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Do Social Factors Matter for Innovation, and Do They Influence Innovation in Aeronautics Industry?

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Abstract

As innovation plays an important role in economic growth and development, it is necessary to understand the factors, especially the social factors, which determine the differences in innovation intensity across countries and regions. However, since they are out of scope, the R&D investments and human capital will not be covered in detail in this paper. The purpose of this paper is to examine the relationships between social factors and innovation generally and the case of Aeronautics Industry (AI). This paper analysed the influence of social factors on innovation activity and tried to understand the effect in AI. First, the theoretical background concerning innovation, and the social factors were introduced. Then, with an overview of the AIs in Europe and Turkey, the influence of different dimensions of social factors on determinants of innovation in AI was discussed. I used secondary data sources published by academics and international organizations.

Keywords: Aeronautics Industry; Turkey; innovation; social factors; human capital
JEL codes: O31; R4

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DO SOCIAL FACTORS MATTER FOR INNOVATION AND DO THEY INFLUENCE INNOVATION IN AERONAUTICS INDUSTRY?

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1. INTRODUCTION

Much of the rise in living standards is due to innovation. This has been the case since the Industrial Revolution. Today, innovation performance is a crucial determinant of competitiveness and national progress. Undoubtedly the capability to innovate and to bring innovation successfully to market will be a crucial determinant of the global competitiveness of nations over the coming decade. There is growing awareness among policymakers that innovative activity is the main driver of economic progress and well-being as well as a potential factor in meeting global challenges in domains such as the environment and health.

In consistency with this purpose, many countries develop national innovation systems, increase public and private investment in research and development and form special clusters of innovation such as free economic zones, techno-parks and centers of excellence. However, the planned processes are impeded by an unaccounted factor; the culture and social context in which innovations are designed and disseminated. Innovation requires investments in research and development (R&D), and qualified manpower is needed to create and utilise innovations. But empirical evidence shows that the same expenditures on R&D in different countries often fail to yield similar success in innovation. This suggests that innovation process is additionally influenced by many other factors.

2. THEORETICAL BACKGROUND

2.1 INNOVATION

Innovation is usually understood as the introduction of something new or significantly improved including both new products and processes. As such, innovation can be broadly defined as an increase in the variety of goods, services and processes, rather than a purely technological advance (Unger and Zagler,2003).

The concept of innovation has evolved over the last forty years. During 1950s, innovation was considered as a discrete event resulting from knowledge developed by isolated inventors and isolated researchers. Nowdays, innovation is rather considered as the result of a process which success rests upon the interactions and exchanges of knowledge involving a large diversity of actors in situations of interdependence. Knowledge based innovation is considered as Landry, Amara and Lamari define it (2000):

- A process, more specifically a problem solving process (Dosi,1982),
- An interactive process involving relationship between firms with the different actors of their environment (Kline and Rosenberg,1986),
- A diversified learning process. Learning may arise from learning by using, learning by doing, learning by sharing (Rosenberg,1982: Lundwall,1995). Learning may arise from internal or external sources of knowledge (Dogson,1991). External learning refers to the absorption capacity of firms (Cohen and Levinthal,1990),
- A process involving the exchange of codified and tacit knowledge (Patell and Pavit,1994). The exchange of codified knowledge is essential but insufficient (Winter,1997),
- An interactive process (Johnson,1992: Lundavall,1992) of learning and exchange where interdependence between actors generates a system, an innovative sytem (Holbrook and Wolfe,2000: Landry and Amara,1998).

This evolution from a discreet event conception to a process conception of innovation has generated two consequences. Fitst, innovation is no longer conceived as a discrete event only involving the development of technical solutions, but also a process also involving social interactions. Second, innovation is no longer explained by the sole combinations of tangible forms of capital, but also by combinations of intangible forms of capital, especially social capital (Landry, Amara and Lamari, 2000).

The involvement of a country in innovative activity has two aspects, inputs and outputs. The inputs include, above all, human capital, R&D expenditures and employment in R&D both in government and business sector. The outputs of innovation include product, process, and nontechnological innovations. The output can be measured by the share of enterprises with different innovative activities and patent applications.

A count of patent is one measure of a country`s innovative activity and also shows its capacity to exploit knowledge and translate it into potential economic gains. In this context, indicators based on patent statistics are widely used to assess the inventive and innovative performance of a country. Appliying for a patent makes an innovation public, but at the same time gives it protection. It may be argued that patent protection motivates the innovations, but at the same time may slow down the diffusion of new technologies, techniques and products.

According to Eurostat Patent Statistics, Germany had by far the highest number of patent applications to the European Patent Office (EPO) among the EU member states, some 21724 in 2010 (39.9% of the EU total). Among the EU member states, the highest shares of innovative enterprises during the period 2008-2010 were absorved in Germany (79.3% of all), Luxemburg (68.1% of all), Belgium and Portugal. 39.3% of EU patent applications to the EPO in 2005 were from single country. In fact, such copatents made upon overall majority(53.1%) of all patent applications(multiple inventors from a single country). Patent applications involving inventors from more than one country made up the remaining patent applications to the EPO.

In 2008, EU had almost 50000 enterprises in hightech manufacturing. Hightech manufacturers were most numerous in Germany, United Kingdom, Italy, and France, all together accounting for around 55% of the hightech sector in the EU. Beside Innovation activity, the utilisation of innovation is also important. The ability to exploit the innovations can be measuredby the share of hightech exports or the share of sales of new products in turnover of the enterprises.

According to INNO Policy Trend Chart and The Innovation Union Scoreboard 2013, the analysis of research and innovation policy measures has detected several robust trends. The most notable overall evolution is an increasing of programme-based research and innovation policy channelled through concrete 'policy measures' relative to institutional funding (i.e. the budget for the functioning of public organisations, mostly comprised of salary and administrative costs). Although the availability of skilled people is often cited as one of the key challenges, there has been only a small share of funding devoted to support innovation skills development. Across the forms of funding, the analysis demonstrates a focus on industry-science collaboration. In the last decade, policy measures have been shifting away from individual research subsidies towards collaborative research subsidies in the expectation that these measures might collaborative schemes contribute to higher innovation performance. This shift reflects the increasing emphasis on the commercialising of the results of R&D.

Likewise, a slight trend towards subsidised loans as compared to grants is noted, although grants remain the most frequently used form of funding. In spite of these observable trends, funding priorities have not changed significantly in any country and prove to be very strongly oriented towards scientific and technological research and development.

The analysis shows that the policy mix pursued by each country has remained quite stable over the past twelve years. It confirms that changes to a policy mix require either a much longer time period or a more substantial 'policy push' if a country wants to reform its innovation system. Secondly, the analysis evidences a relative homogeneity of policy mixes across countries despite them having fairly wide differences in technological and economic developments. This homogeneity of policy mixes may reflect the objective of raising the innovation performance but it also stems from the emphasis put on 'best practices' at the expense of a critical understanding of the specific challenges affecting each country and of an informed discussion on the most appropriate ways to address them.

The analysis tends to confirm the mismatch between the innovation performance and the policy models which are implemented in countries. For example, the 'Business R&D and innovation' policy mix model can be found in leaders, followers and moderate innovators but not in modest innovators that might be expected to follow this policy mix as they are very weak in terms of business R&D. Countries should be encouraged to develop their own specific policy models to a much greater degree, so that each model represents a unique response to the particular challenges that each country is facing. The analysis indicates that no policy mix model is superior to any other in fostering innovation performance. Indeed, during the past decade, no country has substantially or lastingly moved up or down a performance group. It cannot be expected that there are policy models that are successful or less successful across all countries; a chosen model must be workable in relation to the conditions of a country. The review shows that the majority of the country policy mixes investigated do not necessarily respond to country specific innovation challenges and could be made more effective with some degree of reorientation.

Obviously, upgrading the innovation performance of a country and how this translates into concrete economic outputs cannot be limited to the sole innovation policy mix. Technology accumulation and innovation are strongly shaped by favourable or less favourable framework conditions and by the broader institutional environment. Workable innovation policy mixes cannot compensate for weaknesses in the framework conditions. For example, the effectiveness of policies aiming to boost collaboration with public research and/or to directly support business R&D activities requires specific assessments of the innovation capacity of businesses in the country concerned.

As a result, innovation is often considered key to the global race for competitiveness, creating jobs and improving quality of life. The success of firms and national economies are more dependent than ever on innovation and the capacity to create and use knowledge. The capacity to innovate and to assimilate innovation have regularly been considered as two key factors behind the economic dynamism of any territory (Porter and Stern, 2002). As innovation play an important role in economic growth and development, it is necessary to understand the factors, which determine the differences in innovation intensity across countries.

2.2 FACTORS THAT INFLUENCE INNOVATION

The inputs of innovation activity will be considered as an influencing factor of innovation. In order to attain innovation outputs, investments into R&D and education system, public policy for R&D are needed. R&D as an input of innovation is unquestionably a key factor of innovation. Also, the general level of human capital of a country or a region is commonly supposed to positively influence innovation. Investment in higher education, R&D and new information and communication technologies complement each other, empower human capital and provide the infrastructure needed to address the many challenges that societies face.

However, since people are the main source and means to embody knowledge, idea, and creativity, I think human capital plays a key role in generating and accumulating knowledge based capital. The rapidly growing demand for highly skilled workers has led to global competition for talent. High level skills are critical for creating new knowledge, technologies and innovation, and are key to economic growth and social development. High level skills include higher education, creativity, risk taking, and initiative (Heitor, 2002). In this context, top performing students in reading, math and science are likely to contribute to a country s future talent pool. Shortly, the general level of human capital, with individual and organizational technological accumulation considering absorptive capacity and tacit knowledge, determines the quality of the labour force, which is employed or can potentially be employed in R&D.

Factors of innovation include the availability of financial funds for R&D activities. Innovation requires time and effort of research workers in science and technology (S&T). It should be rewarded financially immediately, since the returns from innovation will occur only after time and with unknown rate and probability, to keep motivation and smart persistence to innovate. Basic alternatives for innovation financing include internal finance (out of profit) and external finance (Unger and Zagler, 2003). Regarding internal finance, the innovation rates depends on the probability of success of innovation and on the profit share. However, it could be assumed that, due to high risk and uncertainty, innovation funding only from profits and through private capital markets is insufficient. Innovation involves uncertainty, risk taking, probing and re probing, experimenting, and testing. In case of low internal funds, usually, there is a need for external finance through financial markets, where the cost of capital (therefore the innovation rate) depends on asset prices and interest rates, other enterprises, public institutions and international organizations. In addition to providing grants, contracts and loans (direct government funding of business R&D), many governments contribute to business R&D through tax incentives. Across countries, R&D intensity in the business sector is significantly correlated with total government support for business R&D. This does not imply a causal relationship and there are notable exceptions. Germany and Korea have relatively high business R&D intensity compared to their degree of government support, while Canada, the Russian Federation and Turkey have high rates of support relative to countries with similar business R&D-to-GDP ratios. In 2011, Finland, Germany, Sweden and Switzerland did not offer tax incentives but had very R&D-intensive business sectors.

Expenditure on R&D is one of the most widely used measures of innovation input. The sectoral structure of the R&D performed in a country can be particularly revealing of the relative strengths and weakness of its innovation system. Sectoral differences in R&D performance tend to be reflected in the type of R&D conducted. According to OECD report, the business sector accounts, 67%, for the largest share of R&D performed in most economies, higher education accounts nearly 17%, and government accounts 12% for basic and applied research. Business enterprise expenditure on R&D is an important driver for innovation and economic growth. An ability to encourage research affects its capacity to create new knowledge and stimulate innovation. The United States is the world’s largest R&D performer, with nearly USD 415 billion of domestic R&D expenditures in 2011. This is about twice the amount of R&D performed in China, which is now the second largest performer, ahead of Japan, Germany and Korea. Korea has the highest ratio of R&D expenditures to GDP owing to rapid increases in recent years. Non-OECD economies account for a growing share of the world’s R&D, measured in terms of total researchers and R&D expenditures. Personnel costs account in most economies for the bulk of R&D expenditures. This explains the close relationship between R&D as a percentage of GDP and the number of researchers as a percentage of total employment.

Undoubtedly, as stated before, innovation requires investments in R&D, and qualified manpower is needed to create and utilise innovations. But the same expenditures on R&D in different countries often fail to yield similar success in innovation. This suggest that innovation process is additionally influenced by many other factors, the social environment, networks, norms, trust, and civic participation which can be jointly referred to as social capital and the overall institutional environment of a particular country. The flows of technology and information among people, enterprises and institutions are key to the innovative process. The social conditions (such as help, talk, trust, and cooperation and coordination) that enable and facilitate the flows of knowledge influence success in innovation. Prior research has shown significant differences within country in the levels of innovative activities, human capital and social capital (Daklhi and de Clercq, 2004), and have examined how countries differ in terms of their level of innovative activity. For instance, Shane (1992) found that individualistic and non-hierarchical societies are more inventive than other societies. Further, it has been suggested that societies that are more willing to accept uncertainty may be more innovative than uncertainty-avoiding societies because the legitimacy of innovation championing roles is greater in corporations within the former societies (Shane 1992).

One of the struggles of late industrializing countries in their struggle to overcome their usual backward technological development is to build the adequate institutions and create the type of environment that induces active learning and absorptive capacity. Absorptive capacity is the ability to recognize the value of new external information, to learn, to assimilate and to apply it. Once a sufficient absorptive capacity is developed, foreign knowledge would then and only then, be expected to enhance competence creation. The effective utilization of external capabilities also requires absorptive capacity. Another important sub factor is active learning. A strategy of learning that also focuses on the mastering and improving of the absorbed technologies of production through by imitation, reverse engineering and copying (Viotti, 2002)

The Internet is a key infrastructure for businesses, individuals and the public sector alike and continues to expand rapidly. Global Internet Protocol (IP) traffic rose from 20 thousand Petabytes a month in 2010 to 55 000 in 2013 and has increased 19-fold since 2005. Around three-quarters of the world's inhabitants now have access to a mobile phone. The number of mobile subscriptions in use worldwide, both pre-paid and post-paid, has grown from fewer than 1 billion in 2000 to over 6 billion today, of which nearly 5 billion in developing countries. Mobile cellular penetration (per 100 inhabitants) in the OECD area passed 100% in 2008. The story of mobile communications will now shift from the phone to how it is used. Near ubiquity brings new opportunities. Always-on and mobile connectivity are already reshaping people's daily behaviour and will continue to do so in coming years as well as in innovation activities, helping facilitate the innovation process.

In the global landscape of scientific research, scientific output has grown rapidly and collaboration between institutions in different countries has intensified. The emergence of new players has changed the structure of global collaboration networks. Indicators of triadic patents and of trademarks abroad suggest the worldwide spread of innovative activities, in terms of both technological and non-R&D-based innovation.

Location seems to matter too. Many of the leading firms in knowledge-intensive industries such as information and communication technologies, biotechnology and nanotechnology have emerged in a limited number of regions. The top 20 patenting regions in these enabling technologies are concentrated in a handful of countries, particularly the United States (34%, down from about 50% ten years earlier) and Japan (29%, up from about 17% ten years earlier). China also has innovation hotspots, with the Beijing region relatively specialised in all three technologies but particularly in biotechnology and nanotechnology, and the Guangdong region relatively more specialised in ICT (a 90-fold increase in ICT applications over a ten-year period). Seven European regions are among the top innovation hotspots in enabling technologies, with a share in top patenting regions of about 21% (down from about 29% ten years earlier). Such regions appear to provide environments that are particularly conducive to business innovation. Much of the effort of policy makers in other regions goes to replicating or nurturing the conditions present in the best-performing regions. But each situation and social environment is not similar and need reorientation.

Overall, I think the key elements of innovation capacity are knowledge skilled human capital with absorptive capacity and tacit knowledge, creativity, motivation, infrastructure , technology accumulation at least to a certain minimum required extent for sustainable innovation activities, smart persistence with a long term vision, availability of financial fund for R&D, the social and cultural environment which encourage innovative activities and attractive locations in which all these elements take place.

2.3 SOCIAL FACTORS AND INNOVATION

The central proposition in the social factors or in other term social capital literature is that networks of relationships constitute resources that can be used for the good of the individual or the collective. It is also emphasized the role social capital has in the creation of human capital (Serageldin and Dasgupta, 2001). Similarly, Putnam (2000) conceptualized social capital as features of social organizations, such as network structures, norms, and trust that facilitate coordination and cooperation for mutual benefict within a society. It refers to the institutions, relationships and norms that shape the quality and quantity of a society` s social interactions. Social capital is not only the sum of the institutions which underpin a society; it is the glue that holds them together (World Bank). Increasing evidence shows that social cohesion is critical for societies to prosper economically and for development to be sustainable. It is assumed that different dimensions of social capital can influence innovation in dissimilar ways. Social capital can take different forms, primarily trust, norms, and networks (Dasgupta and Serageldin, 2001). The analysis on country level enables to suggest that the effect of social capital on innovation activity depends on the development level of the particular country (Kaasa, Kaldaru and Parts, 2007).

Shortly, trust is developed over time through repeated series of interactions. In high level of trust, firms are more likely to innovate since by reducing transaction costs. Low trust can also discourage innovation if firms and individuals must devote more time to monitoring for protecting themselves. Norms of appropriate behaviour also develop over time as a result of a series of interactions and exchange of resources. Norms act as a constraint on narrow self interest, leading individuals to contribute productively to exchange instead of behaving opportunistically. Finally, networks develop reliable and effective communication channels across organizational boundaries (Landry, Amara and Lamari, 2000). However, it is better to understand social capital in detail.

Due to heterogeneous character of social capital, no single indicator of social capital can be used and therefore measurement methods using many indicators have to be applied. Measuring social capital may be difficult, but it is possible, and several studies have identified useful proxies for social capital, using different types and combinations of qualitative, comparative and quantitative research methodologies.

The concept of social capital is broken down to five subcategories for operational purposes. These subcategories capture both the structural and cognitive forms of social capital.

- Formal and informal networks, Groups
- General and institutional trust and solidarity
- Social norms, and Social cohesion and inclusion
- Civic participation, collective action and cooperation
- information and communication

A broader understanding of social capital accounts for both the positive and negative aspects by including vertical as well as horizontal associations between people and includes behaviour within and among organizations, such as firms. This view recognizes that horizontal ties are needed to give communities a sense of identity and common purpose, but also stresses that without bridging ties that transcend various social divides (e.g. Religion, ethnicity, socio economic status), horizontal ties can become a basis for the pursuit of narrow interests, and actively preclude access to information and material resources that would otherwise be of great assistance to the community.

The broadest and most encompassing view of social capital includes the social and political environment that shapes social structure and enables norms to develop. This analysis extends the importance of social capital to the most formalized institutional relationships and structures such as government, the political regime, the rule of law, the court system, and civil and political liberties.

Stronger social networks, tight communities bound by shared norms, trust, and reciprocity enhance cooperation and productivity. When people belong to communities with high levels of social capital, the theory goes, they are far more willing to work together and take chances on risky ideas. It followed that high social capital would fuel innovation. However, Regional Innovation and Economic Development studies in the United States show just the opposite. It is found that areas with low levels of innovation, scored high on social capital. And, areas that did well on innovation tended to have below average levels of social capital (Florida, Cushing and Gates, 2002)

Why? Relationships can get so strong that the community becomes complacent and insulated from outside information and challenges. Strong ties can also promote the sort of conformity that undermines innovation. Weak ties, on the other hand, allow a basic level of information sharing and collaboration while permitting newcomers with different ideas to be accepted quickly into the social network. Thus, social groups with weak ties could be expected to encourage innovative thinking (Florida, Cushing and Gates, 2002). Increasingly, creative people are choosing not to live in places with high social capital. Instead, they are following to environment with low social capital, cities and college towns where they can fit in quickly but still find their ideas challenged by other people, whether in business or the arts. These findings have implications for nurturing innovation within companies as well. Companies that foster diversity and openness internally, even at the cost of some cohesiveness, may do better in attracting talented, creative employees and encouraging innovative collaboration (Florida, Cushing and Gates, 2002).

Often, a breakthrough innovation requires marrying or colliding two partial ideas. To do this we have to create spaces for people to get together so we can unlock this innovation. For example, the weekly lab meeting was where most of innovation at lab typically occurred. Social network research shows that often it is not your close ties that unlock this creativity and innovation, but your weaker ties that connect those to others who are a little less similar likely to have differing and highly valuable new ideas.

Organizational support and network activities are crucial for bridging and linking social capital. Engagements of people to organize themselves and mobilize resources to solve problems of common interest are some of the outputs from groups and networks that enhance or build upon social capital. The effectiveness of groups and networks and the extent to which they can help disseminate information, reduce opportunistic behaviour and facilitate collective decision making depends upon many aspects of these groups, reflecting their structure, their membership and the way they function. Social networks can increase productivity by reducing the costs of doing business. Social networks facilitate coordination and cooperation. On the other hand, social capital has an important downside. Communities, groups or networks which are isolated, parochial, or working at cross purposes to society s collective interests (drug cartels, corruption rackets) can actually hinder economic and social development (Portes and Landholt, 1996). I think, moreover, networks which have opportunistic behaviour may prevent right people, skilful labour force, which can potentially be employed in R&D and plays a key role in generating and accumulating knowledge based capital. In other words, many associations may work as special interest groups that lobby for preferential policies and protection of the *status quo*, and therefore hamper risky, innovative activities. Strong, tightly-knit groups may hamper economic development by protecting a disproportionate part of natural resources or by inhibiting individuals' personal advancement and posing strong personal obligations on them (Portes and Landholt, 1996).

Trust and solidarity, the informal and subjective elements of interpersonal behaviour shape people`s thoughts and attitudes about interacting with others. When individuals in communities trust each other and the institutions that operate among them (democracy, civil service, parliament, court system, finance system), they can easier reach agreement and conduct transactions. Previous researchers have argued that trust, both within organizations and in inter- organizational settings, may foster innovation. First, within organizations, trust has been found to be important to innovation in that it lessens the need for rigid control systems (Quinn, 1979). Tight monitoring and control mechanisms reduce creative thinking, while freedom from rigid rules and job definitions enhances idea generation. Second, trust is not only important for innovation through interactions between individuals within an organization but also through inter-organizational cooperation. The capacity to maintain a continuous flow of innovation within a country, therefore, depends on the ability to diffuse basic knowledge to organizations that interact in R&D and production activities among others. A high level of trust among organizations within a country facilitates the exchange of confidential information by diminishing the risk that one party will opportunistically exploit this information to the other's disadvantage (Knack and Keefer, 1997). Trust facilitates social exchange by reducing the need for time consuming and costly monitoring, and therefore makes it possible for people and organizations to devote added time for other beneficial actions and endeavours. In short, both forms of trust, i.e. generalized trust and institutional trust, as factors that reduce the need for monitoring, increase the willingness of people and organizations to interact and to share information, knowledge, and other resources, albeit for different reasons. Akcomak and ter Weel (2006) analysed European regional-level data and found that trust had a positive influence on the number of patent applications.

Collective action and cooperation provides opportunities for participation and gives voice. In other words, they provide the ability to work together for a common good and a common sense of purpose. For example, Snecma (F) and GE (US) run a very successful joint venture in the global market dominating the market for large civil aircraft engines. The dominant engine consortium for LCA is the US and French joint venture CFM. It is far ahead in terms of market shares. They have combined their existing technologies and supplied an innovative engine to the market. The provision of many services requires collective action by a group of individuals or organizations even the purposes of collective action may differ widely across communities. The EU funded research projects like myCopter, Pplane, ACHEON and CROP are collective actions by a group of organizations to work together for a common goal in aeronautics technology.

Social cohesion and inclusion, and norms provide functioning and well fare of society. Social cohesion manifests in individuals who are willing and able to work together to address common needs, overcome constraints, and consider others interests. They are able to resolve differences in a civil, non confrontational way. Inclusion promotes equal access to opportunities, and removes both formal and informal barriers to participation. The relationship between norms of civic behaviour and innovation is, on the one hand, very weak. One possible explanation could be that adherence to norms that reflect the general tendency of 'being a good citizen' is generally contradictory to the general willingness to deviate from existing rules and procedures that has often been shown to be necessary for innovative activities. Radical innovation often entails risky decisions since the costs related to innovation are high and the market success of radical new products is uncertain (Dakhli and de Clercq, 2004). On the other hand, Dakhli and de Clercq (2004) argue that the higher the norms of civic behaviour – for instance, the norm of helping others or the norm of good citizenship – the higher the country's level of innovation. Reciprocity can be one important factor to encourage the diffusion of resources. The norm that prefers society's interests to self-interest also supports the diffusion of information. In addition, shared norms help to avoid misunderstandings and facilitate cooperation. (Kaasa, Kaldura and Parts, 2007)

Information and communication form the crux of social interactions. Downward flows of information from the policy realm and upward flows from the local level are critical components of the development process. Horizontal information flows strengthen capacity by providing civil society a medium for knowledge and idea change. Open dialogue fosters a sense of community while secrecy breeds suspicion and distrust. Enhancing the dissemination of information can break down negative social capital as well as build trust and cohesion. In particular, investment in information and communication technologies is positively correlated with uptake and diffusion of innovation (OECD, 2004). The use of ICT is closely linked to the ability of firms to innovate, i.e. introduce new products, services, business processes and applications. Moreover, ICT has helped facilitate the innovation process, for example by speeding up scientific discovery. ICT has also fostered networking, which has enabled informal learning and co-operation between firms, as well as outsourcing.

Institutional quality, in other terms, rule of law, control of corruption, government effectiveness, political stability, regulatory quality, voice and accountability contributes the ability to work together for a common good, building trust, a common sense of purpose, functioning and well fare of society.

The analysis focusing on differences in social capital across regions shows that a higher stock of social capital yields more innovation. The main reason for this is that innovation is a risky activity, so the venture capitalist and researcher are both helped if they can trust one another.This is easier in an environment in which people trust each other more. This positive relationshipbetween social capital and innovation feeds back into the production process and increases percapita income. An implication of this result is that historical differences between regions of an otherwise relatively homogeneous set of countries seem to have a lasting effect on social capital.

The findings suggest that backward regions cannot improve fast in terms of innovation and per capita income growth, because the shaping of social capital is crucial and takes long to develop. It also suggests that public investments in R&D might not be beneficial because in all likelihood the private sector has trouble investing money efficiently. These regions would benefit probably more from investments in education, because human capital and social capital are likely to be complementary (Akcomak and Weel 2008).

Overall, my standing point is that different dimensions of social capital can also influence innovation activity in AI in dissimilar ways. And, there is not absolute finding that is true in every situation and in every case. For example when the institutional quality is not enough, trust, norms of civic participation and being a good citizen can influence innovation positively to a certain extent, by facilitating coordination and cooperation for collective benefit, reducing corruption and improving the efficiency of R&D funding. On the other hand, when the institutional quality and welfare is high, high social capital can influence less or sometimes some dimensions of the social capital can restrict innovation since it may constraint different ideas. Also when the human capital is weak, the high social capital does not prosper. In short, it is assumed that different dimensions of social capital can influence innovation in dissimilar ways. I think there is not an absolute finding that is true in every situation and case.

3. OVERVIEW OF AERONAUTICS INDUSTRIES IN EUROPE AND TURKEY

The aim of this section is to give an overview of AI generally and in particularly Europe and Turkey. The focus of this paper is on civil aviation, which explicitly excludes defence and space activities. However, military aviation is included in the analysis when interdependencies to civil aviation are significant or when available data do not allow for differentiation. Officially available statistics provided by Eurostat do not differentiate between the sub sectors civil, defence, aeronautic and space.

Based on that classification, according to Eurostat, EU AI employed 375 300 people in 2008 and the output amounted to EUR 27.8 billion. The value added came up to EUR 34.5 billion. As compared with all of the EU manufacturing industries, AI accounts a share of around 1.8% of value added and 1.2% of the number of employees. Production of the EU AI grew between 2001 and 2008 at an annual average rate of 1.5%. The number of employees grew slightly at a rate of 0.1%.

The regional distribution of the AI discloses a concentration in the bigger member states. As measured by the value added as a percentage of total manufacturing industries, the UK is leading with 4.5% followed by France with 3.5%. Then, Germany, Italy, and Sweden are following suit with shares between 1% and 1.5%. For other important countries of the European AI, such as Spain, Belgium, the Netherlands, Poland, the Czech Republic and Romania the share of the AI of the national manufacturing industry lies in the range of 0.5% to 1%. According to the European Association of the AI, The European turnover of the AI in 2008, continued space products(7.1%), military aircraft(32,1%), helicopters(civil and military) (11%), and civil aircraft(49.6%). Large aircraft came up to 87.3%, regional aircraft to 4.6% and business aircraft to 8.1%.

The most important economies in the global AI market are the United States, EU, Canada, Brazil and Japan. Japan is strongly linked to the US value chain as a supplier of high tech components for aircraft. Brazil is the only emerging country that commands a noteworthy state in global trade. These days the other countries AIs are only minor importance. However in particular Russia, China and India are emerging competitors and promising sales market.

The US is leading in international trade with exports of EUR 57 billion in 2007. Next is the EU with around half of that export volume. It needs to be mentioned that these figures contain not only civil but also military aircraft.

A more detailed analysis at sub sectors level discloses that the European AI has gained market shares in important segments. Europe has become the global leader in the supply of large civilian aircraft (LCA), the Airbus, Boeing duopoly. Additionally, Europe is by far in the lead in international trade of civil helicopters. The success has been based on the development of superior technologies. In regional aircraft markets there are also two dominant players, Embraer (BRA), and Bombardier (CA). Both of these manufacturers are about to launch new aircraft on the leading edge of technology. There are few European manufacturers in that market. Most important is the French-Italian ATR that relies solely on conventional turboprop technology. Business and General Aviation, the segment with the smallest aircraft, is dominated by US and Other American manufacturers. The French company Dassault plays a relevant role in this market. Other European manufacturers only play a minor role. Two main European engine manufacturers, Rolls Royce (UK) and Snecma (France) hold almost 40% of the world market for engines. Additionally Snecma and GE (US) run a very successful joint venture in the global market dominating the market for large civil aircraft engines. Furthermore many first tier suppliers in this sector are European companies. The dominant engine consortium for LCA is the US_F joint venture CFM. It is far ahead in terms of market shares compared to the other important consortium IEA (US_UK_JP). Europe plays a significant role in the market for maintenance, repair and overhaul (MRO). With a lifespan of more than 30 years services provide aircraft manufacturer’s permanent access to their clients.

In case of Turkey AI, based on the aviation sector report 2012 by TOBB, Turkish Aviation and Space Industries Ltd. (TAI), for more than 20 years, has been working at maximum performance and harmony with the global players of aviation industry in both civil and military, fixed and rotary platforms of structural component and main assembly units (including design), and in most of them has been the single source producer. One of the top 100 global players in aviation and space industry, TAI – depending on the project topics – is organized around 5 work centers: structural, aircraft, helicopter, unmanned aircraft, space and special programs. Also, TAI provides integrated logistics support for all designed/manufactured products. TAI also provides theoretical/ practical training and certification for the auxiliary industries, acting as an aviation leader and a school. Moreover, the number of companies that provide subcontractor design and manufacture support for the main equipment corporations is rapidly rising.

TAI Aircraft Engine (TEI), being the single source in many components it produces, currently serves the leading main engine producers of the world by producing 709 different components for 38 different type military and commercial engine programs. Since TEI is specialized in jet engine production, it heavily utilizes metallurgy and material sciences in its production processes. Thus, it very heavily uses advanced materials, chrome-nickel, titanium and advanced aluminum-based super alloys. In turning these materials into final products, advanced production methods are employed.

4. INNOVATION IN AERONAUTICS INDUSTRY

According to the Community innovation Survey (CIS) from Eurostat and the Aerospace and Defence Industries Association of Europe (ASD), the aeronautics sector is high technology sector and belongs to the most innovative sector in Europe. Analysis of CIS4 data shows that the aeronautics sector continues to be very innovative. 85% of the firms are engaged in intramural R&D. Total R&D expenditures are between 21% and 11% of total turnover, which is between six and three times higher than the average of all manufacturing firms. More than 50% of the firms introduce new products, services and processes. Both large and small firms are highly innovative. The R&D intensity creates technology and knowledge to other sectors, such as ICT and automotive sectors. The European space and aeronautics sectors are dominated by a small number of large firms and many smaller suppliers. Large system integrators such as EADS orchestrate the supply chain with complex sourcing and technology management processes and also shifting R&D activities, responsibilities and related risks to suppliers.

The technology and product development trajectories are very expensive, R&D intensive and take long time associated with high technological and financial risks and with cost overruns and delays in delivery schedules. This puts pressure on the sectors to improve their performance to decrease development and delivery times and cost. Moreover, life cycles are long and returns are only available in long turn. Technological advancement is essential ingredients to improve the competitiveness of the sectors, but the sectors are mainly focusing on continuous improvement of conventional configurations. Main reasons for this are the highly interdependent systems where even small modifications can be a risky and costly undertaking, the long break even periods and small market, but also the importance of standardisation and regulations. Despite the rather conservative culture in the sector, radical and breakthrough innovation do occur, for example the shift from aluminium to composite materials. The most important breakthrough innovations in the first 100 years of AI are wide body and jet propulsion technologies. The sector sees the need for breakthrough, especially to address the need for environmentally friendly aircraft. The combination of physical products with ads on services such as maintenance has been an important trend in the past and is expected to continue.

Although the number of prime system integrators is limited, the industry uses a broad, deep, multi layered and multifaceted supplier base. Prime manufacturers concentrate on product and system integration and management of the supply chain is now the core competency. They create a cooperative supply system, where suppliers are involved the design and development of new products and responsibilities and associated risks are increasingly shifted to these suppliers. Primes force suppliers to reduce cost, improve the technological level and guarantee higher quality and service level. Open IT platforms are used to organise competitive sourcing, while at the same time primes are seeking long term , stable and reliable relationships with fewer suppliers and outsourcing the design and manufacturing of components and entire sub systems to external suppliers. This implies that the role of supplier in innovation had become more important, requiring new capabilities and capacities.

High performance and safety are crucial in all segments of aeronautics sector with reliability of equipment being a key factor. Societal concerns about the pollution by aeronautics as well as strict regulations urges the sector to develop cleaner and quieter aircraft with a greener life cycle from design and manufacturing to dismantling and recycling. At the same time, the pressure on business performance is driving the need for fuel efficiency. Using less fuel is a main priority for airlines and aircraft manufacturers, as fuel covers 30 to 40% of an airline operating expenses. In this way eco efficiency is a main driver for innovation in the aeronautics sector.

The aeronautics sector is highly regulated and standardised sectors with regulation for safety and environment as the most important focus areas. Regulation can act as both a driver and a barrier to innovation, so that governments play a central role in the development of the sector, as they regulate the markets, are often a major customer in the market, and support the industry through a wide range of innovation support tools. According to the survey SIW_II shows that aerospace respondents consider regulation as one of the main drivers for innovation in the sector. Safety and environmental regulation, as well as industrial standards, alternative materials regulation, waste regulation, land and labour regulation are found to have positive effects on innovation. However, environment regulation can act at the same time as an inhibitor for technology adoption, as proven technologies are preferred by customers and authorities whose prime goals is safety. Innovation, needed to realise the desired efficiency gains through for example new materials or structures is often in tension with regulation. It impacts time to market and development costs. The survey by SIW_II also found that price regulation, regulatory differences across Europe and public procurement regulation are considered as barriers to innovation. Like in other high tech sectors, regional concentration in the aeronautics sector mostly depends on a research friendly environment and the availability of highly skilled workforce. The military and defence play an important role for innovation in the aeronautics and space sectors. The aeronautics sector is increasingly globally oriented.

A skilled and qualified labour supply is essential for the competitiveness of the AI. Generally speaking, the quality of education and training in Europe shows high standard. But there is no guarantee that Europe can keep up with the changing world in a way that maintains or enhances its technological position, as the demand for professional engineers and technicians will grow in all levels of the value chain. Worries about skills shortages are widespread in aerospace industries. It is not only European but also a US concern. Most of the skills shortages are directed at engineering. There has been a steady decline in the number of engineering graduates in the US since a peak in the mid 1980s. But the situation in the US is different. More than EU member states the science community in the US can rely on immigrants, for example around half of the engineers in PhDs in the US workforce are foreigners. For European AI it will be more difficult to access the global market for highly skilled employee because of less open societies and language barriers. In general Europe is less attractive for these people than the US and most Member States are more restrictive. Cross border mobility is an issue of concern for the European AI. Cultural, linguistic, and legal differences among nations challenge companies’ desires to shift work and employees between countries. It is necessary for training and education to coordinate multiple traditions and institutions and make them work across borders. Since workforce mobility is a growing importance for the European AI, National cluster units and the new European Aerospace Cluster Partnership (EACP) constitute opportunities to develop and expand transnational education training programs. The Hamburg qualification Initiative is an example of successful transnational cooperation. It has established an exchange in the field of training between the aviation clusters of Hamburg and French aerospace valley of the regions Toulouse and Bordeaux. The programme has evolved from exchange of trainees to integrated transnational vocational training courses. In the mean time transnational activities have been expanded to Spain (Seville) and Italy (Campania).

Since AI is one of the sector in which dual use and spin off technologies are used frequently, it will be better to evaluate innovation in defence AI shortly. According to RAND analysis and economic and business literature, revolutionary change and innovation come from firms that are not dominant at that time and who thus became dominant in the area of their innovation. Past analysis have identified factors affecting the pace and degree of innovation within an industry. Some of these factors are beyond the direct control of any government agency, but it can be exerted significant influence over three critical factors, it can directly affect investments in the technology base and the level of demand for aircraft, and it can indirectly affect the level of competition in the industry by the way it structures programs and distributes business among the firms. Several changes related to competition and demand has affected the defence AI recently. First the nature of demand is changing. Funding has been increasingly focused on platforms that are joint, interoperable, and common across service and mission. One of the good subjects is the increasing motivation for vertical take-off and landing technology, in other terms hybrid air vehicles. Second, the complexity of the systems being developed has grown significantly through increasing reliance on information technology to provide enhanced functionality. Third, the role of prime and subcontractors has changed; the primes have increasingly focused on the complex system integration functions. The most serious risk facing major prime contractors today is that there might not be enough new military aircraft design and development work to sustain an adequate team of engineers and technical management for conducting technology development, advanced design studies, and prototype development and test of future system concepts. Three of the drivers_ national factors, status and attractiveness, and support industries_ depend on what occurs in the broad national economy. The remaining drivers_ R&D support, demand for products, and competition among the players_ will depend importantly on the policies and practices of governments.

Within Europe, there are clear differences between countries and between regions. Based on CIS4 data, three countries - the United Kingdom, France and Germany - provide for around 80% of the sector`s added value. Reasons include scale advantages, the tacit knowledge that is required, collaboration in clusters, government support, and linked to defence and public research institutes. Five more countries play a substantial role in specific parts of the space and aeronautics sectors: Italy, Spain, Sweden, Belgium and Netherlands. According to European Cluster Observatory, the best performing clusters in aerospace are also located in the most important three countries: Germany, France and the United Kingdom in terms of turnover, value added and employment.

International collaboration within Europe is well above the average of all manufacturing sectors. According to CIS4 data, 76% of firms in aerospace sector cooperate with international partners, from inside and outside their own enterprise group. Cooperation involves firms but also research organisations. 22% of the firms cooperate with international universities, governments or research institutes. Depending on the country sample, the figure for all manufacturing sector is around 9%. International collaboration appears to have been stimulated by European research programmes such as the programmes by the European Defence Agency (EDA), the European space Agency (ESA) and the framework Programmes. According to CIS4 data, 58% of the firms in the space and aeronautics sectors receive European funding. This percentage is higher than national (50%) and local and regional government (34%). The importance of public funding is in line with the general notion of high tech sectors with long term investments, with uncertain outcomes and spill over’s to other sectors.

Future developments in the sector are particularly influenced by demand drivers and technology development. Demand for aeronautics is shaped by expected growth in air travel, which in turn depends on economic growth and fuel prices. One of the economic and social development factors in nations, civil aviation business has been increasing at annual rates of 4%-5% since 1980s, despite some negative factors like wars and economic crises. In Turkey, air transportation is developing faster than others, total number of passengers has risen 14,3%, and total air traffic (including over flights) has gone up 10% on average in the last decade. In the same period, the increase in the number of planes in airline fleets was 128%, in seat capacity 136%, and in cargo capacity 318%, while the total number of domestic and international destinations reached 241 (TOBB, 2012). International companies and major aircraft manufacturers project that in the medium and long term, this current growth will continue into 2030s. According to data from International Civil Aviation Organization (ICAO), 5.8 billion passengers were carried in 2012. This means that the demand for air travel will continue and it will drive innovation activity in AI. Generally, regulation is the largest uncertainty primarily impacting future demand in aeronautics through for example an emission trading system. Important expected technology developments are:

- Improvements in aviation electronics making flying safer and unmanned air vehicles possible,
- Simulation and modelling technologies with positive impacts on development times and costs but also air transport management,
- Artificial intelligence promising increased autonomy of aircraft by reducing failures,
- A range of new materials on the one hand reducing weight of aircraft but also increasing performance,
- Technologies for alternative propulsion systems and fuels, such as fuel cells and bio fuels aiming to reduce the environmental impact of air travel,
- Hybrid air vehicle technologies which have both vertical take-off and landing capability and cruise speed of aircraft.

Bringing the technology and demand drivers together results in several key emerging innovation themes. In AI, the most important topic for the future is the environmental impact of aeronautics and the potential future innovation themes are:

- Air traffic management to increase efficiency and to accommodate more aircraft and also personal and unmanned aircraft,
- Improving aircraft performance to optimise the overall performance of an aircraft,
- New airframe configurations to increase lift and reduce drag,
- Also needed to achieve goals of zero emission aircraft, new propulsion systems and fuels.

Four more innovation themes are related to increasingly distributed air travel and point to point connections:

- Small aircraft and personal air transport systems,
- Personal air vehicles,
- Unmanned air vehicles,
- Hybrid Air vehicles

5. DO SOCIAL FACTORS DETERMINE INNOVATION IN AERONAUTICS INDUSTRY?

In this section, we will try to answer the question by connecting innovation, social factors and industry topics. It is to be stated the role of social factors to innovate is recognized generally, but the connections among three topics are not so clear. The impact and the influence mechanisms of social factors on innovation in AI will be discussed, distinguishing between different dimensions of social factors such as government, the most formalized institutional relationship and structure, formal and informal networks and trust.

To understand the innovativeness of the aerospace industry we need to consider the particularities of this very special industry that we covered above, because these strongly influence the structure and evolution of the organisation, the localisation of activities and the relation between the governments and the industry.

Innovation activities in AI are very expensive, R&D intensive and take long time associated with high technological and financial risks. The high technological level of current aircraft configurations and its underlying technology imply that a slight improvement in the technology is obtained through great efforts and a steep increase in the final costs of the vehicle. This does also explain the significant homogeneity of technological solutions: a little erroneous variation of the technology and price involve massive financial losses. There is a very high risk for a wrong positioning in the technology matrix (ECORYS, 2009). Many times it is beyond the capability of just one organization. Thus, firms try to reduce these risks through various collaboration and cooperation agreements with other firms including those that could be potential competitors. Collaboration, risk sharing, especially tacit knowledge transfer and infrastructure support are so common and important. On the other hand, the complex nature of an aircraft is a barrier to innovation, as it implies limited possibilities to control all technologies and interdependencies. Again, huge efforts translate into small technological improvements. Firms therefore concentrate their know-how in particular areas to push the technological frontier. To manufacture an aircraft therefore implies the need to develop a system of relationships between specialised firms (ECORYS, 2009). Shortly, the high technology level and complex nature of aeronautics industry require establishing relationships between organizations, creating formal and informal networks, trust especially during tacit knowledge transfer, and risk sharing.

The aeronautics industry is highly regulated and standardised sectors with regulation for safety and environment as the most important focus areas. Regulation can act as both a driver and a barrier to innovation, so that governments play a central role in the development of the sector, as they regulate the markets, are often a major customer in the market, and support the industry through a wide range of innovation support tools. Government policies can support innovation in AI by continually reforming and updating the regulatory and institutional framework within which innovative activity takes place. According to the survey SIW_II, as stated before, aerospace respondents consider regulation as one of the main drivers for innovation in the sector. Safety and environmental regulation, as well as industrial standards, alternative materials regulation, waste regulation, land and labour regulation are found to have positive effects on innovation.

As stated above, the technology and product development trajectories in AI are very expensive, R&D intensive and take long time associated with high technological and financial risks and with cost overruns and delays in delivery schedules. Governments can also play a more direct role in fostering innovation by facilitating cooperation. Public investment in science and basic research can play an important role in developing ICT and other general-purpose technologies and, hence, in enabling further innovation. This highlights the importance of reforming the management and funding of public investment in science and research, as well as public support to innovative activity in the private sector. The latter calls for an appropriate mix of direct and indirect instruments such as tax credits, direct support and well-designed public-private partnerships, support for innovative clusters and rigorous evaluation of such public support. In short, it can be argued that the role of government, as a regulator, big customer, funding supplier is so important in AI R&D activities and innovation performance. In other terms, the most formalized institutional relationships and structures such as the political regimes, the regulations and governments, as a macro social and political framework, shape social structure and enable norms to develop. Institutions such as government and finance sector, and institutional quality influence innovation performance somehow.

In case of Europe, all European Member States with a noteworthy stake in the AI assess this sector as crucial for the overall competitiveness of their economy. This view is driven by the knowledge of high-tech products and by the expectation of spill-over and spin-off effects to other industries. The AI is subject to public policies in these Member States and initiatives to be taken are directed towards an improvement of the competitiveness of the AI from the standpoint of the situation in this individual country and the needs of its important players. However, Member States are aware that the efforts to be taken to play a major role in the global market cannot be provided by an individual Member State (ECORYS, 2009).

The spatial concentration of industries is widely observed phenomenon. One striking example of geographical concentration of economic activity is the civil aerospace sector. The three major plant locations are Seattle (Boeing), Toulouse (Airbus wide body) and Hamburg (Airbus narrow body). The reason may be explained by factors that are internal or external to the firms. The firms` probability of innovating is positively influenced by knowledge flows from proximate scientific institution and public information sources as well as demanding local customers (Bonte, 2004). The knowledge intensive process of product development will benefit from strategic alliances with customers based on trust and mutual benefit. The component supplier base in the aerospace industry has historically been highly fragmented. First tier supplier status is becoming increasingly important and the trend is towards building long term relationships with customers and servicing their needs around a manufactured product. Successful business will be those that develop and maintain strategic alliances with customers based on trust and mutual benefit, alliances that extend beyond sales to affect research and development. The knowledge intensive process of product development will benefit from such alliances, with extended networks of specialists working together effectively, cutting across the inherent boundaries of internal and inter-organizational formal structures thus reducing development time and costs. The findings of a case study in the global aerospace industry support the assumption that a managerial tool can be used to improve performance by improving communication flows through enhanced relationships between teams, departments, organizations, and strategic alliances (Morton, 2006).

A study which compares survey results of clustered and dispersed firms in the German aeronautic industry shows that geographic proximity is relevant and statistically significant for inter-firm linkages that may lead to the following effects: labour market pooling, knowledge spillovers, demanding local customers, and trust based effects (Lubinski, 2003). The Member States have been busy in the creation of clusters. In many cases the national clusters have evolved in parallel and measures to coordinate have been taken later on. As a consequence, in most of the Member States there were some complaints on non-coordinated initiatives and the risk of double work. In France there exists a noteworthy division of labour between clusters and funds are provided for specific tasks. One might assume that this is an effect of the centralized structure of the public administration as compared for instance with Germany. In the United Kingdom the RDAs get funds for the development of their regional economy. This is evaluated as a potential risk for double work and the launch of projects with non-far reaching objectives. The Member States have perceived these problems and activities for the coordination have begun. In Germany the association of the industry, BDLI, has taken over the task that is not an easy one because of the federal structure of Germany. The conclusion drawn from the investigation in public policies in the six Member States under investigation is that the governments pursue quite different strategies that to a certain extent suit to their institutional structure, in particular with regard to the regional orientation, but also to general guidelines of the economic policy. The advantage of Germany is its well elaborated R&D infrastructure with universities, private and partly private research bodies and testing facilities. Due to the federal structure smaller companies enjoy the advantage of the closeness to these establishments. The advantage of France lies in the coordination of public initiatives that is presumably best in Europe (ECORYS, 2009).

The relations and relation quality among organizations at national and international level are so important for innovation performance in AI. A study about knowledge network in the Dutch Aviation Industry shows that institutional, social, cognitive, and geographic proximity are crucial for exploring the knowledge network of the Dutch aviation industry. Most interestingly, it was found geographical proximity to be the main driver of network formation. It was also found that for firms` innovativeness, their absorptive capacity as well as their access to distinct knowledge is crucial, but a negative relationship between the technological similarity of the knowledge base a firm as access to through its network and its innovation performance. It takes technological similarity and geographic proximity to exchange knowledge, however too much of these reduce the positive effects of knowledge sharing for firms` innovation performance (Broekel and Boschma, 2009). Social proximity refers to friendship, kinship, and experience at the micro level which influence the role of trust positively (Boschma, 2005). Trust has frequently been argued to foster knowledge exchange (Maskell and Malmberg, 1999). In particular with respect to the dangers of free riding and secrecy, trust based relations are superior to anonymous or newly established relations. Hence, in combination with technological similarity, social proximity should be a strong predictor of the existence of a link between two actors. With respect of the Dutch aviation industry, the “old boys’ network’s” of former employees of Fokker company show being socially close and influence the employees` knowledge sharing activities. The same can be argued for all other actors with a shared history, like going to the same school and university. In Dutch aviation industry, graduates of the Technical University Delft, which is a main player in the aviation industry, are likely to be socially close, because there is a sense of belonging to the same community (Broekel and Boschma, 2009). However, too much social proximity may also be harmful for innovative performance, because of an overload of loyalty and commitment in social relationships (Boschma, 2005).

A recent study by the Gartner Group indicates that more than 60 percent of professional employees work in teams characterized by virtuality (Kanawattanachai and Yoo, 2002). Virtual teams, defined as geographically dispersed, electronically dependent, dynamic, or comprising diverse members working remotely are growing in number and importance. Such teams potentially make it easier to acquire and apply knowledge to critical task in global firms (Sole and Edmondson, 2002). Edmondson (2002) argued that innovation inherently occurs at the team level because it requires learning behaviour, or transmission of knowledge bounded by tasks and opportunities that takes place through conversations among a limited number of interdependent people. These interactions are necessary because they enable individuals to combine different insights and institutionalize knowledge beyond that held by a single member (Nonaka and Takeuchi, 1995). The ability of teams to innovate depends on how well they generate, import, share, interpret, and apply knowledge. It must be openly shared across contexts through relationships and networks, and there must be confidence in the value of that knowledge for achieving the objectives of the collaboration (Konder, 1988). Once these requirements have been met, innovation involves dissemination and application of the knowledge combining and integrating it to develop novel insights, solutions, processes, or products (Obstfeld, 2005). However, just bringing people with the required knowledge and skills together virtually provides no guarantee that they will be able to work effectively and innovate across contexts. According to a study using survey data collected from 266 members of 59 aerospace design teams, the virtual design strategies that organizations create to foster innovation may hinder it. They argue that the four characteristics of virtual teams (geographic dispersion, electronic dependence, structural dynamism, and national diversity) are not highly interrelated, that they have independent and differential effects on innovation, and each hinders innovation through unique mechanisms. But many of them can be overcome by creating a psychologically safe communication climate, and it helps mitigate the challenges they pose. Communication climate has been found to play a critical role in fostering team learning and innovation. A psychologically safe communication climate characterized by support, openness, trusts, mutual respect, and risk taking. It facilitates innovation because it involves speaking up, raising differences for discussion, engaging in spontaneous and informal communication, providing unsolicited information, and breeding differences by suspending judgement, remaining open to other ideas and perspectives, and engaging in active listening (Gibson and Gibbs, 2006).

In Europe, based on CIS4 data, three countries - the United Kingdom, France and Germany - provide for around 80% of the sector’s added value. Reasons include the tacit knowledge that is required, collaboration in clusters, government support, and linked to defence and public research institutes. International collaboration within Europe is well above the average of all manufacturing sectors. According to CIS4 data, 76% of firms in aerospace sector cooperate with international partners, from inside and outside their own enterprise group. Cooperation involves firms but also research organisations. International collaboration appears to have been stimulated by European research programmes such as the programmes by the European Defence Agency (EDA), the European space Agency (ESA) and the framework Programmes. In case of Turkey, as stated above, TAI has become one of the limited number of 1st level subcontractors in the global aviation industry by taking risk and design responsibility. I think that these data enable to suggest that the dimensions of social capital such as formal networks, trust and institutional quality foster collaboration, coordination, help, especially tacit knowledge diffusion, and risk and cost sharing among clusters and countries which influence innovation process positively.

A skilled and qualified labour supply is essential for the competitiveness of the AI. Worries about skills shortages are widespread in aerospace industries. It is not only European but also a US concern. Most of the skills shortages are directed at engineering. But the situation in the US is different. More than EU member states the science community in the US can rely on immigrants, for example around half of the engineers in PhDs in the US workforce are foreigners. For European AI, it will be more difficult to access the global market for highly skilled employee because of less open societies and language barriers. In general Europe is less attractive for these people than the US and most Member States are more restrictive. Cross border mobility is an issue of concern for the European AI. Cultural, linguistic, and legal differences among nations challenge companies’ desires to shift work and employees between countries. It is necessary for training and education to coordinate multiple traditions and institutions and make them work across borders. In short, I think, an open social environment with loose tied social capital and institutional quality will attract a skilled and qualified labour supply, a kind of fresh outsourcing and influence innovation somehow.

Reform of financial markets can also boost innovation and growth, including by helping to reduce the financing gaps faced by some innovative small firms. As stated above, the European aeronautics sectors are dominated by a small number of large firms and many more smaller suppliers. Large system integrators such as EADS orchestrate the supply chain with complex sourcing and technology management processes and also shifting R&D activities, responsibilities and related risks to suppliers. Empirical literature suggests that industrial sectors that are most dependent on external finance tend to grow faster in countries that have better developed financial systems.

It is generally accepted that firms do not innovate in isolation but need interaction with their environment. I think there are similar evidences in AI too. As stated before, iinternational collaboration within Europe in AI is well above the average of all manufacturing sectors. The technology and product development trajectories in AI are very expensive, R&D intensive and take long time associated with high technological and financial risks and with cost overruns and delays in delivery schedules. The intensity of the tacit knowledge is high. Hence, the structural dimension of social capital − both formal and informal networks − can be thought to be paramount for several reasons. First, inno-vation significantly depends on spread of information, especially in high-technological fields, where information is very specific (Fukuyama, 2000). Further specialisation and more complex technologies demand more cooperation. Networks consist of ties between individuals and through them also between firms. These ties enable, help and accelerate information exchange and also lower the costs of information search. It has been said that access to know-how can be gained with the help of know-who, that is, information about who knows what (Lundvall, 2006). Often, networks may help to avoid duplication of the costly research. Second, networks have a synergy effect, bringing together complementary ideas, skills and also finance. Connecting different creative ideas and thoughts can lead to unusual combinations and radical breakthroughs (Subramaniam and Youndt, 2005). For example, Snecma (F) and GE(US) run a very successful joint venture engine in the global market dominating the market for large civil aircraft engines. They combined their technologies and this led innovation in turbofan engine technology. In addition, networks not only facilitate the innovations themselves, but also help and accelerate the distribu-tion of innovations (Abrahamson and Rosenkopf, 1997).

In case of Turkey, Turkish society was attributed with some cultural specifications such as collectivism, high risk avoidence and high power distance (Sargut, 2001). Turkish society consist of many internal subgroups among which conflictions are common and the level of trust is relativly low (Bugra, 2000). There are numerous subgroups embedded in the Turkish societi and these subgroups have strong commitment only among their members that in return, creates a marginilization of other individuals and subgroups within society (Sargut, 2001). Sargut suggest that these attitudes reduce the general trust and synergy within the society. Being graduated from the same school or being a townsman can be more than enough to bring people together in the same group and create loyalty for each other (Kiray, 1997).

Based on a research on a leading manufacturer in AI in Turkey, competence based trust among the members of the organization and stronger ties with the innovation team led organization to achieve its innovation goal. The exchange of tacit knowledge among the members of the innovation team facilitated the outcomes (Ozdemir and Demirci, 2012).

The creation of new knowledge is characterized by the interaction of codified and tacit knowledge (Nonaka and Takeuchi, 1995). Thus it can be argued that there is a strong relationship between radical innovations and tacit knowledge (Ozdemir and Demirci, 2012). In the process of searching knowledge, weak ties are more proper to acquire new knowledge (Hansen, 2005). Creation and transfer of tacit knowledge require stronger ties that reuires trust and willingess. Both weaker and stronger ties should be adopted depending on which one complies with the goals of the actors. The findings indicate that the organization has benefitted from the existence and effective use of internal social capital, strong ties were developed and used among the members of the same department, strength of the ties got weaker as the team members responsibilities and job descriptions started to vary and, finally, the case revealed that competence based trust and tacit knowledge were found to be the essential parts of creative and innovative thinking (Ozdemir and Demirci, 2012).

6. CONCLUSIONS

This paper analysed the influence of social factors on innovation activity generally and in particularly AI. First, the theoretical background concerning innovation and the influence of different dimensions of social factors was introduced. R&D and human capital as traditional factors of innovation that have gained more attention in previous studies were also included briefly. Then, with an overview of the AIs in Europe and Turkey, the influence of different dimensions of social capital on determinants of innovation in AI was discussed. I used secondary data sources published by academics and international organizations.

Innovation is often considered key to the global race for competitiveness, creating jobs and improving quality of life. The success of firms and national economies are more dependent than ever on innovation and the capacity to create and use knowledge. The innovation performance of firms is primarily determined by their own innovative activities and the interaction with their innovation related environment. Typically these environments differ across countries. For instance, central governments of some countries provide generous support for private R&D activities, others sustain the formation of R&D cooperatives while yet others, in addition, subsidize these agreements. Schooling systems also differ across countries, hence affecting the supply of knowledge workers, while consumers propensity to buy novel products might very well be related to cultural aspects, hence affecting the demand for innovative products. As a result, firms located in one country can easily have different returns on innovative inputs from other identical firms located in another country using the same inputs.

It can be argued that social factors, especially its structural aspects in the form of formal and informal networks, the most formalized institutional relationships and structures such as government, the political regime, and the regulations as a macro social and political framework, and general and institutional trust has positive influence on innovation activity in AI. They may provide a psychologically safe communication climate, improve knowledge flows, lead collaboration and cooperation, and reduce development time and cost. Both weaker and stronger ties should be adopted depending on which one complies with the goals of the actors and situation. Strong ties and competence based trust are crucial for tacit knowledge transfer. The historical depth and the technological accumulation in AI correlate with internal and regional social capital and determine the level of social capital influence on innovation. Good governance associates with higher innovation activity since government plays an important role in AI innovation activities.. To summarise, different dimensions of social capital have a different impact on innovation activity in AI also. Yet, there is not a ready solution which is effective in every situation. The question must be addressed as to how far the findings can be generalized from these case studies. The same access to product developers over such sensitive issues may not be forthcoming in every environment. However, it could provide a transferable approach.

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