

Technological Innovation, Institutional Change and Economic Performance: The use of Economic Compensations associated to public acquisitions

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1. Introduction

The aim of the thesis in progress is to propose and validate a theoretical framework able to provide an understanding of the factors influencing nations' ability to foster innovation and economic growth through the use *economic compensations* associated with public purchases of high unit price systems.

A particular focus is given to how countries, under the acquisition of goods of high unit price, manage industrial cooperation programs to stimulate learning across innovation systems, as well as the development of new technology thought networks of local organizations. An analysis is been made on data available from the experience of a representative group of countries, searching inferences between factors and efficiency in use of this specific policy tool.

While some countries like Finland seem to describe a sharp learning curve, data from other like Portugal, Turkey and Greece preliminary suggest that, despite dealing with offsets and industrial cooperation for more than two decades, nations in this group are not producing evidence that such tools has been used effectively.

Therefore the focus for the thesis has been to understand how countries have been learning to use economic compensations and offsets in particular when trying to balance asymmetries resulting from the acquisition of weapon systems. Mainly why and how some are learning faster than other in dealing with compensations associated to the purchase of weapon systems and other high-tech goods.

These are usually the most expensive items in public acquisitions and, although considered as highly valuable for the nation, their use is not reflected directly in the local economy. The theory to generate from the research will address the main questions related with the use of offsets in managing those asymmetries and when countries use them with the aim of developing institutions and foster technological innovation.

2. Definitions associated with Economic Compensations

Economic compensations refers to reciprocal trade agreements involving purchase of goods and services by the seller, from the purchaser of his product, or arrangements

whereby the seller assists the purchaser in reducing the amount of net cost of the purchase through some form of compensation. In developed countries, compensations are mainly associated with the acquisition of weapon systems, while in developing nations it is common to identify forms of compensation also associated to other products like food and public infrastructures.

Under the present definition, compensations can take different forms, under which the seller tries to decrease the financial effort of the buyer. The most common are: Barter, Countertrade, Buy-backs, BOT, Offsets and Industrial Participation.

Barter is a direct exchange of goods where the seller accepts other goods as a part or full payment of the goods being purchased. When this mechanism is used by countries to import goods, the buyer is able to keep foreign currency. Barter has been used also by countries whose currency is not convertible in foreign markets.

From the seller side, to barter (accepting these goods as payment) may be the key factor to make the transaction. Usually, a third party enters the deal in order to sell the goods, converting them into cash for the seller.

Many countries with a low level of industrialization use compensations in the form of barter to access strategic goods for their social and economic activity such as oil (overcoming problems of debt and lack of foreign currency), or to promote exports of local raw materials, such is the case of Malaysian payment of jet fighters with palm oil¹. This case shows how nations combine imports and export priorities.

Other form of compensations is *Countertrade*, which involves parallel transactions, with monetary fluxes generated, but only locally. *Countertrade* has been used by different nations dealing with countries with non-convertible currency.

Similarly to this are the *BOT (Build-Operate-Transfer)* initiatives. Most usual cases concern the construction of a public infrastructure by an investor, who will be given the rights of its commercial exploitation for a certain period of time.

3. Industrial Cooperation ('Offsets')

In *Industrial Cooperation ('Offsets')* type of compensations, monetary fluxes take place between the seller and the buyer side. The buyer is usually a government and the seller a company. Two contracts are signed: one for the equipment, the other for the compensation transactions, obliging the seller to fulfill an *offset agreement*. The amount of the obligation is defined as a percentage of the volume of the sale, and in some countries may be higher than 100 per cent.

Offsets may be of three different types: *direct*, *indirect* and *semi-direct*. *Direct offsets* refer to transactions where organizations from the buyer country provide products and services to be integrated in the system being purchased. If other units of the same system are to be integrated in similar equipment to be sold to other country, those sales will count as *semi-direct offsets*. Transactions not related with the purchase in any of the forms described, are *indirect offsets*, and are used by the purchasing governments to develop other economic sectors beyond the defence industries, usually taking part in the direct offsets transactions.

Under some cases, *direct offsets* and *semi-direct offsets* may developed to a fourth type of offsets, called *Industrial Participation*, where the country, through some of its companies, gets involved in an early phase of the development of the system that will be purchased. The nation supports financially the project by investing upfront (usually in the range of hundreds of millions of dollarsⁱⁱ), assuring the acquisition of some units and sharing the possible profits of the program.

The project is managed by a large and multinational organization who tries to identify, among the companies in the participating countries, innovative ideas and distinctive competencies that may be incorporated in the final product. These are usually nations with well developed defense industries, most of them resulting from the use of direct and indirect offsets during the last two to three decades, and from work sharing agreements after the Second World War. The group includes, among other, the United Kingdom, Israel, Netherlands, Italy, Norway, Spain and Denmarkⁱⁱⁱ.

Under the more traditional forms of offsets (direct, indirect and semi-direct), the offset transactions may be of different nature such as technology transfer, subcontractor production, co-production, licensed production, purchases, training, foreign direct investment, marketing and other.

4. Data and research methodology used in the thesis

Military acquisitions are responsible for most of the data found produced so far on offsets since, for the majority of nations, weapon systems represent the largest proportion of capital or industrial goods bought. Due to this fact the decisions associated to the procurement process have significant economic, political and social implications. By demanding compensations in the form of offsets/industrial cooperation, governments look for the need to compensate the tax payer for the large flow of resources that may be associated with the purchase of these goods, with limited access by the population and, in some cases, and to be fully explored in the operational sense only in very extreme situations.

Among the several organizations all over the World dealing with this particular subject, the Department of Commerce of the United States Government is one of the very few entities publishing data on the use of industrial cooperation by what may be assumed as a representative group of countries. To report this data, the US government asks details of offset projects to the US exporters who were involved with such kind of process.

Therefore, and being the United States the larger military exporter and the nations receiving offsets some of the countries with highest military expenditure, that data has been considered so far as representative of the worldwide practice on industrial cooperation associated with public acquisition of weapon systems. This data has allowed ton understand some of the trends associated with the use of offsets from a macroeconomic perspective, before moving to the next step of the research. Under this, where more data will be gathered in order to generate new insights on the effects of offsets at the level of regions and firms.

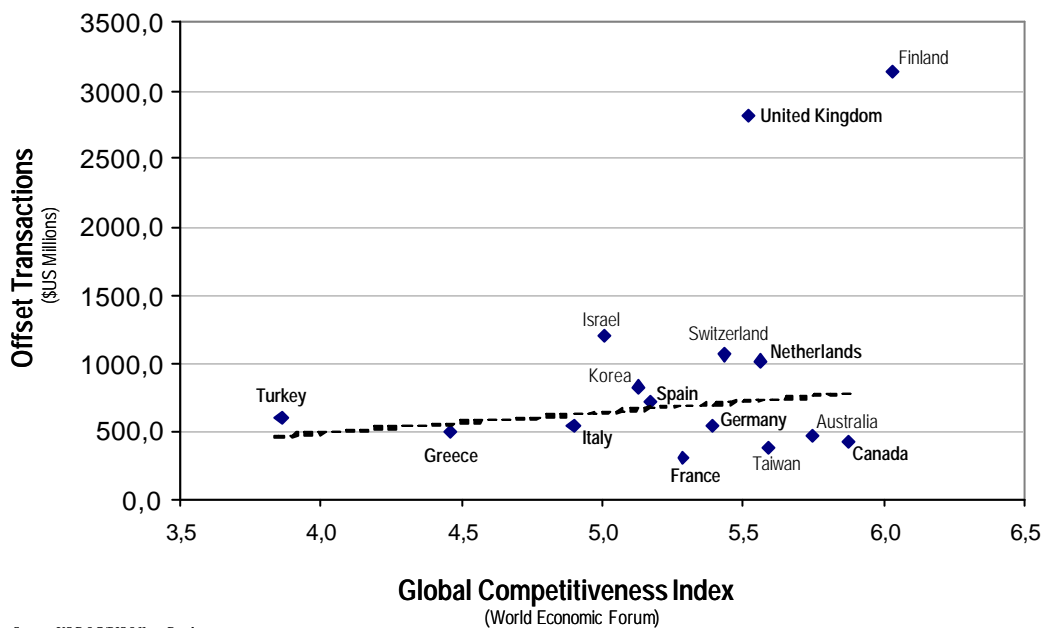
Following this methodology, information from the US observatory was firstly use in analyzing possible correlations between offset-related data and other related with the

economic performance of the receiving countries. Figure 1 crosses volumes of offset transactions received by nations between 1993 and 1999 and their level of economic performance by the end of the same decade.

Information in the graphic suggests that a country's ability to absorb offset volumes increases with their competitiveness. As stated in the report of World Economic Forum, and among the three categories of indicators that supports competitiveness (technology, institutions and macroeconomic environment), countries achieving higher paces of development in the last century are those that increased their efficiency in dealing with technology.

Therefore, more competitive countries tend to have a more developed industrial base which helps them when involving their companies in offset transactions with a higher technological content and added value for the local economy. On the other side, and for some countries, it was possible to develop players who now have to deal with offset obligations when exporting military systems based on technology provided by networks of companies emerging from local innovation systems.

For countries represented in figure 1 it was possible to draw a line supporting the trend suggested above. Performance from the United Kingdom and Finland are distant from that line. And if for the United Kingdom case the period after World War II has been characterized by close political and economic links with the United States, for the Finnish case the scenario is different, since the country emerged as a main offset user during the nineties decade.



Source: US DOC/BIS Offsets Database

Figure 1. Offset transactions received by countries versus their WEF competitiveness index

Data presented concerns only one acquisition program from the US supplier McDonnell Douglas Corporation and suggest that, among this group of nations, Finland seems to be an important case study for the research for the learning pace in dealing with offsets as a tool to foster economic development.

At the same time, the analysis on cases such as the Finnish should consider other indicators and the way they changed throughout the period from where data is been taken (the 1990's decade). Research questions to address include:

1. *How are offsets being used to develop 'knowledge hubs' within the receiving countries ?;*
2. *In order to develop those 'hubs', in which way are offset-related activities being used by receiving countries to stimulated the learning capacity of local companies to enhance their capability of absorbing knowledge ?;*
3. *How are offsets being use to develop networks of organizations that may foster leaning and the development of exportable technologies, products and services ?;*
4. *In which way are offsets in its 'indirect' form being used as an alternative tool to support innovation in other industries rather than defence-related ?;*
5. *What are the political and economic factors playing a role in the technological trajectories of countries that are moving from direct and semi-direct offsets to industrial participation as a preferred form of compensation ?;*
6. *Which factors have been playing a role in countries' ability to deal with offsets not only as receivers but also as obligors through the development of local exporters of sophisticated systems with high unit price?.*

5. Cases being considered under the analysis

To address the questions above, seven cases studies are being analyzed, based on the analysis of data resulting from the experience of several countries with US exporters of military systems in the seventies, eighties and nineties decade. Data gathering has been focused on evidence of ventures and opportunities developed by local industries under compensations related with large public acquisitions.

The list of case studies, still to be consolidated throughout the research, includes the analysis on the impact of offsets in fostering technological innovation and institutional development in regions within Spain, United Kingdom, Finland, United Arab Emirates/Kuwait, South Africa, South Korea and Turkey.

All cases present different levels of results, while presenting new topics based on local data such as:

- *Which political and policy issues has been contributing for Spain to increase the absorptive capacity of its Getafe and Seville regions, to a level that is enabling the country to export product from sectors with a higher degree of technological intensity (defense aerospace) to competitive markets like the US ?;*
- *Why offsets were unable to support United Kingdom's ability in maintaining the design and assembly of aircrafts (for instance in the Woodford, Cheshire*

region where the assembly line of the Avro RJ commercial regional aircraft was discontinued in 2003)?. Despite the fact that the country was, between 1993 and 2000, the top offset receiver in the World from US obligors;

- *Which other factors related with regional policies have been contributing to position Finland as a main offset receiver?. How has been influenced Finnish offset and industrial participation policy since the collapse of the Soviet Union, (until then a major industrial partner)?.*
- *Which factors surrounding the management of offsets programs have been influencing the development of the economic, social and industrial infrastructure in the United Arab Emirates and in the Aby Dhabi-Dubai-Sharjah regions in particular?;*
- *After several decades of political isolation, how are offsets contributing in South Africa for the emerging of networks and clusters in the aerospace and defense sector in the Gauteng province (the Johannesburg-Pretoria axis)?;*
- *Despite establishing equal priorities for same products (assembly under license in the country of the US F-16 fighter jet), how South Korea and the cluster around Sachon were able to develop an aerospace integrator supplying final products while Turkey-Ankara shows little signs of effects at a similar level?;*

Taking this research questions, some preliminary information is presented based on the main data gathered so far on these seven cases.

Case #1. Spain

By using offsets and Industrial Participation as a policy tool, Spain was able to upgrade its defense and aerospace industry to a level which allows some companies to perform final assembly. Not only for products to be sold for the Spanish government, but also platforms and systems to sell abroad (Molas-Gallart, 1996). The country has a tradition with some of those products in foreign markets, especially in Latin America and Indonesia, but recent initiatives by the local industry includes the development and assembly of platforms such as the C-235 CASA's aircraft. This particular product is now entering the United States defense market, known by its restrictions for foreign suppliers.

The Spanish industry was able to develop skills in sectors with a higher degree of technological intensity that allow local companies to become involved in main international programs, either in Europe as in the United States. In the aerospace field, long term partnerships with the European Aerospace Defence and Space company EADS, and McDonnell Douglas (now Boeing) supported the development of technological areas in the Spanish industry, such as composites and aluminum sub-assemblies.

At the same time, these initiatives together with Spain's capabilities to develop and assembly final products, also provided economies of scale which allowed the development technology based firms who also became international companies, supplying complex products and services. The path of Gamesa (based in the Basc

country) and Indra are two of the examples, having the later used offsets in the last two decades as a tool for the development of their own strategy.

Concerning offsets and Industrial Participation, and institutional environment towards their use, and according to a recent study, Spain is one of the few countries with a positive attitude among the different players involved in the process. That may be confirmed by the way those players welcomed recent announcements by the local government that strategic systems (submarines, helicopters, combat vehicles and surveillance ships), to be acquired in the next decade, will have their final assembly in Spanish companies who will work as prime contractors to the government.

Case #2. United Kingdom

According to the data from the United States' Department of Commerce, the United Kingdom was the nation receiving more offsets on behalf of American suppliers between 1993 and 2000. The country has an extensive tradition in fulfilling local needs concerning products with a high unit price such as defense systems and airliners. Among main contractors, British Aerospace (now BAE Systems) moved from the supplier of complete solutions to the design and assembly of systems to be integrated by non-local primes who emerged in the meantime like Airbus.

In the field of commercial aeronautics, the United Kingdom does not have any company assembly final products today. The last project, the assembly line of the BAE Systems Avro regional jet, was deactivated in 2003. In the defense aeronautics field the company still assembles jet trainers based on a last contract celebrated in 2003 with the government of Bahrain.

Other defense programs have been running for the UK government (some also by BAE Systems), with recent research showing some difficulties of local prime contractors in keeping those programs on schedule and within budget. These data may be suggesting that, although with a strong tradition, the local industry shows signs of weakness when trying to cover all the needs of the UK government. That has been also supported during the last 10 years with cases of acquisitions to foreign suppliers, particularly with Boeing, against indigenous proposals (Martin, 1996).

At the same time, key players in UK industry such as BAE Systems and Rolls-Royce increased their focus on foreign markets, especially in the United States, as a condition to improve their market share. Rolls-Royce has been transferring for their Indianapolis site their core competencies in the development of jet engines for commercial regional aircraft, while other core areas related to technology for engines for bigger jets are kept in Derby. Changes in local procurement has also been reflected in the research and development area, with the main governmental R&D defense structure being privatized to US investors in late 2002, and looking to explore new business opportunities outside the sphere of Ministry of Defense.

In the US, the company competes with the local company, General Electric, next to local customers such as Northrop Grumman and Cessna, but also shipping their products from there to their Brazilian customer, Embraer. The UK government is also supporting this trend by financing international programs such as the development of

Lockheed Martin's Joint Strike Fighter in US\$2 billion, so far the biggest contribution from a single country¹.

Concerning local player's attitude towards offsets and despite the fact that the UK is the biggest offset receiver, some level of primary research done so far shows different views. While policymakers tend to explore scenarios with *wavers* and *Letters of Intention* that will avoid offset and Industrial Participation obligations, players from the industry (including Small and Medium-Sized Enterprises, SME) support the interest of such policy tools in order to sustain their business within local supply chains (Kim, 2002).

Leaffield Engineering in the Bristol/Bath region (southwest of the country) may be presented as one of the possible examples. The British *Defense Manufacturers Association* also runs two interest groups in the areas of Offsets and Industrial Participation. Such events usually gather audiences with around 60 to 70 industrialists, supporting the idea that, against apparent reluctance from some official representatives, this kind of policy tools is recognized as strategically important by parts of the British industry².

Case #3. Finland

Until 1999, Finland was the country receiving more offsets benefits from the US suppliers of military systems. The Finnish industry has been developing core capabilities in niche areas either in the defense and commercial areas. In 2000, the United Kingdom took that position.

During also the 1993-99 period the Finnish company Valmet was, at the worldwide level, the company receiving more offsets for US offset obligors, making it possible to develop new core competencies in sectors with a higher degree of technology intensity, such as aerospace. Along this path, Valmet Aviation became Finavitec who later integrated the Patria group as Patria Aviation³.

Based to its geo-political and neutrality situation before military alliances such as the former Warsaw Pact and NATO, Finland has been trying to develop core capabilities indigenously, with most equipment belonging to the Finnish army used to have Russian design, with the Finnish Air Force turning to American (fighters) and British products during the nineties.

Also with the support of offsets Finland is able to export final products today with cases emerging such as Patria, already mentioned above. The company is known worldwide for skills in designing land systems (with the armoured vehicles being the more visible), as well as solutions for aerospace (military and commercial) and civil products. At the same time, and despite the priority of sustaining in Finland core capabilities in engineering and system integration, the company has been establishing other activities outside Finland, mainly in Sweden, Norway and Germany, working as *knowledge hubs* for absorption in specific areas (Archibugui, 2003).

¹ Lockheed Martin's corporate web site

² Authors' primary research

³ Corporate web site

Other case has been the creation in 1999 of the Metso Corporation, as result of the merger of Valmet and Rauma, and after many consolidation steps taking place within the Finnish industry during the decade. Metso keep an extensive portfolio of activities concerning the design and engineering of products with a higher degree of technological intensity, including automotive, shipbuilding and paper machines⁴.

Therefore, and due to their location in the northern areas of Europe, both Valmet and Patria had to support local supply chains in order to assure the necessary know-how to export high technology solutions in highly competitive markets such as the United States. The dynamics of innovation in regions such as Halli (Patria Aviation) and Tempere and Linnavuori (Patria) should provide valued insights towards the understanding of how offsets should be combined with other policy tools⁵.

Case #4. United Arab Emirates/Kuwait

The two nations are considered as a case together based on the recent initiative of merging their offset authorities. Beyond the political reasons behind it, this step also reflexes the similar paths that both counties have been following.

The oil crises following the Yom Kippur conflict in 1973 allowed the biggest flow of financial resources to the region (the biggest in the history of world economics). The need to protect their oil reserves became a main concern for these nations, who started to make important acquisitions of military systems, while using offsets to build their infrastructures.

Initiatives in the Gulf by offset obligors such as French Dassault contributed to a continuous improvement of those infrastructures. Entrepreneurial activities based on foreign direct investment initiatives on behalf of the obligors were extensively used in the region, facilitating some development among the local institutions and the accumulation of some human capital that allows already some absorption of knowledge in sectors with a higher degree of technological intensity.

Case #5. South Africa

South Africa has been using offsets and industrial cooperation mechanisms to develop its industrial base, including defense. In 1994 the country entered the multiracial democracy system which allowed the establishment of innovative activities with an increased number of nations and regions. Before that, South Africa interacted with some countries like France, working under licensed production agreements in order to satisfy its needs more of sophisticated military systems such as jet fighters.

Deep social changes experienced by the country after the end of the embargo have been introducing new challenges at the institutional level. The business environment has been affected throughout the by the local crime, while local currency, rand, has been rising his value next to the US dollar, producing an impact on the competitiveness of the local companies as global suppliers of products and services.

⁴ Corporate web site

⁵ Data from company's web site

At the same time South Africa has been able in the last decade to develop core capabilities among main local firms, where a visible example is Denel's technology for the design and manufacture of helmets for jet fighter pilots and Grintek's lightweight radar and missile warners. Through the partnerships now in place with European partners under offset agreements, local companies have now the expectation of entering new markets, while increasing the inflow of new knowledge, while understanding some of the factors responsible for recent failures among South African companies who tried to implement business models to promote exports.

Other players such as Avitronics, Racal Aviation Systems and Kentron have been increasing their visibility outside South Africa, starting to make the Gauteng province a knowledge hub in core capabilities whose development have been supported by the networks and clustering activities among firms. The level of isolation before 1994 also contributed to increase knowledge sharing among those companies which might have helped the development of those skills.

The new political environment has also produced changes in policies aiming to reinforce human capital in the local industrial and within the Gauteng province. Training of black aircraft engineers is a top priority for the local government, with Denel taking already some leading initiatives in this specific area⁶.

Such examples have been supported by specific initiatives to provide a favorable institutional environment for the goal of promoting the aerospace business outside South Africa. The local government created the National Industrial Participation program which has been also assuring conditions for the development of core competencies in the South African companies, while actively chasing FDI initiatives.

By December 2003, the FDI projects had attracted more than 14 billion US dollars, of which 8.7 billion were developed under the umbrella of BAE Systems and Saab, the two partners in the supplying of the new jet fighters for the South African Air Force. As a result BAE Systems is currently one of biggest investor in the country, marking a turning point when compared with the situation more than a decade ago when players like France's Dassault used to have that role.

Case #6. South Korea

South Korea has been developing a path focused on the goal of establishing an indigenous defense industrial capacity since 1970. At the base of it was US President's Richard Nixon announcement of the *Nixon Doctrine* that started the withdrawing of some of the US military forces in the region. Later, in 1989, the government established the Development and Promotion Law for Korean Aerospace Technology with a committee combining different policy areas such as trade, industry, finance, defense and economy.

Other initiatives followed with the aerospace industry as the main priority. These included production under license of several types of US designed aircrafts and, despite low production volumes, the country was able to consolidate a network of companies who have been cooperating for more this decades under several programs, including Daewoo's Woong-Bee turboprop trainer program (originally named KT-1),

⁶ 'Open arms', *Flight International*, number 4913, volume 164, pp.35-40

and Korean Aerospace Industries' T-50 supersonic jet trainer program (the KTX), both considered milestones under the South Korea's strategy started in 1969 (Cheng, 1996). The first unit made the first flight test in August 2002, with plans to develop an indigenous fighter (the FXX)⁷.

Evidence from the two programs suggests that inflows of knowledge from foreign partners may have been a factor in the development of such platforms with a higher level of technological integration. However 55 per cent of the product is still content coming from US companies, with Korean Aerospace Industries and Korean Air Lines (aft fuselage) remain the main local partners.

Lockheed Martin (still General Dynamics in the beginning) is a 13 per cent risk partner in the T-50 program, under which the industrial infrastructure made some adjustments. Initial agreement for production was signed between Lockheed Martin and Samsung, with Korean Aerospace Industries (KAI) formed in October 1999, after the overall design of the aircraft was frozen. KAI resulted from the aerospace division of three local companies: Daewoo, Samsung and Hyundai, with the T-50 assembly line in the Sachon. In 2000 a specific company was founded to market the product for foreign markets⁸.

Case #7. Turkey

The country has been making an extensive use of offsets to develop industries with a higher degree of technological intensity. Aerospace seems to be one of the major based on the offset obligation under which General Dynamics (today Lockheed Martin) built an assembly plant for the F-16 fighters at Turkish Aerospace Industries (TAI) in Ankara (Hammond, 1990). United States organizations Lockheed Martin and General Electric also became TAI shareholders, with 42% and 7% respectively.

The site, seen as a major step in stimulating the country's industrial infrastructure, also produced jets that were exported to Egypt. As F-16 assembly line, the plant was discontinued in late 2002 with new projects were starting such as the manufacturing of parts and systems for Airbus platforms. During the last decades Turkey has been developing several partnerships with foreign suppliers of defense systems, mainly Americans. Offsets are also recognized internally as an important tool to develop the local economy.

However, and from the perspective of the local institutions, the country seems to follow a different path when compared with other regions also making use of this particular tool such as the United Kingdom, the Scandinavian nations or Switzerland. Some data shows that, despite the learning curve behind, Turkey shows some apparent difficulties when managing offsets programs with constant arguing between parties and changes in its offset and industrial participation policies.

At the same time and as far as the absorptive capacity of the local industry is concerned, research on the Turkish case remains today as an important option in order to improve the understanding of offsets as a policy tool to foster knowledge flows and absorption. As a developing country, Turkey is allowed by the World Trade

⁷ 'Golden Eagle completes first flight', *Flight International*, number 4846, volume 162, pp.8

⁸ Corporate web site

Organization to require offsets to their suppliers of military systems. However, and despite belonging to the group of countries, data gathered so far doesn't show the same signs in Turkey as in other nations such as South Korea.

Both nations have a similar geo-political situation, with some threat of conflict (Greece in Cyprus and North Korea), similar institutional links to American firms (Lockheed Martin has a joint marketing agreement since November 2000 to support the sales of the new KAI's T50 Golden Eagle jet trainer), and similar programmes (Samsung also produced F-16 jets under license from Lockheed Martin to the Korean Air Force).

However, while South Korea shows a strategy towards the development of new skills allowing them to develop systems with a higher degree of technological integration, Turkey seems to remain on a different path focusing on the development of non-final systems to first and second-tier suppliers. Therefore the research will try to identify the factors producing such difference and, in particular, the dynamics of innovation in the Ankara (TAI) and Sachon (KAI) regions.

6. Issues and Hypothesis to address under the current research

Although with similar goals and approaches, this group of countries reflects different results from the use of offsets and industrial participation associated with public acquisition with high unit prices. Priority in the analysis is given to the analysis of data reflecting the effects in the consolidation of networks and clusters of companies able to perform activities with an increasing demand on human capital development and ability of those players to build and exchange knowledge in sector with a higher degree of technological intensity (Brenner, 2003).

Selected from a groups of 36 countries and group of countries, this sample of seven nations allows an exploratory analysis on the factors to consider by nations using offsets to foster the creation and consolidation of networks and clusters or firms in specific regions.

Firstly the long-term nature of offset programs makes possible for each country to define its strategy, considering industrial, economic and also social priorities. Therefore, and contrary to some *blindspots* on the issue, it is possible to define innovative projects with foreign partners inside the offset programs in sectors of higher degree of technology intensity. Not only transactions related with export of finished goods to new markets and clients where the offset obligor or other organizations on their behalf act only as a business facilitator.

Data suggests the existence of nations who have adopted that type of approach, defining long term priorities for specific regions where larger companies take the lead of local supply chains able to develop products and solutions with a higher level of technology integration in a cooperative process supported by network activities where knowledge is absorbed and shared on a continuous basis.

At the same time, the analysis of results from the implementation of these mechanisms of economic compensation shows that, as a policy tool, offsets and

industrial participation should be managed together with other instruments, and not relying exclusively on actions carried out on behalf of the offset obligor.

Although the final output of the offsets activities should be oriented to the generation of exports and import replacement, other incentives may have to be provided in order to increase the knowledge and technological capability in the region to level that allow the implementation of those higher valued transactions. On top of those policies seems to be the initiatives focused on the creation of human capital with the ability to gather and select information from outside sources, before integrating it into new product and services with acceptance in foreign markets.

Also related with the building of human capital is the involvement of other entities beyond firms that may also act as knowledge sources in specific areas where higher economies of scale may be achieved in the region, while distinctive core capabilities are also developed and contemplated in science and education policies.

Universities and laboratories are among the main players in this particular area, not only performing R&D activities and sharing knowledge with the industry (including on an informal basis), but also exploring local institutions that facilitate the creation of new technology-based firms (Nootboom, 2003).

Finally, relation of offsets with Foreign Direct Investment incentives is also analyzed, with data suggesting that, in some cases, better results were achieved through the promotion of FDI projects can also that contributed mostly to reinforce local economies of scale and core capabilities that may position the region as a *knowledge hub* in specific areas of competence. These hubs may then attract knowledge to be absorbed by local companies before integrated in highly complex solutions integrating a wide range of technologies, which can be successfully exported to foreign markets.

When summarizing this type of conclusions, a preliminary list of hypothesis to analyze and validate includes:

1. *Less military spending doesn't mean less intensive use of offsets;*
2. *Despite the existence of joint initiatives in the past, offsets seem to be moving towards a scenario where each country takes its own approach;*
3. *Offsets can not be seen in pure economic terms. Political aspects of both internal and external nature as well as history of foreign relations must also be considered in the analysis;*
4. *Ability of countries to deal with offsets as a policy tool to foster innovation should go through a learning path where factors such as technology and institutional development seem to have an influence;*
5. *More than increasing countries GDP, offsets may promote new competences among the industry of the buying country, particularly by supporting innovative activities that may generate high-tech exports*
6. *Intensive users of offsets are not necessarily the larger incomers of Foreign Direct Investment, although major offset receivers increased their capability in attracting FDI. They also increased their role as home country for Trans-National Companies (TNC).*

7. *Developed countries use offsets to increase exports and to channel new competences for local companies, while developing countries concentrate benefits in sustaining state-owned organizations;*
8. *Most of developed countries seem to use offsets on an ah hoc basis, while some developing countries seem closer to a scenario where some of the local companies (particularly state-owned) need to rely on offset to sustain business and jobs;*
9. *Developed countries with stronger military and historic links with exporter's country tend to have a higher content of direct and defence-related offsets, while developed nations with weaker links tend to focus more on indirect transactions;*
10. *Offsets are mainly a localized issue which main benefit should be seen at the regional level, by providing knowledge hubs;*

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ⁱ 'Defense contractors must receive Malaysia's palm oil or pay damages – civil sector too', *Countertrade and Offset, Volume XX, No.17, September 9th, 2002, pp.1*

ⁱⁱ Based on the data available for the *Joint Strike Fighter* program from Lockheed Martin

ⁱⁱⁱ Several news related with the *Industrial Participation* projects in *Countertrade & Offset* and *Aviation Week & Space Technology*