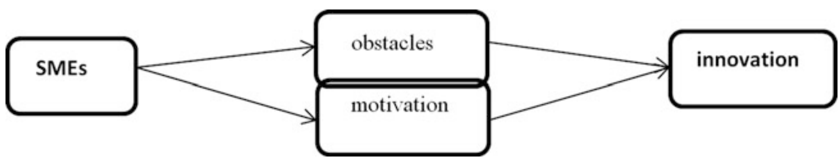

Fig. 27.1 Research model

27.4 Importance of Research

Due to a number of positive features such as fast adaptability to changing market conditions, flexible production structure, reduction in unemployment, contribution to opening new businesses, SMEs are cornerstones of countries' economic and social development. So by knowing the problems of SMEs and resolving them and also finding ways to motivate them we can make a major contribution to the country's economy.

This study tries to define the obstacles and motivational factors for innovation in SMEs in Turkey. To maintain competitiveness and continue to prosper, firms should innovate. As discussed previously, SMEs play an important role in countries' economies. This study therefore tries to find obstacle factors for companies' innovation and also motivating factors for innovation and find solutions to remove obstacles.

27.5 Research Methodology

Research data were collected using the face to face survey method. The survey comprised four groups of questions. The first group measured the reasons for and level of innovation in SMEs. The second group of questions measured obstacle factors for innovation in SMEs. The third group of questions measured the motivating factors for innovation in SMEs and the last group of questions was prepared to determine the demographic characteristics.

Survey questions related to innovation were measured on a 5 point Likert scale (1 = Strongly Disagree and 5 = Totally Agree). Data were analyzed using frequency distribution and regression analysis by SPSS 18.0 statistical software.

27.6 The Research Participants and Sampling

The main purpose of the study is to determine the obstacles and motivational factors for innovation in SMEs in Turkey. In this direction SMEs of Turkey are scope of study. In terms of large universe brings time and costs limitation together. So it was encouraged to limit the universe. The survey was carried out on SMEs in Erzurum with more than 10 employees. The survey application was conducted face to face with business owners with an easy sampling method. 53 of a total of 69 companies participated in the survey.

27.7 The Hypotheses of Research

The basic hypothesis of the study is to present the obstacles and motivational factors for innovation in SMEs.

H1 Lack of access to new technologies impacts the production of new products or services

H2 Lack of access to qualified people impacts the production of new products or services

H3 Financial insufficiency impacts the production of new products or services

H4 R&D deficiency impacts the production of new products or services

H5 Lack of access to new technologies impacts the improvement of existing products or services

H6 Lack of access to qualified people impacts the improvement of existing products or services

H7 Financial insufficiency impacts the improvement of existing products or services

H8 R&D deficiency impacts the improvement of existing products or services

H9 Meeting customer needs impacts the production of new products or services

H10 Improving competitiveness impacts the production of new products or services

H11 Improving efficiency impacts the production of new products or services

H12 Obtaining government grants impacts the production of new products or services

H13 Meeting customer needs impacts the improvement of existing products or services

H14 Improving competitiveness impacts the improvement of existing products or services

H15 Improving efficiency impacts the improvement of existing products or services

H16 Obtaining government grants impacts the improvement of existing products or services the establishment of hypotheses questions Cronbach's alpha reliability coefficient is 80.5%.

Research Results

The survey results of SMEs which participate are shown in the tables.

The summary of the demographics of the 53 participating companies is shown in Table 27.1. The level of education is high, 88.7% of respondents have graduate education and 11.3% of them have post graduate degrees. As far as the number of employees is concerned, 17% of the participating firms have 11 to 30 employees, 47.2% of participating firms have 31 to 60 employees, 30.2% of participating firms have 61 to 100 employees and 5.7% of participating firms have more than 100 employees.

Table 27.1 Summary of demographic characteristics of the businesses which participated in the survey

Number of employees	Frequency	Percent	Educational level	Frequency	Percent
11–30	9	17.0	Graduate	47	88.7
31–60	25	47.2	Postgraduate	6	11.3
61–100	16	30.2	Total	53	100
101+	3	5.7			
Total	53	100			

Table 27.2 Factors which impede or slow down innovation in SMEs

	N	Mean	Std. Deviation
Lack of access to new technologies	53	3.81	0.7609
Lack of access to qualified people	53	4.16	0.5089
Financial insufficiency	53	4.67	0.4712
R&D deficiency	53	4.37	0.7900

Results of respondents on factors which impede or slow down innovations are shown in Table 27.2.

The questions on obstacles are grouped into 4 factors: lack of access to new technologies, lack of access to qualified people, financial insufficiency and R&D deficiency. For the first factor – lack of access to new technologies – the mean of the respondents' answers is 3.81, i.e. they don't know but it is close to agree (4). For factor 2 – lack of access to qualified people – the mean of the respondents' answers is 4.16, i.e. they agree. For the third factor – financial insufficiency – the mean of the respondents' answers is 4.67, i.e. they agree and for the last factor – R&D deficiency – the mean of the respondents' answers is 4.37, i.e. they agree.

The questions on motivation are also grouped into 4 factors: meeting customer needs, improving competitiveness, improving efficiency, and obtaining government grants. As demonstrated in Table 27.3 for the first factor – meeting customer needs – the mean of the respondents' answers is 4.73, i.e. they agree. For factor 2 – improving competitiveness – the mean of the respondents' answers is 4.75, i.e. they agree. For the third factor – improving efficiency – the mean of the respondents' answers is 4.52, i.e. they agree and for the last factor – obtaining government grants – the mean of the respondents' answers is 3.73, it means don't know but it is close to agree.

Table 27.4 shows in the first line the dependent variable (I1) producing new products and the independent variable (O1) lack of access to new technologies. The durbin watson value is 2.183 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The value of Sig. is greater than 0.05 so hypothesis 1 is rejected.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (O1). The durbin watson value is 2.309 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.556

Table 27.3 Motivation factors for innovation in SMEs

	N	Mean	Std. Deviation
Meeting customer needs	53	4.73	0.4451
Improving the competitiveness	53	4.75	0.4765
Improving efficiency	53	4.52	0.5407
Obtaining government grants	53	3.73	0.7881

Table 27.4 Regression analysis between innovation variables and obstacles variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	O1	0.201	0.600	2.183	0.218	0.411
I2	O1	0.556	2.405	2.309	0.409	0.010

which shows that lack of access to new technologies impact improving existing products much. The Sig. value is 0.010 so hypothesis 5 is accepted with 95% degree of confidence.

Table 27.5 shows in the first line the dependent variable (I1) producing new products and the independent variable (O2) lack of access to qualified people. The durbin watson value is 2.183 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.684 which shows that lack of access to qualified people impact producing new products much more than the previous factor. The Sig. value is 0.048 so hypothesis 2 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (O2). The durbin watson value is 2.309 and therefore the regression analyze can continue. The β value is 0.636 which shows that lack of access to qualified people impact improving existing products much more than previous factor. The Sig. value is 0.035 so hypothesis 6 is accepted with 95% degree of confidence.

Table 27.6 shows in the first line the dependent variable (I1) producing new products and the independent variable (O3) financial insufficiency. The durbin watson value is 2.183 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.816 which shows that financial insufficiency impact producing new products too much. The Sig. value is 0.029 so hypothesis 3 is accepted with 95% degree of confidence.

Table 27.5 Regression analysis between innovation variables and obstacles variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	O2	0.684	0.600	2.183	0.218	0.048
I2	O2	0.636	2.405	2.309	0.409	0.035

Table 27.6 Regression analysis between innovation variables and obstacles variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	O3	0.816	0.600	2.183	0.218	0.029
I2	O3	0.759	2.405	2.309	0.409	0.024

Table 27.7 Regression analysis between innovation variables and obstacles variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	O4	0.712	0.600	2.183	0.218	0.000
I2	O4	0.721	2.405	2.309	0.409	0.038

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (O3). The durbin watson value is 2.309 and therefore the regression analyze can continue. The β value is 0.759 which shows that financial insufficiency impact improving existing products too much. The Sig. value is 0.024 so hypothesis 7 is accepted with 95% degree of confidence.

Table 27.7 shows in the first line the dependent variable (I1) producing new products and the independent variable (O4) R&D deficiency. The durbin watson value is 2.183 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.712 which shows that R&D deficiency impact producing new products too much. The Sig. value is 0.000 so hypothesis 4 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (O4). The durbin watson value is 2.309 and therefore the regression analyze can continue. The β value is 0.721 which shows that R&D deficiency impact improving existing products too much. The Sig. value is 0.038 so hypothesis 8 is accepted with 95% degree of confidence.

Table 27.8 shows in the first line the dependent variable (I1) producing new products and the independent variable (M1) meeting customer needs. The durbin watson value is 2.186 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.704 which shows that meeting customer needs impact producing new products too much. The Sig. value is 0.005 so hypothesis 9 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (M1). The durbin watson value is 2.493 and therefore the regression analyze can continue. The β value is 0.723 which shows that meeting customer

Table 27.8 Regression analysis between innovation variables and motivational variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	M1	0.704	0.619	2.186	0.221	0.005
I2	M1	0.723	0.866	2.493	0.259	0.008

Table 27.9 Regression analysis between innovation variables and motivational variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	M2	0.782	0.619	2.186	0.221	0.026
I2	M2	0.738	0.866	2.493	0.259	0.044

needs impact improving existing products too much. The Sig. value is 0.008 so hypothesis 13 is accepted with 95% degree of confidence.

Table 27.9 shows in the first line the dependent variable (I1) producing new products and the independent variable (M2) improving competitiveness. The durbin watson value is 2.186 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.782 which shows that improving competitiveness impact producing new products too much. The Sig. value is 0.026 so hypothesis 10 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (M2). The durbin watson value is 2.493 and therefore the regression analyze can continue. The β value is 0.738 which shows that improving competitiveness impact improving existing products too much. The Sig. value is 0.044 so hypothesis 14 is accepted with 95% degree of confidence.

Table 27.10 shows in the first line the dependent variable (I1) producing new products and the independent variable (M3) improving efficiency. The durbin watson value is 2.186 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.602 which shows that improving efficiency impact producing new products too much. The Sig. value is 0.010 so hypothesis 11 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (M3). The durbin watson value is 2.493 and therefore the regression analyze can continue. The β value is 0.742 which shows that improving efficiency impact improving existing products too much. The Sig. value is 0.036 so hypothesis 15 is accepted with 95% degree of confidence.

Table 27.11 shows in the first line the dependent variable (I1) producing new products and the independent variable (M4) obtaining government grants. The durbin watson value

Table 27.10 Regression analysis between innovation variables and motivational variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	M3	0.602	0.619	2.186	0.221	0.010
I2	M3	0.742	0.866	2.493	0.259	0.036

Table 27.11 Regression analysis between innovation variables and motivational variables

Dependent variable	Independent variable	B	F	Durbin watson	R	Sig
I1	M4	0.410	0.619	2.186	0.221	0.033
I2	M4	0.444	0.866	2.493	0.259	0.028

is 2.186 which is between 1.5 and 2.5 and therefore the regression analyze can continue. The β value shows the impact of independent variable to dependent variable. The closer it is to 1, the more impact it shows. The β value is 0.410 which shows that obtaining government grants impact producing new products not too much. The Sig. value is 0.033 so hypothesis 12 is accepted with 95% degree of confidence.

In the second line it shows the dependent variable (I2) improving existing products and the independent variable (M4). The durbin watson value is 2.493 and therefore the regression analyze can continue. The β value is 0.444 which shows that obtaining government grants impact improving existing products not too much. The Sig. value is 0.036 so hypothesis 15 is accepted with 95% degree of confidence.

Conclusion and Suggestions

This study explored obstacles and motivational factors for innovation in SMEs. According to information obtained from the results of the analysis, hypotheses 2, 3, 4, 5, 6, 7, 8 are accepted and hypothesis 1 is rejected. This means lack of access to qualified people and financial insufficiency and R&D deficiency impact the production of new products but lack of access to new technologies do not. Also lack of access to new technologies, lack of access to qualified people, financial insufficiency and R&D deficiency impact the improvement of existing products. Among obstacle factors, financial insufficiency impacts innovation factors more than other obstacle factors.

According to the results of motivational factors, hypotheses 9, 10, 11, 12, 13, 14, 15, 16 are accepted. This means meeting customer needs, improving competitiveness, improving efficiency, and obtaining government grants impact the production of new products and also the improvement of existing products. The factor improving competitiveness impacts the production of new products most. The factor improving efficiency impacts the improvement of existing products most.

Enterprises are one of the most effective levers in the development of countries. Thus, governments should identify the problems facing these enterprises and help enterprises to solve these problems because countries develop with the growth of SMEs.

Since the most effective obstacles to innovation are financial problems, governments can facilitate the conditions of lending to firms and increasing the repayment period and lower interest rates in order to help SMEs to obtain financial resources.

The second obstacle affecting enterprises in terms of innovation is R&D deficiency. In this regard experience can be added to this area and R&D department performance can be increased by organizing professional exhibitions and education.

Also, the lack of access to qualified people is another obstacle factor for innovation in enterprises. In order to solve this problem, enterprises must enhance their relationship with universities and help them in training professional students. In fact, these firms can cooperate with universities and related organizations by holding seminars and conferences and also holding educational classes to train employees and raise their performance level.

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Part VII
Miscellaneous

Emotional Ethnic Marketing

28

Differences Between Emotional Advertising Effectiveness of Population with Turkish Background and German Population in Germany

Julia Hermann

Contents

28.1 Introduction of Ethnic Marketing

Germany is a country with a huge cultural diversity. With 15.9 m people, nearly one fifth of the whole German population has a migration background (Statistisches Bundesamt 2014). This challenges marketing activities because cultural differences are not always obvious and can make a uniform addressing of target groups more difficult. At the same time, this cultural diversity, due to different ethnic groups, offers new and so far rarely used chances. An ethnic group is described as a group of people with a mutual cultural background which can be defined by qualities like language, history, country of origin and religion (Aboud and Skerry 1984; Yinger 1985). The group can thereby represent a minority which originates from the immigration into a host country with a mainstream population (Pires and Stanton 2000, 2005). The fundamental aspect which differentiates an ethnic group from the mainstream population and also from other ethnic groups lies in the cultural peculiarities, so that ethnic groups can also be called subcultures within a national culture of a country (Kroeber-Riel and Gröppel-Klein 2013; Uslu et al. 2013). Culture in general is very important for marketing due to its most important influence

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_28

on consumer behavior (Kotler and Keller 2009). Ethnic groups can be especially of high interest if their consuming behavior deviates from that of the mainstream population and they therefore represent an own target group. The orientation of marketing activities to ethnic target groups within a country is thus described as ethnic marketing. Ethnic marketing aims to reach an ethnic group due to their assumed unique ethnic characteristics and therefore to support their identification with a company and its products (Cui 2001; Wilken 2004). Therefore, ethnic marketing needs to be set apart from international marketing which refers to the conduction of marketing activities in multiple country markets and from intercultural marketing which additionally considers the cultural peculiarities like specific behavioral characteristics and values in marketing activities (Müller and Gelbrich 2004). Both forms do not focus mandatorily on the culturally specific addressing of different ethnic target groups within one country.

Facing saturated markets, homogenous product performances, high competition and the need of long-term consumer bonding, target-oriented marketing through market segmentation generally gains importance (Heinrich 2004; Wilken 2004). Ethnic marketing is also understood as a segmentation-oriented marketing approach (Rinas 2006). Cui (1997) clarifies that the use of ethnic marketing is especially appropriate if an ethnic minority has unique needs which cannot be satisfied by products designed for the mainstream population and if the addressing cannot be conducted by traditional communication channels. By segmenting consumer groups based on their ethnic features, the responsive behavior becomes more predictable which is a huge benefit for companies (Pires and Stanton 2005). This differentiating approach addresses the target group more directly and therefore serves the special satisfaction of needs (Rinas 2006) as well as the higher identification with corresponding products and companies which results in higher sales and profitability (Meissner 1997). Segmentation of ethnic groups thus gains more importance the bigger the difference between cultural values of the receiving society and the ethnic minorities is (Pires and Stanton 2005; Schneider et al. 2010). However, high populated ethnic target groups are more problematic to address because they can differ from the total market or also be heterogeneous among themselves (Cui 2001).

Ethnic marketing has a long tradition in the US where the origins are dated back to the year 1932, but only in the late 1980s and 1990s the number of studies and marketing activities dealing with ethnic marketing increased. Focus of the American studies is the addressing of three different ethnic minorities: Asians, Afro-Americans and Hispanics (Cui 2001). Other examples can be found in Great Britain where the Asian target group consisting of Indians, Pakistani and Bangladeshi is focused on as biggest ethnic minority (Nwankwo and Lindridge 1998). However, in Germany ethnic marketing is a largely undeveloped topic and especially in a scientific view explored insufficiently (Gerpott and Bicak 2011). The concepts which derived from the Anglo-American studies however can't be simply adopted and transferred to other national markets (Stayman and Deshpandé 1989). Conditions between the US and Europe, especially Germany, can't be generally compared due to a different understanding and history of immigration. For instance, the society in the US was built in its origins by culturally heterogeneous groups of immigrants, whereas in Germany there was a later moving into an existing mainstream population with a predominating national culture (Bouchet 1995; Kulinna 2007; Wilken 2004). Additionally, the amount of ethnic minorities in the total population is much higher in the US than in Germany. At the time when ethnic marketing in the US was paid high attention to, already one fourth of the population was a member of one of the three main ethnic minorities, whereas in Germany the part of the population with migration background in the total population is currently at 19.7% (Cui 2001; Statistisches Bundesamt 2014). Therefore, Germany offers a lot of development potential for research in the area of ethnic marketing for the various ethnic minorities.

Being the biggest ethnic minority in Germany, the population with Turkish background offers especially high potential. Besides its size, this group represents a very interesting target group due to its high quality consciousness, its brand loyalty and a high purchasing power (Akyol 2002; Coşkun 2011; Kraus-Weysser and Uurdemir-Brincks 2002). Several companies already conducted ethnic marketing specifically for the population with Turkish background, e.g. Volkswagen AG, Daimler AG, Deutsche Bank AG or the E-Plus group. Generally, ethnic marketing can be applied to all four instruments of the marketing mix, precisely to product, price, distribution and communication policy, whereas communication plays the most important role and has the highest degree of intensity regarding the cultural adaption (Dülfer and Jöstingmeier 2008; Gerpott and Bicak 2014). Here, the main goal of ethnic marketing is to improve communication (Holland and Gentry 1999). Especially difficulties with understanding the communication message (Müller and Gelbrich 2004) as well as unpleasantness emerging from the style or means of communication for the target group need to be avoided. Improvement in the communication of an advertising message can for example be derived from using the native language to increase comprehension. This can simultaneously create a pleasant experience (Pires and Stanton 2005) and a certain appreciation (Kraus-Weysser and Uurdemir-Brincks 2002). Language barriers are a fundamental obstacle for successful communication, but the mere translation of advertising is not effective because important elements of the message can get lost and be misinterpreted (Kraus-Weysser and Uurdemir-Brincks 2002; Wilken 2004). Also the employment of models or actors being part of the addressed ethnic minority offers potential for positive reaction. In order to gain a desired reaction, it is furthermore very important for ethnic marketing to consider the culturally formed norms and ideals of the target group in shaping the advertising message.

28.2 Importance of Emotional Reactions for Advertising Effectiveness and Marketing

For both, the addressing of certain target groups as well as for classic marketing, advertising as a communication instrument is attached with a very high importance because it achieves a high reach (Gerpott and Bicak 2014; Meffert et al. 2015). Negative reactions to an advertising spot need to be avoided because these can be transferred to the brand. Here,

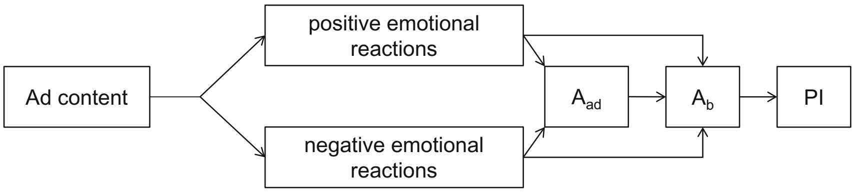


Fig. 28.1 Effect model of advertising effectiveness. (Own diagram based on Batra and Ray (1986), Bhat et al. (1998), Edell and Burke (1987), Gardner (1985), Holbrook and Batra (1987))

emotions play a decisive role for the effectiveness of an ad. Emotional reactions serve as mediators because they are caused by the content of an ad and themselves have effects on the *Attitude toward the ad* (A_{ad}), a central construct of advertising effectiveness (Batra and Ray 1986; Edell and Burke 1987; Holbrook and Batra 1987). Furthermore, there is a fundamental assumption that the emotional reactions caused by the advertising stimulus are unconsciously connected with the promoted brand and therefore influence the *Attitude toward the brand* (A_b), which then affects purchase intention (PI) (Batra and Ray 1986; Gardner 1985). Recent research additionally assumes that emotional reactions also have a direct influence on A_b, thus a partial mediation by A_{ad} takes place (Pham et al. 2013). These findings can be illustrated by Fig. 28.1.

28.3 Research Question and Procedure

So far the possible different emotional reactions to advertising between ethnic groups in Germany have been excluded by research. This question therefore frames the conducted empirical investigation. The primary goal was to compare the differences in the emotional perception of commercials and the resulting advertising effectiveness between German people and people with Turkish background. The investigation was conducted against the background of possible cultural influencing factors which can cause a different emotional reaction in the two groups. Differences, especially in emotional mimic reactions, can be attributed to a different perception of the eliciting stimulus or, due to the social environment, a control or regulation of the facial expression in a certain way (Ekman 1972; Ekman and Friesen 1969).

Previous studies give information about differences of norms and ideals between Germans and ethnic Turks living in Germany concerning topics like modern gender roles, female sexuality and homosexuality. According to a study of the INFO GmbH and Liljeberg Research International from 2009, 47% of the respondents with Turkish background disapprove that men and women live together before their marriage, whereas just 8% of the German respondents think this is not acceptable. Even higher differences exist regarding the pre-marriage sexual intercourse of women which is rejected by 56% of ethnic Turks compared to 7% of Germans. The female virginity as requirement for a marriage is considered as important by 6% of German study respondents, whereas 48% of the respondents with Turkish background see this as essential (INFO GmbH and Liljeberg Research International 2009). These results establish the consistency of a traditional Turkish Islamic understanding of family and roles for the ethnic Turks living in Germany. Also social tolerance differs between the two investigated groups. Whereas a homosexual relationship between men is not accepted by 29% of Germans, 65% of ethnic Turks reject it. The latter speak for the permission of homosexual marriage only in 30% of cases, Germans in 57% (INFO GmbH and Liljeberg Research International 2009). Therefore it seems obvious that, with regard to these topics, different values between people with Turkish background living in Germany and German people exist which should also be reflected in the assessment of commercials showing such content. Specifically, a less positive emotional reaction of ethnic Turks compared to Germans on advertising with objective content is expected because the images might hurt ideals and norms of the ethnic Turks.

More specifically, the investigation compares the emotional reactions of ethnic Turks living in Germany and German people to humorous commercials which are free of objective content and humorous commercials with potentially objective content. Additionally, it was meant to prove if any differences in the emotional reactions are also transferred to the attitude toward the ad as well as toward the promoted brand. In the framework of the empirical investigation the following hypotheses have been set up among others:

H_1: There is no difference in the emotional reaction between German and ethnic Turk respondents if the ad is free of objective content.

H_2: German respondents show a more positive emotional reaction compared to ethnic Turk respondents if the ad implies objective content.

For the analysis of the emotional reactions the GfK EMO Scan technology was used. The fundamentals of this technology have been developed by the GfK Verein and the GfK SE in cooperation with the Fraunhofer Institute for Integrated Circuits (IIS) and emotional experts of the Centre Interfacultaire en Sciences Affectives (CISA) at the University of Geneva. The current version of this software-based technology can capture emotional reactions regarding their positive or negative valence. Hereby, the felt pleasantness or unpleasantness of the presented advertising stimulus can be conducted. The procedure uses an automatic comparison of the recorded facial expressions with over 12,000 pictures of different positive, negative as well as neutral facial expressions from an existing database, which is based among others on pictures of Ekman and Friesens' (1978) Facial Action Coding System (FACS) with the most relevant Action Units for positive and negative valence. Results are analyzable numeric values for each video frame (Dieckmann and Unfried 2014; Garbas et al. 2013). The process of a GfK EMO Scan measurement is shown in Fig. 28.2. It starts with a calibration and examination of the used webcam's image quality. After completion of this step, the advertising spot is presented, simultaneously the facial expressions of the participant are recorded and analyzed on the GfK server. To maintain anonymity of the respondents, the recordings are deleted from the server after this step

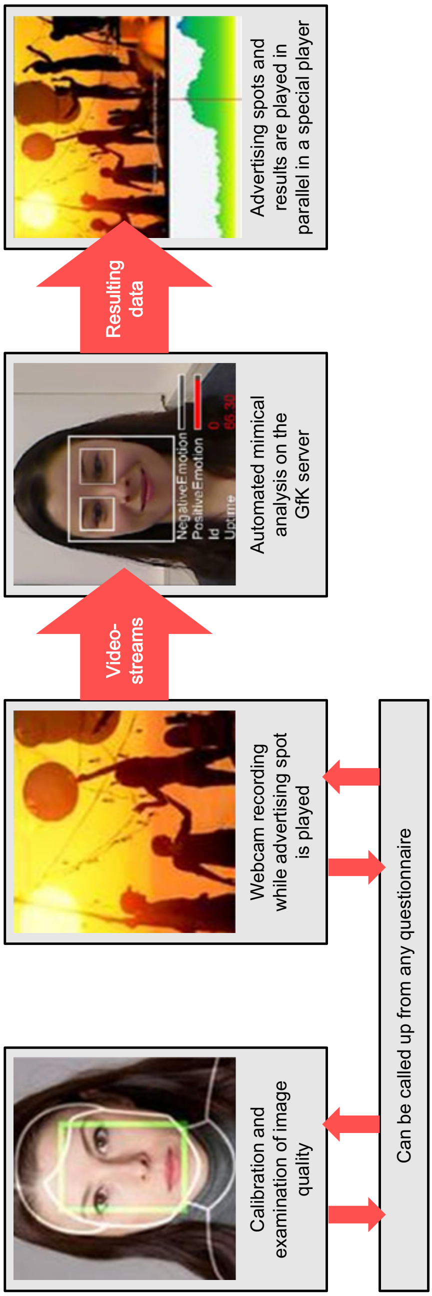


Fig. 28.2 Process of a GfK EMO Scan measurement. (Based on Dieckmann and Unfried 2014)

and only the resulting valence values are stored which can then be readout and analyzed by a special software (Dieckmann and Unfried 2014). The validity of measurements with the GfK EMO Scan was approved successfully by an empiric study which measured the mimic reactions of participants to the 32 motives of the standardized International Affective Picture Systems (IAPS) which cause the same negative and positive emotional reactions across cultures (Garbas et al. 2013). Additionally, a joint measurement of the GfK EMO Scan with measures of Electrodermal Activity (EDA) was conducted in which a correlation of the results was noticed (Dieckmann and Unfried 2014).

One advantage of this method is the possibility to embed it into an online survey which does not require a laboratory measurement with the presence of a study conductor, but can take place in an artificial place, e.g. at home with the own PC. Furthermore, the GfK EMO Scan is based on an implicit measurement technique which captures emotional reactions in real time and therefore delivers methodically unbiased results (Desmet 2002; Lewinski et al. 2014; Poels and Dewitte 2006). As the GfK EMO Scan can so far only record and recognize the valence of an emotional reaction, the implicit analysis was complemented with a self-describing, explicit method called the GfK EMO Wheel. This technique is based on the *Geneva Emotion Wheel* (GEV) from Scherer (2005). Here, the participants are asked to name the felt emotion by showing 10 positive and 10 negative emotional categories which are arranged circularly. The felt intensity of the emotional category can thereby be recorded by gradations. Additionally, participants are asked to choose from a variety of pre-selected scenes from the spot for each selected emotion in which it was sensed most strongly.

28.4 Conduction of the Study and Results

The study was conducted by the use of an online survey. Participants were recruited in Germany by the personal network of the author. In total 99 people finished the survey completely. 41% of the participants were male, with the mean age being 27.68 years ($SD=7.36$), and the age of the participants ranging from 18 to 61 years. Most of the participating people had a university or a university of Applied Sciences degree (63%), further 31% named high school graduation as highest degree of education. 81% of the participants have German nationality, 32% are Turkish, out of which 15% possess a dual citizenship and are therefore both German and Turkish. The following analyses have been conducted based on the membership of a group (Germans and ethnic Turks respectively). The subgroup of German people consists of 54 participants which claimed that they feel akin to the German group exclusively. In total 39 people felt a membership with the Turkish group and therefore count further as ethnic Turks, whereat 28 people feel akin to the Turkish group exclusively and 11 classified themselves additionally as member of the German group. Six participants, which classified themselves as neither belonging to the German nor to the Turkish group, have been excluded from the analyses.

Table 28.1 Short description of the commercial spots used in the main study

Spot No.:	Product Category	Ad Category: objective vs. funny
1	Chocolate bar	Funny
2	Car manufacturer	Funny
3	Furniture manufacturer	Objective (broaches sexuality, unfaithfulness, homosexuality)
4	Electronics dealer	Objective (broaches pornography in context of family)

For the first hypothesis two humorous commercials were used which had already been tested with the GfK EMO Scan technology in former studies by the GfK SE and the GfK Verein respectively and caused particularly positive reactions. To examine the second hypothesis, two humorous commercials from a previously conducted pre-test were used, which polarized best between German and ethnic Turk participants with respect to felt objectivity. Table 28.1 gives a short summary of the used commercial spots.

To make a first judgement about the differences in the assessments of the ads, the results of the explicit measures of the GfK EMO Wheel were considered first. For each spot the respondents could name a maximum of two out of the 20 emotions which they felt during the time of inspection. The respective choices were aggregated for each spot to figure out if there is a significant difference in the mention of positive and negative emotions between the two investigated groups. Hereby just the cases with only up to two positive or only up to two negative emotions were taken into account, whereas cases in which respondents named one positive and one negative emotion were excluded. By conducting a Chi-square test of independence, the frequencies of negative and positive emotions for the group of Germans and ethnic Turks were analyzed. For the two objective spots significant differences in the number of reported positive and negative emotions between the two groups have been found (spot 3: χ^2 (1, N = 83) = 13.10, $p < 0.001$; spot 4: χ^2 (1, N = 89) = 4.63, $p = 0.031$).

Additionally to the analysis of the felt emotion, the investigation of scenes from the ad in which each of the emotions was sensed strongest was conducted. This analysis was based on the top three felt emotions in each of the respective groups. Spot 3 (furniture manufacturer) was mostly described as amusing in both groups, but with a significant difference between the groups (Germans: 72%, ethnic Turks 44%). Participants with Turkish background additionally named shame (23%) more often than Germans (13%) and had a significantly higher feeling of disgust (18%) than Germans (2%). Especially when examining the scenes, which were connoted with the negative emotions, it becomes evident that they represent the controversial and objective content (see Fig. 28.3). Spot 4 (electronics dealer) shows similar results. Here, also both groups claimed the spot to be amusing, but show again significant differences (Germans: 85%, ethnic Turks 59%). Both groups also feel pleasure (Germans: 13%, ethnic Turks 21%). However, 13% of participants with Turkish background versus 4% of German participants named shame as felt emotion and chose scenes which clearly referred to the controversial content (see Fig. 28.4). The results

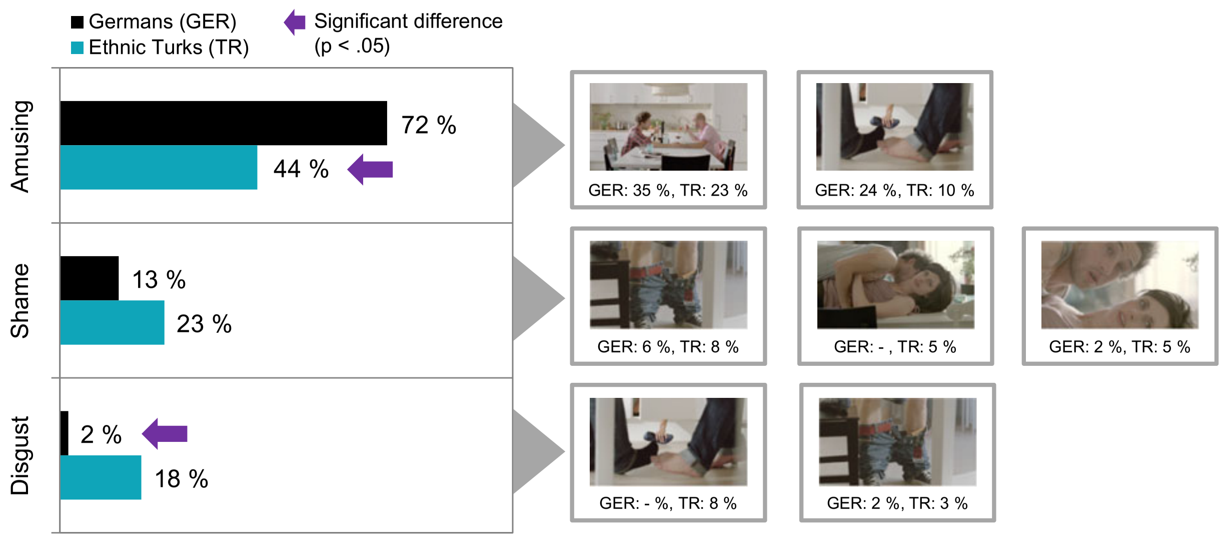


Fig. 28.3 Analysis of the Emotion Wheel and scene selection for spot 3. (Own diagram)

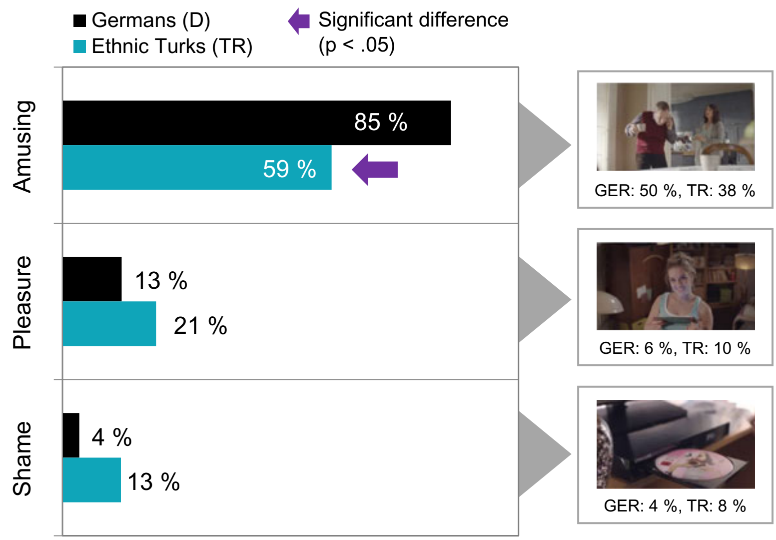
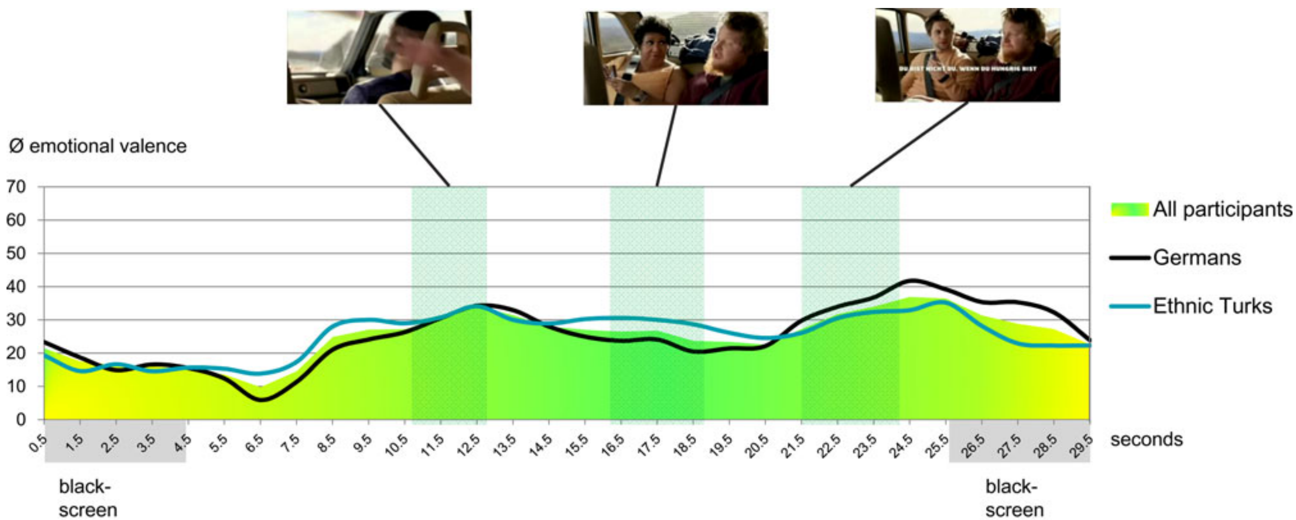


Fig. 28.4 Analysis of the Emotion Wheel and scene selection for spot 4. (Own diagram)

of the explicit emotional measurement therefore show first signs of different emotional reactions to the objective spots which were further investigated by the following implicit analyses.

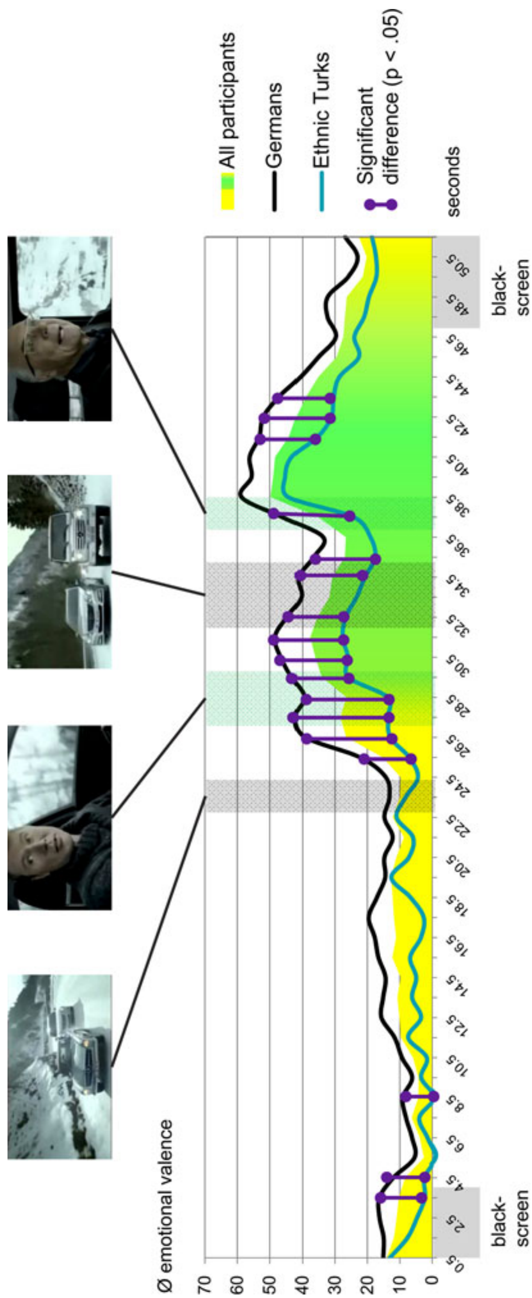
To get a first impression of the implicit measurement conducted with the GfK Emo Scan, the valence curves for the four spots are shown in Figs. 28.5, 28.6, 28.7 and 28.8. They reveal several differences in the average emotional valence for spot 2, spot 3 and spot 4 which were tested to the split second by Mann-Whitney-U tests for each spot.

The implicit measures of the GfK EMO Scan were also used to test the proposed hypotheses. For this purpose, the mean values of the maximum positive emotional valence (mpev) for each advertising spot were compared for both investigated groups by using *t*-tests. The mpev value exhibited the highest correlation with internal parameters for the success of an advertising spot in previous studies of the GfK SE and the GfK Verein and is therefore suitable for the prognosis of advertising success. For the humorous spot of the chocolate bar (spot 1), which was free of objective content, it was ruled out that a significant difference in the average mpev between the German group and the group of ethnic Turks can be found ($t(88) = 0.38$, $p = 0.703$). Here, an additional calculation of the Confidence Interval for the difference in the mean value was conducted to prove the likelihood that no differences can be found (CI [19.07, 28.39]) (Levine and Ensom 2001). The spot of the furniture manufacturer (spot 3), which showed unfaithfulness, sexuality and homosexuality reveals that in line with expectations a significant higher positive reaction is initiated in the German group ($t(91) = 2.43$, $p = 0.017$). However, for the spot of the car manufacturer (spot 2) differences have been detected likewise and the German group showed a significant higher value for the mean mpev ($t(90) = 2.19$, $p = 0.031$)



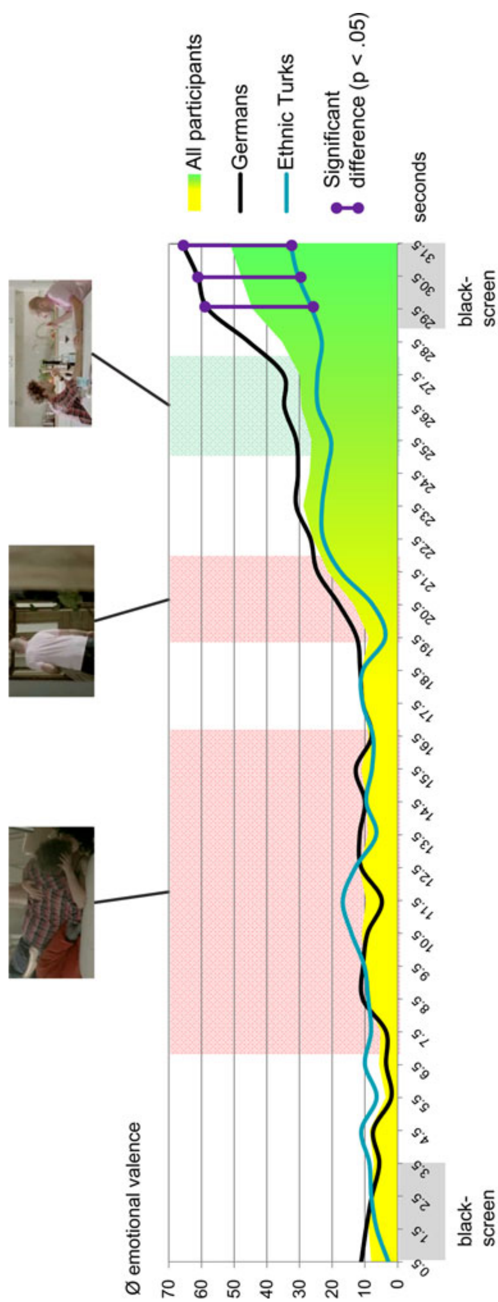
Base: All participants: n=96, Germans: n=51, Ethnic Turks: n=39

Fig. 28.5 Valence curves for spot 1. (Own diagram)



Base: All participants: n=98, Germans: n=53, Ethnic Turks: n=39, significance of group differences based on Mann-Whitney-U tests.

Fig. 28.6 Valence curves for spot 2. (Own diagram)



Base: All participants: n=99, Germans: n=54, Ethnic Turks: n=39, significance of group differences based on Mann-Whitney-U tests.

Fig. 28.7 Valence curves for spot 3. (Own diagram)

Base: All participants: n=98, Germans: n=54, Ethnic Turks: n=38, significance of group differences based on Mann-Whitney-U tests.

Fig. 28.8 Valence curves for spot 4. (Own diagram)

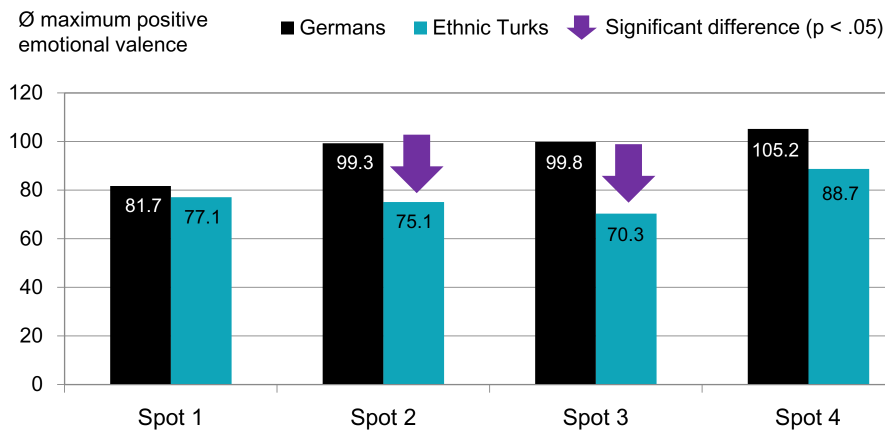


Fig. 28.9 Mean values of the maximum positive emotional valence for the tested commercial spots – comparison between the German group and the group of ethnic Turks. (Own diagram)

which was against expectations. For spot 4, the spot of the electronics dealer, differences have been found as anticipated, but these didn't reach the level of significance of $\alpha = 5\%$ ($t(90) = 1.38$, $p = 0.171$). Thus, two out of four hypotheses could be confirmed. The detailed results can be seen in Fig. 28.9.

Using a mediation analysis, the study furthermore investigated for the first time how measurement values of the GfK EMO Scan can be used as predictors for selected advertising effect parameters like the *Attitude toward the ad* (A_{ad}) and the *Attitude toward the brand* (A_b). The hypothesis that the mpev influences A_{ad} positively was confirmed ($b = 0.0065$, $t = 5.23$, $p < 0.001$). Thereby the impact of mpev on A_b is mediated completely by A_{ad}. This can be discerned by the fact that in the simultaneous regression of A_{ad} and the mpev on A_b the coefficient of mpev is reduced and no significant influence can be found anymore ($b = 0.0009$, $t = 0.86$, $p = 0.389$). Only A_{ad} appears as a significant predictor for A_b ($b = 0.34$, $t = 7.87$, $p < 0.001$). Moreover, the indirect effect of 0.0022 (95%-Bootstrap-CI [0.0013, 0.0033]) is significant (Preacher and Kelley 2011). Hence, the implicit measures with the GfK EMO Scan can forecast important advertising effect parameters which can influence the following consuming behavior.

28.5 Summary and Future Perspective

Using both implicit and explicit measurement techniques, the present study was able to answer the question if differences in emotional reactions to advertising spots between two ethnic groups, ethnic Turks and Germans, exist. These differences were measured by means of the GfK EMO Scan, the analytic tool for automated emotional recognition from GfK SE. It was hypothesized that humorous advertising stimuli without ethnic relevant content cause the same reactions, whereas humorous advertising spots with objective content are rated differently (H_1/H_2). This rests upon the supposition that the images of objective advertising spots violate culturally caused ideals and norms in the group of ethnic Turks which is why the emotional reactions are less positive compared to the German group. Findings of the study conducted for this purpose reveal that two out of four advertising spots show the expected results. For the humorous spot 1, which is free of objective content, it can most probably be precluded that differences are found in the average maximum positive emotional valence between the German group and the group of ethnic Turks. For Spot 3, broaching the issue of unfaithfulness, sexuality and homosexuality, it was revealed that in line with expectations significant higher positive emotional reactions are caused in the German group compared to the group of ethnic Turks. Beside the results of the implicit emotional measurement, this finding becomes moreover apparent in the explicit interrogation of felt emotions. Respondents with Turkish background expressed increased negative emotions like disgust and shame facing this advertising spot and hereby referred in particular to scenes which represent the controversial images clearly. Against expectations, spot 4 did not reveal significant differences in the average mpev between the two groups. However, in this spot a polarizing effect can be recognized, too, so that respondents with Turkish background named the occurrence of felt negative emotions more often in the explicit interrogation. Additionally, the analysis to the split second on differences in the mean values of the emotional valence between the two groups shows that in certain sections significant better evaluations by the German respondents can be found. Results for spot 2, which was classified as a humorous spot without objective content, shows a significant higher average mpev of German respondents in contrast to the hypothesis. A possible explanation for that is a generally more positive attitude of the German group towards the celebrities popular in Germany which were shown in the commercial whereas the respondents with Turkish background feel less related to them. Moreover, the commercial can convey a certain reference to the home country for Germans because a traditional German pop song is played as background music. In this regard it can be concluded that the positive emotional reactions, which have been possibly targeted at by these culturally based elements, were only elicited for Germans whereas the respondents with Turkish background did not show these enhanced reactions. In a nutshell the results of the study point out the need to investigate potential violations of cultural ideals and norms, which are not obvious to the advertiser, previous to the use of communication activities addressing people with Turkish background in Germany. Here it is advisable to develop a consciousness which negative reactions can be avoided. In this way optimal conditions for marketing campaigns can be created and the same positive effects of advertising can be achieved for ethnic target groups such as for the German target group (Haegele 2000). By means of the results, implications can be deduced concerning the use of advertising for the target group of ethnic Turks in Germany. These implications should not, however, focus on the specific use of peculiar culturally relevant characteristics. They should rather establish sensitivity for possible culturally caused differences to hereby reduce the risk of causing unintentional and potentially negative reactions of an ethnic target group towards advertising efforts.

The conducted analyses and background about ethnic Turks in Germany enlarged the understanding about cultural values of people with Turkish background in Germany as an ethnic target group. Expansion of that knowledge to more areas of both research and marketing practice should hereby be encouraged. The investigation can represent a starting point and reveals the potential outcome if commercials are used whose contents and exposures are contrary to cultural ideals of the target group. Besides the objectiveness of commercials, which was the focus in the present study, it is also interesting which other levels of content can cause differences in the emotional reactions. Thus it became clear that non-objective and thoroughly positively connoted contents can trigger reactions of different magnitude if their full impact evolves only in one of the aimed target groups. Therefore it seems necessary to gain an understanding for the processing of communication content against a cultural background. Besides, the study only focused on the less positive emotional reactions to commercials, which were triggered by a culturally caused incongruence with the own values. Further analyses with regard to a different magnitude of positive emotions are desirable to gain a deeper understanding of advertising effectiveness for the population with Turkish background living in Germany. In this case qualitative studies with the corresponding target groups can provide new insights for culturally relevant areas.

Additionally there are manifold starting points to describe further possible research goals in the area of ethnic marketing in Germany. For instance the development of an operationalization is desirable which allows a holistic measurement of acculturation of the population with Turkish background as well as additional ethnic groups in Germany. Hereby marketing relevant segmentation based on ethnicity can be built. Longitudinal studies investigating ethnicity of ethnic Turks can gain further insights regarding the future potential of ethnic marketing campaigns in Germany for this target group. Particularly with regard to the younger generation of ethnic Turks a change is anticipated where either a further adaptation to the German mainstream society or a return to traditional Turkish values is possible.

In this regard the concept of ethnic marketing can also be questioned critically. By developing special marketing strategies for ethnic groups they are constantly portrayed as being different and therefore certain "ethnic hierarchies" are maintained (Dávila 2001). By superficially focusing on the differences of ethnic groups and addressing the target group regarding their differentiating peculiarities, marketing campaigns risk building parallel societies by confirming stereotypes (Nwankwo and Lindridge 1998). Selected addressing of target groups can furthermore increase the feeling of discrimination for the excluded groups (Pires and Stanton 2005) so that, for instance, advertising in Turkish language or with Turkish celebrities is not understandable for the main part of the German population. These aspects need to be considered constantly in order to prevent impediment of the integration process in a multicultural society. Despite this, it is necessary to consider that especially the neglect of ethnic minorities leads to a marginalization of this potentially profitable target group (Chudry and Pallister 2002). Thus, a responsible use of ethnic marketing, which does not place the economic view too much in the foreground, seems to be expedient. Instead of striving for short-term sales increases, companies should place the emphasize on the building of long-term consumer relationships when conducting ethnic marketing which requires both understanding for cultural differences as well as similarities (Nwankwo and Lindridge 1998). Hereby ethnic marketing facilitates the development of open-mindedness and tolerance for various lifestyles between consumers with different ethnic background (Jamal 2003).

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29 Use of Information Communication Technologies in Political Communication and Participation – with Special Reference to Turkey

Hasan Emir Aktaş

Contents

29.1 Development of Political Communication Techniques in the Modern Era

The prominent means of political communication during the pre-modern period was print media. During the last quarter of the nineteenth century, photography and cinema and during the first half of the twentieth century, radio and television were the new communication technologies which were used, at first, for common communication purposes.

After the first radio broadcast in the 1920s, US president Franklin D. Roosevelt started to use radio to publicize the "the new deal" program of his government, which had been drafted to restore the US economy after the 1929 economic crisis.

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_29

Radio was widely employed by totalitarian systems for the mobilization of their people and diplomatic manipulation of the international community. Especially Hitler's Germany used radio effectively and professionally during the pre-war period to consolidate the national socialist regime and mobilize the masses under his political designs, and during the War, to encourage and mobilize the fighting forces and people of Germany and to demoralize the peoples and military forces of the enemies.

Television broadcasting was launched during the late 1930s. But its widespread use for common communication purposes only started after the Second World War and its use for political communication could only start during the 1950s.

Since the mid-20th century, political parties and actors have begun to use more sophisticated and effective communication technologies to reach the masses, preferring to run their campaigns on electronic media like television. Moreover, a more common use of communication technologies has driven political actors to employ experts for advertising, public relations and political communication on a larger scale. The US seems to assume a leading role in the use of communication technologies as well as in employing new communication techniques for political campaigns (Kalender 2000, p. 92).

The US presidential election of 2008 was President Barack Obama's first political competition. His Republican rival was John McCain. During the election campaign, Obama used social media and the Internet much more effectively and successfully than McCain. The number of followers Obama reached on Facebook, YouTube and other web sites was four times more than that of McCain. The total amount of donations raised by Obama's campaign reached $750 million, with most of it coming through online communication. This was a record in the election history of the US. In other words, Obama's campaign was a revolution in terms of using information and communication technologies for politics (Borins 2011, p. 92).

Recently, the Internet and mobile phones have come to be widely used for political communication. Through these means, individuals can communicate their messages and opinions to each other. Previously, telephones could only be used for auditory communication, but with new technologies, they can also be used for visual and written functions. Similarly, the Internet can be used for auditory, visual and written communication (Motion 2005, p. 506).

SMS messages can be widely used for political communication. Although these comparatively short messages do not have the capacity to include elaborately organized political contents, they can be used effectively and instantly to inform people about planned meetings, rallies, conferences and other political communication activities.

A new development combines mobile phones and the Internet to constitute an efficient political means of communication – the use of the Internet on mobile phones. When the Internet is used via a mobile phone, its use becomes much more efficient and frequent, giving it flexibility in terms of time and place. Thus, political communication of political actors and political participation of democratic actors (voters/citizens) gains efficiency, as it expands the sphere of communication to a much wider area as well as gaining frequency, as people can connect to the Internet any time of the day.

29.2 What's the Role of Communication Technologies in Politics?

29.2.1 How Communication Technologies Contribute to Direct Participation in Democratic Systems

Since the 18th century, the mass media with their different functions have become increasingly more important for the efficient function of democratic political processes. The development of universal suffrage in some capitalist western countries in parallel with a revolution in the political communication technologies like print, film, radio and television enabled them to reach an ever larger audience. Since the mid-20th century, television broadcasts in western societies reached almost every household, and this considerably lowered the scope of interpersonal political communications, with television becoming an integral part of political life (McNair 2003, p. 23).

Political communication through ICTs helps people receive more comprehensive information and an enlightened understanding of political issues, which in turn helps their democratic deliberation and enables them to make better decisions (Dahl 1989). ICTs provide the public with a large amount of information. This striking increase in the political information received helps people to improve their decisions and views. For instance they can evaluate a public project with much more detailed data and background information. Secondly, they can examine statements of political actors in full text instead of their abstracts. Thirdly, by using the information from the ICTs, citizens can actively "search out the information they want, compare sources, and look for alternative views". This will enhance the quality and quantity of the information that people might use to develop their decisions and preferences regarding political matters (Vedel 2003, p. 43).

Political communication is used for the participation of the people in political debates and programs. Their opinions and preferences are for policy and decision making processes. The Internet helps governments to reach different societal levels more easily and rapidly to establish democratic institutions as well as promote popular participation, thus helping a stable and efficient democracy to function (Açıkgöz 2007, p. 252).

The emergence of the 'Blogger' culture is one of the aspects of internet media which have undermined official news sources and offered alternative outlooks on the events which are presented by other mainstream media with their own news agendas and within their own framings. Blogging first came to public attention during the 2003 Iraq war. At that time, bloggers in Bagdad described their daily lives in a city going through troublesome days of the war "when the world media were reporting their own accounts of the conflict, framed according to particular news values and agendas and often based on information gathered from a narrow range of elite sources". Thus blogging represents a bottom-up process of unmediated and unfiltered social and political communication (Rawnsley 2005, p. 179).

On the other hand, some observers question the claimed contribution of the Internet and other communication technologies to the improvement of direct democracy. Castells (2005) argues that a small group of educated and wealthy people living in certain countries and in certain cities will benefit from the information and participation means like the Internet, thus expanding their political and civil rights, whereas other masses of the world or of any country will be excluded from the new environment of democracy like the excluded position of slaves and "barbarians" during the ancient Greek democracy.

For popular access and use of the Internet some equipment, knowledge and skills are required. In the developed countries, declining costs and developing technological knowledge have enabled an increasingly large amount of the population to use the Internet, whereas in the underdeveloped and poor countries, the Internet is in the hands of a limited minority. This shows that information technologies transform the lives of certain people while putting some others into more intensified misery. Those who govern, produce, sell and use the technology will control, supervise, decide and govern, while the others will have to obey those decisions and governance (Turan and Esenoğlu 2006, p. 82).

29.2.2 Positive and Negative Role of Communication Technologies, Especially Social Media, in Restructuring Domestic and Foreign Politics

Internet showed a liberalizing effect on the politics of both Britain and the USA. Bill Clinton's affair with Monika Lewinsky in 1998 was exposed on the Drudge Report website. But Clinton received sympathy from some people as the victim of the exposure, thus not suffering serious damage. He was more popular with his people after the affair. That news spreads rapidly in similar cases, and politicians cannot prevent its "public consumption" and discussion, might provide the basis for the future development of democracy. We can conclude that as new communication technologies develop further, elites of public life will be exposed to more comprehensive democratic scrutiny and this is a positive contribution (McNair 2003, p. 225).

In different parts of the world, mobile phones and the Internet have been used to help massive movements seeking comprehensive or fundamental political changes. An SMS campaign in the Philippines managed to overthrow President Joseph Estrada. David Broder, a columnist of The Washington Post, observed that Chinese students could express themselves best in abundantly emerging web sites, as pluralistic forums that are difficult to control for the government (Hiebert 2005, p. 4).

Another example of the possible impact of ICTs on restructuring political systems is the role that the Internet played during the first days of the "Arab Spring" movements. When these protesting and rioting movements first started in 2011, people of the Arab countries willing to free themselves from decade-long authoritarian regimes could be organized and informed by social media messages.

The Gulf War witnessed media management and manipulation. In this televised conflict, transmission of a large number of messages had concrete political and military results. Television broadcasting was used especially by the Americans to outrage public opinion against the enemy, to receive public support for the raids or to provide legitimation for the official accounts of the alliance about the conflict. During the 20th century, new communication techniques have widely been used in similar military conflicts (McNair 2003, p. 218).

Considering the two opposite sides of the matter, we can conclude that when the social media and other ICTs are used in a democratic system by extremist groups usually provoked by some foreign power centers, they play a negative role for the stability and consolidation of the democratic system. But if they are used in authoritarian and totalitarian regimes by democratically-inclined social groups, they will help democratic dynamics within the political community to pressure the political system to be transformed into a more open, democratic and legitimate structure.

29.3 Political Communication and Participation Through Television and the Internet

29.3.1 Political Communication and Participation Through TV

One of the most influential features of television is that it can give an impression of seriousness and credibility by its visuality. This strong inclination in political life, which makes images even more important than ideas, led to the emergence of a new political era. That's why political advertising was first launched by the people who realized the power of that medium in the 1950s. As seen in the political contest in the 1960s between Kennedy and Nixon, what's important for television has been rather the visuality. The effect of that visuality was believed to be so important that Nixon tried to explain his failure in the election with the "sabotage of his image maker" (Çankaya 2015, p. 421–422).

Television reached its peak in political marketing during the 1960s in the USA. Before the presidential election in 1960, the presidency candidates, Kennedy and Nixon, first confronted each other in a live television debate. Kennedy was able to win the support of approximately two million extra voters just before the election thorough his high performance in the campaign and especially in TV debates. Kennedy himself stated just after the election results that the factor which reversed the flow of the stream was, above all, television (Çankaya 2015, p. 85).

Referring to the role that the CNN television news network played during the Gulf War, some editorials started to talk about a "CNN effect", suspecting the media of setting the agenda in foreign policy. There was a new media influence on government regarding foreign issues, stemming from their ability to report live and real time. This potential of the media "fundamentally changed the rules of the game" in decision making processes of foreign policies (Miller 2007, p. 7).

Although some structural changes in television broadcasting in recent years like the proliferation of channels have made its control for political purposes difficult, it is still "crucial in assuring celebrity to unknown political personalities and wide echo to their words and enterprises, something that no internet web site can guarantee". As accessing too numerous television channels to build "public visibility" has become more difficult today, politicians and candidates will have to design and implement more developed techniques to overcome the fragmented media problem and to draw the attention of a larger amount of television channels. Politicians will probably have to invest more money and set up complex connections to secure wider visibility (Mazzoleni 2005, p. 32).

John Zaller has argued that the power of television in affecting political outcomes is much more limited than usually supposed. He thinks the effects of television are not usually real and lasting. People often disregard political information channels, "capable of recognizing and focusing on their own conception of what matters" in politics (Zaller 1998, p. 186–187).

Taylor suggests that television could be and should be used for "consolidation propaganda purposes". He thinks new communication technologies like the Internet could offer opportunities to reach people of other countries directly and individually. On the other hand, television has become a common communication means for the most part of the world. So it can efficiently be used to win the support of other peoples in the context of public and cultural diplomacy "to further national politics, economic and security interests" of his country (US). He even suggests using the Internet, television and radio as means of cultural imperialism, each to be used for different relevant parts of the world, with radio functioning in the least developed countries of the Third World (Taylor 2003, p. 82).

29.3.2 Political Communication and Participation Through the Internet

First of all, the Internet gives political actors an opportunity to control and administer their campaign processes and political agendas in accordance with their projections and planned strategies. Unlike conventional mass media which are not usually under the direct control of political actors themselves, different functions of the Internet, like web sites, e-mails, Facebook, twitter, YouTube, etc. are becoming exclusively under the control and management of political actors.

Internet gives politicians an opportunity to gain autonomy from journalists. They can communicate to voters without facing the obstacles created by traditional media norms. Political news on mass media is usually prepared and shaped by the journalists according to their own preferences, whereas politicians can organize the informative and advertising materials in the Internet in accordance with their own political needs and strategies (Galley and Jamieson 2001, p. 175).

The Internet helps the political candidate to introduce himself/herself to political society, to set up an interactive relationship with people, to explain the matters in question about his projects and campaign and to carry out rapid communication with the party organization units and overall voters (Gürbüz and İnal 2004, p. 95).

The low cost of online advertising has opened the political arena to the political actors who could not afford advertising on the mainstream media, considering their extremely high charges. In the 2004 US presidential and congressional elections, the two presidential candidates and all congressional candidates paid a total of $29 million for online communication, whereas the same candidates spent about $600 million for TV commercials.

Moreover, the Internet allows the candidates to format the political ads in the most efficient and attractive ways, considering the timing and possible profile of their targeted supporters (Ancu 2011, p. 191).

In order to use a website designed for political purposes efficiently, it should be upgraded on a systematic basis, aiming to meet the information needs of the voters. The websites might be more interesting and active by using for example e-mail message systems, chat rooms, dialogue pages, polls, and contact lines open to the candidate or the party (Gürbüz and İnal 2004, p. 96–97).

Candidates running for elections can use the Internet for political advertising. They can introduce themselves through moving images and present their projects in further detail. The Internet media can be utilized for efficient advertising, as they give the opportunity to take the number of followers of the websites and the features of the addressed group into consideration (Öztuğ 2007, p. 348).

That social media give the political actors an opportunity to receive instant feedback for their communication activities is a considerable advantage compared to conventional media. But a much more striking difference emerges in the sphere of freedom. Whereas conventional media are under the pressure of governments and power centers, social media have built up a sphere of freedom which everyone can reach and advocate his/her views in unlimited freedom (Johnson 2005, p. 76–79).

The Internet is important not only for political actors but for voters and citizens as well. They can more easily express themselves in the political arena and organize themselves into groups in which they can pursue common political goals, ideological objectives, ethical sensibilities, civil societal endeavors or human values.

Due to the use of social media for political communication, the relationship between politicians and the people has become closer, direct democracy has become much more consolidated, and different forms of participation have emerged (Aktaş 2004).

The integration of social media platform in international social media networks results in circles like international actors, power centers, intelligence services etc. being included into the system. Suggested first in 'The Global Village' concept of Marshall McLuhan as an apparatus to transform the world into a global village, social media have restructured the political culture, social system, communication network and freedom spheres over the course of time (Tamçelik 2014, p. 29).

29.4 Development in Turkey of the Process in Which Information Technologies Have Been Used for Political Purposes

During the 1923–1946 period of the Turkish Republic, the Republican People's Party governed the country in a single party system, with a very limited period of multi-party system experience. So, with a lack of political opposition and competitive elections and with the politics confined completely to the RPP, radio could not be used functionally for political campaigns (Balcı and Bekiroğlu 2015, p. 11).

Radio broadcasting in Turkey started in 1927 within a limited sphere. The "Voice of Turkey" channel of Turkish radio which was launched in 1938 and broadcast home and abroad, was the only means for Turkish people to receive information about the Second World War. As Turkey was ruled by a single party regime until 1946, radio broadcasting was used by the Republican People's Party to consolidate its government and party politics during this period (Aziz 2013, p. 71–72).

Although not for political competition and campaigns, radio was however used largely for the indoctrination of the people with Kemalist tenets and consolidation of the Kemalist regime. As the Kemalist reforms provided a comprehensive and fundamental transformation in all areas of political, cultural and social life, this reconstruction process required employment of mass media and especially radio, regarding the limited technological level and mostly rurally concentrated population settlement of the time.

The Election Act of 16 February 1950 was drafted by the RPP government in collaboration with and under the pressure of the new opposition party, the Democratic Party. According to the Act, radio would be opened to political campaign and propaganda. In order to use the right to propagate on radio, a political party had to nominate candidates in at least at five constituencies. This political right which was introduced by demand of the DP, was later cancelled, again by the same party's government (Balcı and Bekiroğlu 2015, p. 13).

During the ruling period of Anavatan Partisi (the Motherland Party) after 1983, the Prime Minister Turgut Özal addressed the public once a month on the state-owned TV channel TRT, explaining his government's accomplishments, thus propagating his party's performance. This was open and direct propaganda conducted with the help of professional advertising experts, as well as an endeavor to give the people optimism and confidence about the politics and future of the country.

In 1990, privately-owned television and radio channels started broadcasting, first from abroad and later from inside the country without legal permission; as, at that time, broadcasting rights were constitutionally exclusive to TRT, the state-owned Turkish Radio and Television Corporation. Until constitutional amendment in 1993, Turkish politicians turned a blind eye to the matter, at the same time using the opportunity offered by those channels for political purposes (Aziz 2013, p. 74).

Turkish non-state television channels have been a determining force in the formation of ruling governments and political agendas. During the 1990s, some media monopolies like "Doğan Grubu" used their television channels along with newspapers to put pressure on governments. For instance, in 1997, Aydın Doğan, the owner of Doğan Group Media Corp. hosted Mesut Yılmaz, the prime minister of the time, in pajamas. This scene was interpreted by many as a sign of an attempt by a "media boss" to establish hegemony over politicians. Early in the same year (1997), when secularist military forces tried to interfere and put pressure on the ruling coalition government formed by the Islamic-leaning Welfare Party (Refah Partisi) of Necmeddin Erbakan and the moderate right-wing True Path Party (Doğru Yol Partisi) of Tansu Çiller, the same media monopolies supported the interference of the generals, broadcasting systematic anti-government news and programs. The fact that those media groups owned some companies and businesses outside the media sector gave the impression that they pursued some economic and commercial goals in their political positions apart from possible ideological concerns.

As R. Tayyip Erdoğan, the current president and former prime minister of Turkey was a member and mayor of the governing Welfare Party overthrown in 1997, he recognized the significance of television and other mass media in order to maintain the popular support and legitimacy of governments as well as in struggling against anti-democratic forces. After his Justice and Development Party came to power in 2002, he attached special importance to developing alternative television and media channels to counterbalance those opposing his party and leadership. Today Turkish TV channels might be put into three categories: those politically supporting the government and the ruling JDP along with the president Erdoğan, those opposing them and those trying to take a relatively impartial position.

During the campaign period of the 2002 elections, the Genç Parti (Young Party) of Cem Uzan conducted a multidimensional and intensified campaign. In this marketing focused campaign, Cem Uzan as a political figure was designed and presented like a political product. There were advertisements for the Uzan Group in a news format on the television and radio channels, the party program was introduced on information portals like Yahoo, and GSM messages propagating the party were sent to mobile phone users through the GSM operator Telsim owned by the Group (Balcı 2003, p. 157).

During the campaign period of the 2007 elections, television advertisements were banned, so television could not be used for political propaganda. So the ruling Justice and Development Party (JDP) used other means like Internet media instead. Before the 2011 parliamentary elections, this ban was lifted and television became the most preferred communication means for political campaigns. During the 2011 campaigns, JDP preferred television, open air advertisements, the Internet, newspapers, cinema and radio respectively as channels of political communication (Yiğitbaşı 2015, p. 52).

A remarkable example of the political effect that social media have been exerting recently in Turkey is that records of the eavesdropping carried out in the working office of Turkish President Recep Tayyip Erdoğan were leaked to the public on social media (Kartal 2013, p. 163).

After the municipal elections held on 30 March 2013 in Turkey, social media have proved to be an “offensive weapon” having the potential to manipulate the polls, to destabilize the political system, to undermine moral/ethical values and to cause a confidence crisis. And even some politicians have stated that they have become social and political weapons using “cyber warfare” techniques (Tamçelik 2014, p. 32).

Nevertheless, as with the increasingly wide use of communication technologies in Turkey over the past decades access to political information has become easier, the interest and participation of the younger generation in political issues have considerably increased. The youth has begun to use the opportunities offered especially by the Internet to receive information about political parties and actors, developing a sense of responsibility about issues of national politics (Özkan 2004, p. 97).

Conclusion

Information communication technologies (ICTs) like radio, television, mobile phones and the Internet have been used since the 20th century for political purposes. As politics is a comprehensive and influential field in the life of social communities, the political function of ICTs provides them with high significance and functionality.

Television started to be used for political debates, advertising and campaigns in the 1950s. As television was a visual and moving medium, instantly reaching millions of viewers, its use for political purposes was a corner stone in the history of political communication. There were print and auditory media prior to this, but both lacked the degree of attraction and functionality that television enjoyed.

The Internet has become the second revolution for political communication. It can be employed more cheaply, organized directly and independently by thousands of democratic actors, used as a platform to gather different groups of people pursuing common social, political or ethical values and goals. The Internet's facilitating and accelerating nature have brought political actors (political parties, candidates, deputies, presidents, cabinet members and other politicians) and citizens closer, giving the politicians and candidates an opportunity to exert their influence over a larger amount of people, as well as enabling the democratic actors (voters) to express themselves in the political arena much better and to participate in the democratic political process more constantly and consciously.

Information technologies and especially social media can become a platform by which politics of a country can be restructured. When this role is carried out within democratic countries by extreme groups, these communication means may exert a negative and destabilizing effect on the political system. But if this role is played by democratically-inclined groups in autocratic systems, they may have a positive and democratizing effect on the political structure.

A prerequisite for television to contribute to positive political communication and a wider democratic participation is that it should be pluralistic and to a certain degree impartial, acting with social responsibility instead of negative opposition and systematic attacks against democratic governments and public authorities. A similar requirement for contributive functioning of the Internet is that it should be subject to at least some universal limitations like natural or international law if not national regulations.

Political communication in Turkey usually closely follows the developed democratic countries of the globe. In the 2010s, political actors primarily used conventional communication channels like television, face-to-face communication etc. But they have been employing more and more different instruments of the new technologies like the Internet as a complementary and consolidating communication means.

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Trust Management as an Innovative Factor of Customer Retention: the Negotiation Behavior in Comparison to German and Turkish Business Partners

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F. Bakırcı et al. (eds.), *German-Turkish Perspectives on IT and Innovation Management*, FOM-Edition, https://doi.org/10.1007/978-3-658-16962-6_30

30.1 Introduction

30.1.1 Motivation

In general, it is well-known in practice that customer retention is five to ten times cheaper than acquiring new customers (cp. Kotler and Bliemel 2001, p. 83). Hence, customer retention is an explicit marketing goal that is characterized by a number of marketing strategies (cp. Kotler and Bliemel 2001, p. 82). In this sense, customer relationship management (CRM) is one approach to raise the chance of achieving customer satisfaction and binding them normally via contracts (cp. Kotler and Bliemel 2001, p. 84). But such customer retention methods do ensure whether there are reasons for and in what way customer might feel linked or connected with the company. Despite the existence of a contract, which frequently leads to follow-up orders, there may be customers who show hesitant behavior. Such behavior may be based on or be justified by a lack of trust. But lack of trust in business situations is usually not covered by the terms of contracts, nor reduced prices nor free services because lack of trust is often not justified by clear or rational arguments. Instead, lack of trust often poses an indefinite and intangible condition that is difficult to define with respect to a non-directional and unmotivated emotion (see Kierkegaard 1992, p. 57).

Based on this rationale, there is reason to suppose that contract-based customer retention could be more successful if it were accompanied by activities which bind customers (either by winning their trust or reducing their lack of trust). To elaborate, trust is the most important reward that a company can receive from its customers (cp. Eickenberg 2010, p. 71). It is invisible but powerful. It establishes the basis for the effectiveness of all marketing and sales activities. More specifically, because the customer expects individual counselling interview by a salesman, he opens the door to him, lets him in, shows him his business situation, and finally, he signs the contract. Hence, the most important success factor for customer retention is to win customers' trust (cp. Eickenberg 2010, p. 71). Consequently, this suggests that amplifying CRM with a trust management component could lead to more effective and efficient customer retention.

Because this claim raises several questions, the remainder of this essay focusses on addressing the following themes: What is trust and how can trust be developed or lack of trust reduced. In doing so, successive goals and benefits will be presented in order to establish the answers to these questions.

30.1.2 Goals

The main purpose of this paper is to demonstrate trust management with respect to customers' trust as a success factor for customer retention. This leads to the second goal which is to modify the general predominating business conduct in practice i.e. to receive controlled sales successes by highlighting different aspects and connections of trust. The third goal is to inspire the discussion about trust definition. Finally, the fourth goal is the presentation of the differences between the negotiation behavior German und Turkish business partners. The subject's use of trust lies in understanding trust and similar terms of trust in a sales oriented context. This requires recognition of trust strengthen aspects as well as differentiation of how trust can be developed and hindered as shown in following structure and methodology.

30.1.3 Structure and Methodology

The next section clarifies key terms and definitions in order to generate both an information base as well as a deeper understanding of the subject. To achieve this key themes related to the discussion such success factors, customer retention, trust, trust model, and trust management are presented in detail.

The subsequent section then discusses trust constricting and developing aspects. First, aspects are presented which constrict trust. Then key actions are presented which develop trust (or more specifically three aspects related to building trust). These include: trusting the customer, trust-building activities, and developing trustworthiness.

Based on the perceptions which were developed in the discussion in the previous sections, recommendations are proposed for applying these insights in a marketing and sales context with a view to improving customer trust, generating ideas for trust management, and finally, achieving better customer retention levels. Because this theme intersects with a range of scientific disciplines including business management, sociology, social psychology, and philosophy, the theoretical basis for this subject is established via literature which has been drawn from diverse field of past scholarship.

Finally, the trust oriented negotiation behavior in comparison to German and Turkish business partners is a detailed example to show differences of applied trust-building behavior in an intercultural context.

30.2 Discussion Oriented Definitions

The following terms are defined in this section in order to establish a basic and consistent understanding of trust management as a success factor for customer retention. That means success and success factors, customer retention, trust, and trust management.

30.2.1 Success and Success Factors

Success means the receiving of fulfilling of a wished result by doing, tolerating, or forbearing something. In a customer retention context success factors are all human being behaviors – they contribute to find and to win new customers saver, more targeted, and quicker. Moreover, success also depends on an individual competition oriented personality. Exemplified success factors are pleasing manners, patience, humor, persuasive power, eloquence, tactfulness, quick-wittedness, and intuition. Furthermore, there is the ability to receive and to reinforce trust (cp. Eickenberg 2010, p. 73).

30.2.2 Customer Retention

Normally, customer retention is defined as an activity to reduce customers' defections (see Eickenberg 2013, p. 76; Kotler and Bliemel 2001, p. 82 f.). Apart from the acquisition costs, there is a further reason why CRM has been established and implemented in organizations. CRM's goal is to know what customers want in order to have an individual approach and customized solutions for a continuing cross selling. Furthermore, CRM will reduce the risk of likelihood to disappoint or to annoy customers (see Kotler et al. 2012, p. 437). But even satisfied customers may defect to competitors without return. Although there are a lot of reasons, which lead to customers' defection, e.g. disappointment, wrong or not fulfilled expectations, bad feeling, or irritation. In other words, defection itself implies that there has been trust before.

30.2.3 Trust

Trust can be transcribed that there is somebody one can involve and rely on, or that things or behaviors happen as expected (cp. Luhmann 2009, p. 126). Otherwise, trust can be understood as the will to show himself vulnerably (cp. Bijlsma and Costa 2003, without page). Trust is as an abstract term like health, freedom, and justice. Such terms will not be recognized neither as a value nor as self-evident. But they will be regarded as an important issue or value if they are absent or wounded. In such a case they create the wish to the opposite (cp. Eickenberg 2010, p. 73 f.). For this work, trust will be understood in an utilitarianism sense as a developed condition of rational flexibility and emotional stability in order to achieve advantages and to avoid disadvantages (see Fig. 30.1).

Trust has been developed by lifetime. In general, it consists of successful managed difficult, new, or doubtful experiences (trust by doing) and insecure expectations (trust by bearing something). Those situations have trained the individual emotional stability

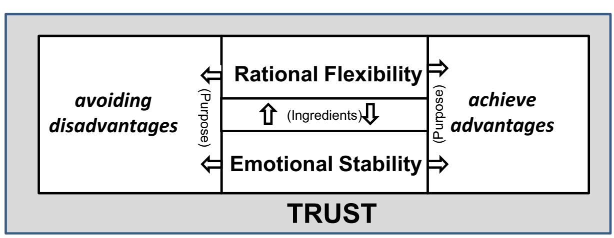

Fig. 30.1 Trust, its ingredients and purposes

and rational flexibility for new or similar situation in the future. On one hand, one has to control his feelings, to reduce his lack of trust and nerviness in that situation (to the lack of trust respective fear or angst driven behavior see Panse and Stegmann 1997, p. 85–91). On the other hand, one needs an idea how to solve, to decide, and to act in that situation. Trust is both, process and structure to manage decision making situations. People tend to avoid disadvantages, e.g. risks, illness, punishment, or they tend to receive advantages, e.g. chances, career, health, remuneration.

Above all, people will, can, and must trust because they are confronted with not controllable conditions in their lives. Some examples make it more understandable. Babies have to trust in their parents. People have to trust in their bodily functions like heartbeat, blood circuit, and metabolism. They must trust that earth keeps its gravitation. They have to trust in a pilot's, doctor's, lawyer's architect's, scientist's, and other expert's competence. Or people, who are on holiday abroad, will trust in people, who are familiar with the strange place or strange language, for the sake of convenience. Finally, they also must trust in the social, justice, and economic system and the dominant market mechanism (cp. Sprenger 2007, p. 55).

In special, trust will be reinforced by experiences in order to fulfil, e.g. customer's bargain buy and its involved positive feelings. From this point of view, trust is related to a concrete and secure use or advantage. Beside marketing concepts, which are oriented to customer acquisition and retention, trust receives a key role because it (cp. Sprenger 2007, p. 15–53):

- leads to quicker and more flexible decisions.
- enables communication between customers and sales.
- enables creativity and innovation.
- transforms people to customers.
- binds customers.
- leads to more profit.
- reduces costs.

30.2.4 Trust Management

Trust management includes both information what is to do by CRM including its data warehouse and how it is to do by sales force to hold personal contact and to bind customers (see also Cofta 2007. He regards trust management as a symbol-based automation of social decisions related to trust). Sales is both, part of marketing and part of trust management in order to win customers, to generate orders, and to bind customers (cp. Weis 2012, p. 95; Kuhlmann 2001, p. 10). Sales force is the most important instrument of trust oriented communication between people in business relationship, which means both consumer business and corporate business. In consumer business there is a relationship between a salesperson and a consumer customer. Often, in corporate business there is a relationship between a key account manager and a business customer (further details to key account management see Backhaus and Voeth 2007, p. 265; Vergossen 2004, p. 248; Weis 2005, p. 64 ff.).

30.3 Discussion of the Phenomenon Trust

For receiving an arc of suspense, there is a discussion between trust constricting and developing aspects. It starts with trust constricting aspects.

30.3.1 Trust Constricting Aspects

Trust in the defined sense will be constricted by a multitude of factors which have more or less strong influence on trust. Representative trust constricting exemplified aspects are:

- people's own negative view of the world,
- people's own negative idea of man,
- prejudgment of human behavior without knowing its coherences,
- confirmation of negative customer expectations,
- the own incalculable behavior which gives customers no orientation,
- the feeling of oppression something to do, respectively to have no option for action,
- the feeling to be treated unjustly.

Finally, the trust constricting aspects named above produce a lack of trust. And a lack of trust generates a lack of trust again. In order to stop this process there is the discussion's interest what can be done to develop trust.

30.3.2 Trust Developing Aspects

Trust will be developed by several factors. Their influence on trust has a different intensity. Trust developing exemplified aspects are:

- people's own positive view of the world,
- people's own positive idea of man,
- balanced judgement of human behavior with knowing its coherences,
- confirmation of positive customer expectations,
- the own calculable behavior which gives customers orientation,
- the feeling that there is no oppression, that there is something to do, and there are options for action,
- the feeling to be treated justly,

- trustworthiness,
- trust in others,
- use of trust-building activities.

Certainly, there is a whole clutch of sales trainings which point out the aforementioned aspects and teach trust oriented behaviors in order to receive urgently needed trust. But everybody who sales should be aware which hidden barriers are existing to win customer's trust during sales. Sales representatives have to cope with three barriers during their battle for customers. That means, sales representatives have to trust customers, the trust-building activities, and they have to be convinced they are trustworthy so that customers trust them. Successively, trust the customer, trust-building activities and trustworthiness receive a closer attention because they give an essential contribution to trust development.

30.3.3 Trust the Customer

The most important step for a sales representative is to trust the customer. This may sound strangely. But it is understandable before the background when one has a negative point of view of a customer by considering him as a pure turnover factor or reducing him to his signature. Such a point of view has different reasons. One reason may be salesman's pressure to succeed he is constrained. In such a case he may feel exploited and project it on the customer. The concerned sales representative should develop a positive view of a customer. He needs the positive insight that a customer is the utmost reason to work for. Normally, a customer will not control the salesman's expert knowledge by questions to the product or services.

If there is developed a positive point of view of a customer by a sales representative, customer will be trusted by considering him as a person who needs advice, assistance, help, and support. Sometimes, it is helpful to imagine a customer is a salesman's best friend. Normally, a customer has no bad intentions, but he will trust in someone or something. Hence, a sales representative has to give him a leap of faith. Afterwards the salesman may be pleased that his trust-building activities have a positive effect at the second step.

30.3.4 Trust-building Activities

Trust-building activities lose their effectivity if they are understood as an instrument of control. In such a sense techniques of questionnaires and dishonest selling behavior may have rather the character of a controlled sales conversation in order to receive customer's signature. Otherwise, trust-building activities also can lose their influence on the customer if a sales representative is not convinced of their positive effects. But trust developing activities should be part of a salesman authentic and honest personality, who has the deep insight in the effectivity of trust-building activities. Those activities ought to be adequate and accentuated to sales situations.

Anyway, the customer will notice selling behavior both consciously and unconsciously whether there is a salesman who deals dishonestly or honestly with him. In case of an honest sales representative, who has a positive point of view of the customer and who is convinced of trust-building activities, following proven examples underline his efforts to win, to confirm, and to strengthen customer's trust. All he has to do is to:

- appreciate the customer,
- hold eye contact with the customer,
- point out common interests with the customer,
- give orientation,
- be calculable for the customer,
- give safety to the customer,
- offer different alternative, flexible, and customized solutions,
- show quick responsiveness in case of order,
- be polite to the customer,
- develop customer's economic needs,
- fulfil customer's expectations positively,
- keep his promise,
- give respectable, competent, well informed and honest advice to the customer,
- show the customer his vulnerable side.

It is self-evident that those trust developing activities should not be simply copied, but calibrated on the personal communication style. That means, sales representative's clothes, jewelry, carriage, gesture, mimics, and behavior, which underline his personality and his communication style in sales conversations. They develop his authentic and convincing appearance (to the nonverbal communication by mimics and gesture see Görgen 2005, p. 18–21). Are those aspects individualized and internalized, the sales representative feels himself self-confident. Thus, he will be convinced that the customer will trust him at the third step.

30.3.5 Trustworthiness

There may be sales representatives who say to themselves theory and practice are two different pair of shoes. They may justify their sales successes because of using techniques of questionnaires and a dishonest selling behavior. Furthermore, it is possible that they mistrust the term trust and they do not consider themselves trustworthy. Partly, those attitudes are based on the lack of time for own reflection during sales activities. Nevertheless, winning customer's trust needs time for conversation. A long term, sustainable success is based on mutual trust only. That includes a salesman's attitudes he feels himself trustworthy and he decides on trust for a long-term, sustainable customer retention. However, trustworthiness is the most difficult barrier in order to receive trust because it is questionable whether a salesman himself is able and willing to perceive himself as trustworthy. It needs more courage, discipline, and force to trust himself than to trust others because trustworthiness corresponds with individual responsibility. Individual responsibility is based on the firm conviction that one has options and criteria for the assessment of relationships, which are rich in opportunity or hazardous. Options are given for the one who does not feel directed by others, but self-determined. Finally, he cannot act and react freely without trustworthiness. At this context developed trustworthiness and a critically consideration of himself need a regular and consistent exercise in order to obtain permanent mutual trust for mutual success.

30.4 Trust Management

Sales conversations are sales' core functions. In such conversations are a lot of findings and data from the customers which should enrich CRM in order to expand it to a trust management. Nevertheless, the data of the CRM for trustworthy sales should be used to have approaches for trust before the sales conversations start with customers. Especially, sales conversations have the highest potential for obtaining customer's trust. The personality of the sales representative and its associated trust aspects are valued as key success factors (cp. Vergossen 2004, p. 256). Therefore, following behavior recommendations for associated practical trust-building work in sales, which refer to the known sales phases, are given (to sales phases see Vergossen 2004, p. 256; Weis 2005, p. 233):

- Sales representatives should let the customer talk and hear out especially. They should not interrupt, listen carefully and indicate understanding of the situation and reasoning of the customer.
- The sales staff should listen to what the customer says to them and how he says it. Active listening is more important than persuasion. Will the client be persuaded, though he listens to yet, but not out.
- Sales representatives remain friendly and polite conversation participants throughout the customer visit. A customer visit is not a fight interview to being right. It is advertised to win the favor of customers and to find solutions.
- Sales representatives should always have an interior picture of what they do with fun and with great satisfaction with the customer. They are successful if they believe in this file.
- Sales representatives should not copy successful behavior of other salesmen. They should rather understand that they have to be faithful and have the courage to be themselves. To give themselves to the customer is the best thing they can do.
- Sales representatives should be polite and smile. It is helpful to break the ice.

- Sales representatives should not wait too long – the customer wants to address his problems. Normally, it is pleasing to the customer when they go to the first step on him.
- Sales representatives should be aware that they detect and solve costumer's problems. They always sell customer's use which gives the customer an impact for buying. If Sales representatives are not convinced of their products and services they sell, they should not have any arguments.
- Sales representatives should talk with the customer about the wanted advantages and avoidable disadvantages they are connected with the relevant product or service.
- Customer objections are grist to the mills of argument distribution, as they are a hidden invitation to a dialogue.
- Sales representatives should learn to build with their clients an intense and insightful trust and to maintain with trust-building measures. It almost goes without saying, trust will be achieved with the customer if one shows a sincere and honest behavior.
- Sales representatives reach seriousness by avoiding it to appear against the customer intrusively.
- Sales representatives are specialists of their services. They show their professional knowledge and the fact that they can explain complex issues to the customer well. Openness and clarity are its trump cards.
- Sales representatives are on first-name terms with many customers. They should make sure that they do not appear disrespectful to the customer despite or perhaps because of this confidential tone of voice.
- Sales representatives should remain objective about competitors and customers. They should not be provoked by the customer to an irrelevant or inaccurate comparison and to hasty conclusions.
- Sales representatives should represent in competitive situations their strengths. They provide the customers neutral and verifiable facts. This includes that they should praise the strengths of the competition if they are clear and obvious.
- Sales forces should make no competitors bad at the customer but stay a fair fellow even if the competitor behaves towards them unfair.
- How good it is to address customer issues the better it is to be also sensitive when the customer wants to end the call.

Customer's trust is gained to a considerable extent in talking to customers. A trust management, based on CRM, also takes into account the trust-building activities of the sales representatives. A trust management like understood above shows how trust developing aspects cooperate with CRM. That also means that sales and CRM need to be linked more closely together to achieve a successful customer retention.

Trust management should not only include CRM, but also sales men's trust-building activities in personal conversations or negotiations with business partners. It should be further extended to the international sales management and thus intercultural competencies in order to learn from the different trust oriented negotiation behavior between international business partners.

30.5 Trust Oriented Intercultural Competencies

Nowadays economic activities are strongly influenced by globalization, i.e. foreign customers and business partners. In this respect, an internationally oriented trust management, which should include an international sales management and thereby intercultural competencies, receives high importance. The intercultural competencies include the knowledge of the culture of the business partner. Deresky speaks of cultural sensitivity or cultural empathy which requires the ability to understand the perspective of those living in other societies and the willingness to put oneself in another's shoes (cp. Deresky 2011, p. 90 f.).

Intercultural skills lead to trusting intercultural relationship. Intercultural skills cover a cognitive, an affective and a communicative-behavioral dimension. The cognitive dimension stands for intercultural knowledge. That means the similarities and differences between the cultures' complexity. The affective dimension stands for the willingness to empathy, openness, tolerance and patience. The communicative-behavioral dimension stands for an effective communication and behavioral skills to interact and to avoid problems and conflicts with people of another culture (cp. Herbrand 2002, p. 33 f.; Erll and Gymnich 2014, p. 11 f.; Koch 2012, p. 106 ff.).

Koch has developed a so-called *Communication Style South,* which is based on the assumption that in many southern cultures certain cultural dimensions are pronounced. This style has four dimensions. 1) High context meaning: That means persons are more important than functions, employees have to be valued, it is important to create a pleasant working atmosphere and we-feeling. 2) Great power distance: That means existing hierarchical structures have to be integrated, showing authority and clear decision making, provide the opportunities for independent action of creativity. 3) Strong uncertainty avoidance: That means the fulfilling of procedures, give clear instructions and reduce complexity, secure understanding, anticipate missing error culture and accompany implementation processes closely. 4) Polychronic: That means pretend structures and arrangements and handle them flexible, openly made processes and monitor them regularly, use synergistically diversity and multidimensionality (cp. Koch 2012, p. 141 f., 215).

In this sense respectively oriented at an example, country specific intercultural competencies help to develop successful trust oriented negotiations between Turkish and German business partners.

30.6 Trust Oriented Negotiation Behavior in Comparison to Turkish and German Business Partners

The culture specific trust behavior of business partners has influence on a successful negotiation. Hence, it is useful to deal with the buyer-seller relationship. That means the culture specific trust behavior of the business partners in front of a negotiation. The term negotiation describes the process of discussion to reach a mutually acceptable agreement (cp. Deresky 2011, p. 153). A good and optimal preparation for a negotiation develops trust between the business partners. To be successful in negotiation, German business partners should be well prepared for negotiations with Turkish business partners. This also applies to negotiations with Turkish business partners. In the recent years, many branches in Turkey have developed positively. They have been becoming attractive for trade relations for German business partners. Moreover, Turkey is an important trade bridge between the markets of the East and the West.

30.6.1 Preparation for a Negotiation

For understanding the Turkish negotiation behavior, it is useful for German business partners that religion does not dominate the business life in Turkey. The Turkish negotiation behavior is a mixture of traditional and a modern dynamic communication. Turkish business partners prefer verbal communication, the professional hierarchy, and – in a historical context – obedience to authorities. In general, Turkish business partners are very adaptable, entrepreneurial, decisive and stress resistant. They are solution oriented, creative, and dynamic. Moreover, the Turkish business partners expect fast and high profits (cp. Koch 2012, p. 180; Deresky 2011, p. 137 ff.; Inanç 2006, p. 7 f.).

Hence, Turkish business partners are focused on the emotions and personality of their German negotiation partners. They invest time in building relationships. In this context, the development of trust is very important for Turkish business partners. The personal and objective are often not separated. That means, Turkish business partners often communicates indirectly. Small talk is a necessary part of building trust and relationship between the negotiation partners. It is very helpful to respect age and status and to avoid directly pronounced refusal of the negotiation partners. During negotiation, Turkish business partners want German negotiation partners who have a wide range of decision competence. Furthermore, they want to have the feeling that they have gained a special position towards their German negotiation partners (cp. Deresky 2011, p. 94; Inanç 2006, p. 8 f.).

In preparation for a negotiation between Turkish and German business partners, it should be considered that Turkish and German business partners have different basic attitudes to life in general and business in special which can influence the development of trust in a negotiation (see Table 30.1).

If German business partners take an eye on the aspects mentioned above, they are well prepared for performing their negotiation with Turkish business partners.

Table 30.1 Turkish and German attitudes to life and negotiation. (Source: cp. Inanç 2006, p. 9 f. See also Deresky 2011, p. 94; Erll and Gymnich 2014, p. 120 ff.; Kathriner and Schuler 2008, p. 177 ff.)

Turkish basic attitude to life they trust in	German basic attitude to life they trust in	Possible influence on trust in a negotiation
One should do the best to shape the future. But life follows ultimately the predetermined path.	One can shape the future.	Planning and scheduling of a negotiation
Ideals should be pursued independently from rational reasons.	One should be realistic in his/her pursuit.	Goals of a negotiation
Hard work is important. But wisdom and happiness are also important.	One have to work hard to achieve his/her own goals.	Motivation, performance incentives, and ethical work in a negotiation
Agreements must be kept. But a negotiation can be changed or stopped by new findings or results.	Agreements must be kept.	Development of a negotiation
Time is important, but only in conjunction with other priorities.	One should act time-critically.	Planning of a negotiation
The loyalty to the own company is as important as to the own family and friends.	One should be loyal to the own company.	Motivation, decision making process, priorities in a negotiation
Facts play an important role. However, the decider's wisdom is also very important which must not to be questioned.	Emotional influences should be minimized. Facts must dominate in decisions.	Decision making process in a negotiation
It is often not necessary that the decider consults experts before he/she makes a decision.	The decider consults experts before he/she makes a decision.	Decision making process in a negotiation

30.6.2 Performance of a Negotiation

Turkish business partners want a comfortable atmosphere for their negotiations. Therefore, they choose a cafe or restaurant for such talks. This may seem strange for German business partners. In Turkey it is usual to make business at the restaurant and to have a plenty of time for it. It has the advantage to learn the business partners. On this way, Turkish business partners try to find out more details about German business partners at the table (cp. Koch 2012, p. 181; Deresky 2011, p. 137 ff., 154 ff.; Inanç 2006, p. 10).

There can be identified five rough phases of the performance of a negotiation which are crucial for a trust building relationship between Turkish and German business partners.

First Negotiation Phase: Welcome and Introduction

The handshake of Turkish business men is less firm than in Germany. But the Handshake can last long. This means special appreciation of the German business partner. The German business cards should be written in English. German business partners should not be irritated if they receive marked business cards. Some Turkish business partners draw a cross of the back of their business cards to protect against abuse (cp. Eickenberg 2013, p. 246 f.; Koch 2012, p. 181 ff.; Deresky 2011, p. 138, 161; Erll and Gymnich 2014, p. 126 ff., 131, 134 f.; Inanç 2006, p. 10).

Second Negotiation Phase: Small Talk

As Turkish business partners give attention to the personal relationship it is very important not to start the negotiation with the business or with objective details. They talk about the weather or the journey of the German business partners. Helpful is for both partners that they have a cup of the traditional black tea Çay to break the ice. If German guests are invited to lunch time, it belongs to traditional Turkish behavior that the guest rejects the offered food several times before accepting it (cp. Eickenberg 2013, p. 248 f.; Deresky 2011, p. 138 f., 161; Inanç 2006, p. 10 f.).

Third Negotiation Phase: Negotiation in a Narrow Sense

It is utmost useful to show respect and understanding to Turkish business partners' culture and national consciousness in order to gain trust. This includes interest in their country and language. Even some Turkish spoken words with a German accent can lead to sympathy. That means on the other hand to avoid political and religious subjects they could concern Turkish business partners (cp. Eickenberg 2013, p. 249 ff.; Deresky 2011, p. 161; Inanç 2006, p. 13).

Moreover, Turkish business partners have a strong interest in the German negotiation partner's personality and private life. For trust building, a German business partner should not hesitate telling them about his family, hobbies, and personal attitude to life. Turkish business partners expect the same interest in their private sphere from the German side. That is why German should ask them about their private sphere tactfully and carefully. Furthermore, German negotiation partners should avoid talking too long and too object oriented or interrupting too often. Finally, they should listen to the Turkish business partners actively. An attentive and polite German listener is important because Turkish business partners speak indirectly and they use nuances of disagreements and rejections. This helps to preserve their face (cp. Koch 2012, p. 182; Deresky 2011, p. 138 f., 161; Inanç 2006, p. 4, 11).

Turkish business partners want to be motivated and inspired by their negotiation partners. They want a good conversation atmosphere and mutual goals. For trust building, German business partners better use goal oriented arguments which address Turkish emotions and their advantages they could have with the addressed goals. Do not ask any questions about objective details they could lead to serious problems or negative emotions. Hence, German business partners should avoid negotiation pressure. But on the other hand, Turkish business partners have a certain sense of humor. Some well-prepared jokes can be helpful to activate their positive emotions. Do not be irritated when the phone rings or people come and go several times during a negotiation. Turkish business partners regard this as a normal and tolerated process (cp. Koch 2012, p. 183, 186; Deresky 2011, p. 139, 161; Inanç 2006, p. 14).

Fourth Negotiation Phase: Closing

The closing phase is as important as tricky (see Table 30.2). Above all, the price has the highest priority for Turkish business partners. From a psychological point of view, German business partners should have price leeway and should not give a discount too early. A Turkish negotiation partner want to have the feeling of success that he has gained the best price he could encounter. This also applies to the case that sometimes in the very last moment of the closing phase, the Turkish boss activates himself for gaining an additional discount. During that time too long discussions about the price can reduce the negotiation motivation (cp. Eickenberg 2013, p. 269 f.; Deresky 2011, p. 161; Koch 2012, p. 186 f.; Inanç 2006, p. 16).

It is important to make a protocol of the negotiation in order to avoid open questions, misunderstandings, or distrust. In general, Turkish business partners do not like long and detailed written contracts or additional meetings with lawyers. Hence, German business partners should use a short easy reading contract. On one hand, this could lead to an insecure feeling to German business partners. On the other hand, such an uncertain or insecure situation is normal and tolerated by Turkish business partners who regard personal relationship and verbal agreements higher than written statements (cp. Koch 2012, p. 187 f.; Deresky 2011, p. 161; Inanç 2006, p. 17 f.).

Table 30.2 Differences of negotiation behavior between German and Turkish business partners. (Source: cp. Inanç 2006, p. 19 f. To the German business behavior see Deresky 2011, p. 112 f.)

German Business Partner	Turkish Business Partner
Advantage and profitability	Practical and quick result
Perfection and quality	Applicability
Stability	Change and adaptability
Equality for all people	Inequality for all people
Insecurity leads to stress	Insecurity can be tolerated
Trust is object oriented	Trust is personal oriented
Precisely formulated	Globally formulated
Emphasis	Unspoken
Check out whether the other has understood the information	Expect that the other knows the information
Need for detailed information	Detailed information are useless
Planning oriented	Time oriented
No disturbances	Disturbances are tolerated
No shift of activities	Shift of activities
Objective and goal oriented	Relationship oriented
Short small talk	Long small talk
Direct	Indirect
Objective	Emotional
Organized	Disorganized

Fifth Negotiation Phase: Celebration and Time to Say Goodbye

After the negotiation has come to a positive end for both parties it is utmost important to leave a positive impression to the Turkish business partners. An invitation to a generous dinner is a wonderful idea for celebrating the so called win-win situation. Additional Gifts will underline the positive relationship to Turkish business partners if they are full of prestige. They should be given after the negotiation to avoid the purpose of corruption (cp. Deresky 2011, p. 156 f.; Inanç 2006, p. 12, 18).

To hold a sustainable relationship to the Turkish business partners, German business partners have to cooperate with them steadily and friendly. It is a hard work. But trust is very important for Turkish business partners. They need the emotional conviction that one is highly engaged in the relationship by phoning, visiting, and inviting them (see Deresky 2011, p. 129; Inanç 2006, p. 18).

Conclusion

In general, trust is an essential success factor between the buyer-seller relationship. That means in special, trust develops a customer retention. In respect to the understood trust model, trust is a developed condition of emotional stability and rational flexibility in order to avoid disadvantages and to achieve advantages. Moreover, it is a most important step for sales representatives that they have to trust the customers. The next step is that he uses trust-building activities. The final step deals with his attitude to be convinced to be trustworthy in order to obtain permanent trust for mutual success with the customer. This leads to a trust management which should be focused not only on CRM, but also on sales conversations because they have the highest potential for obtaining customer's trust. This includes trust constricting and trust developing aspects during a conversation. Hence, several recommendations are given to sales men's trust-building behavior.

In general, due to the globalization trust oriented intercultural competencies are important to international business partners. In special, due to the important business relationship between German and Turkish business partners the differences in their negotiation behavior are presented. In order to win trust, German business partners have to be well prepared for a negotiation with Turkish business partners because they prefer verbal communications. Due to the different basic attitudes to life and business relationships and the focus on the emotions and personality of their negation partners Turkish business partners invest a lot of time in building business relationships. German business partners should accept the differences in order to develop mutual trust.

Furthermore, German business partners have to consider five rough negotiation phases during a performance of a negotiation to develop a trust oriented business relationship. Personal welcome and introduction is the first phase of the trust-building process. The second phase is small talk which needs time for knowing each other and to develop mutual trust. The third phase consists of the negotiation in a narrow sense. Due to the wishful business success it is important to use country specific respectively intercultural oriented trust-building measures. The fourth phase includes the closing.

In this phase German business partners even have to trust the verbal agreements of the Turkish business partners. In the fifth phase the so called win-win situation ought to be celebrated by the business partners. German after sales activities have to focus on the emotion based trust by a high engagement in the German-Turkish relationship.

Finally, the business success between German and Turkish business partners can be seen in the fact that there is not only a flourishing business relationship, but also a trust based partnership and friendship between people and two nations.

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