The Development of Aerospace Sector in Morocco

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Abstract: Given the high barriers to enter the aerospace industry, developing countries tend to use the needs of aerospace manufacturer leaders for a competitive cost as main attracting factor. The objective of this study is to investigate the attracting factors of Moroccan regions and country policy measures toward the aerospace sector. A survey applied to all aerospace firms in Morocco is the main information source. The existence and quality of industrial areas and labour force cost are considered as the main attraction forces by all local subsidiaries.

1 INTRODUCTION

In the recent year there is a large consensus that the industry is the development engine of the country. Especially for Morocco through industries called Morocco world metier (aerospace, automobile, off shoring and textile). Given the profound restructuring facing the aerospace sector internationally, this industry booming in Morocco, represents a major opportunity. Indeed, this sector shows a world strong growth, with order books of nearly one thousand planes over the next five years and sustained growth of 5% over 20 years. It is facing a complete overhaul of its industrial map with the arrival of so-called "low-cost" competitors, exerting strong pressure on prices and major technological changes.

The battle to conquer new markets, especially in emerging countries requires companies subcontracting to be more competitive while meeting safety requirements and maintaining the high quality of manufactured parts. The constant search for competitive niches has become a question of survival for the whole aviation value chain.

The specific questions addressed in this paper are: What are the main reasons for aerospace firms for migrating to Morocco, and how they overcome limitations of the local environment, which has a nascent aerospace industrial infrastructure? Do Moroccan aerospace sector presents similar centripetal forces found in other well-known aerospace clusters or sectors to maintain Moroccan competitiveness in term of attracting and retaining aerospace companies? Are there firms that might be considered Anchor Tenants? Does Moroccan government policy towards the sector, proposes similar measures taken by other successful countries? We think these questions will give us some understanding about the potential of Morocco's aerospace regions. A survey applied to aerospace firms in Morocco and government publications are the main information source for this study.

2 THE MOROCAN CONTEXT

The history of Moroccan aviation coincides with that of the Royal Armed Forces (FAR), the Royal Air Maroc (RAM) and Morocco Aviation (EADS). Established in 1957, RAM develops an industrial centre of aircraft maintenance at Casablanca airport. The settlements of aerospace firms in 1990s favoured labour pools around Casablanca, either integrated into the city nearest population areas or industrial areas. The focus was then is to move closer to the workforce. In 1999, SNECMA and RAM have created a joint venture, Snecma Morocco Engine Services (SMES) for the maintenance and repair of aircraft engines. SMES not only works for Airbus but also for global aircraft manufacturers such as Boeing, Embraer, Bombardier, Suiza, Messier Buggati, Dassault Facon. In 2001, SMES participated in a joint venture with Boeing and RAM to give birth to Matis Aerospace, specializing in the

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production of wiring harnesses for aircraft engines. Since then, the Safran group has attracted several of its subsidiaries to Morocco (Aircelle, Teuchos, Labinal Aerospace Morocco) and a number of subcontractors. Each of these subsidiaries in turn influenced the choice of location of its suppliers or subcontractors. The Moroccan Aerospace industry is moving towards production. It consists of tier one and two sub-contractors that can attract their customers and suppliers of tier three and four (Figure 1). All Airbus partners are present in Morocco except Latécoère which is implanted in Tunisia through its subsidiary Latelec(Hattab-Christmann, 2009). The number of aerospace companies actually located in Morocco is around 100 (GIMAS, 2013). Some companies produce only for aerospace. While others also work for the automobile. Others are very active in the aerospace sector when they are attached to the electronics industry (Hattab-Christmann, 2009).

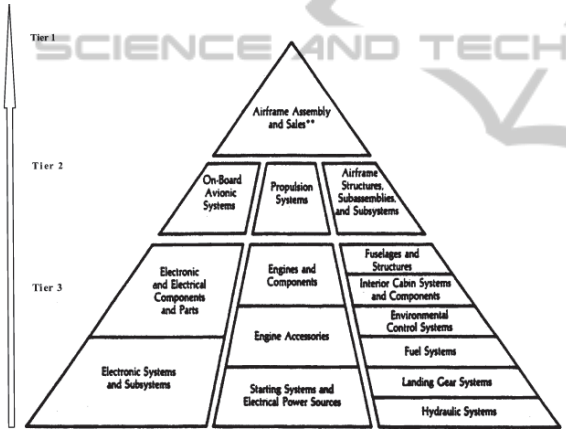

Figure 1: Aeronautical subcontracting pyramid (Niosi and Zhegu, 2005).

The Moroccan aerospace sector has three levels of sub-contracting .The aircraft and engine manufacturer's category represented primarily by EADS and SMES. The first ensures the maintenance and assembly of aircraft subassemblies and the second the maintenance of aircraft engines. The second level consists of components designers and manufacturers that include the assembly of electronic card and component manufacturers, cables and connectors and aircraft structure companies. And the last level is entities subcontracting capacity or specialty that includes 90% of Moroccan's aerospace firms. Their work relates to the mechanical precision, machining and sheet metal. The turnover of aerospace companies based in Morocco is estimated at 8 billion Dirhams in 2011. The sector potential is approximately 4 billion Dirhams additional GDP with the creation of around 15,000 new direct jobs by 2015(AMDI, 2013). The battle is tough internationally for Moroccan government; it is not only to attract new investors and diversify opportunities, but also to defend their position against Tunisia and Eastern Europe countries, especially Romania.

3 CONCEPTUAL FRAMEWORK

3.1 Source of Knowledge and Innovation

Knowledge sources in innovation are defined as sources of information that the firm may seek to use in the technological innovation process (Leiponen and Helfat, 2005). Being able to effectively access knowledge from external sources is increasingly recognised as a key factor in a firm's competitiveness (Huggins et al., 2010). Knowledge sourcing and the networks through which this knowledge flows are seen as crucial to economic success and competitiveness (Huggins et al., 2010). In particular, proximity to key knowledge sources is regarded as a key reason for the greater competitiveness of some of the most successful cities and regions in the world. While innovation is a complex process which may require knowledge to flow between firms and other actors (Lichtenthaler, 2005). Increasingly, this process is viewed as a systemic undertaking - firms no longer innovate in isolation but through a complex set of interactions with others(Chesbrough, 2003).

3.2 Centripetal and Centrifugal Forces

Aerospace is a high value-added sector, strongly affected by scale and timing. The industry success depends on rapid technological progress and government support for corporate R&D is essential. Their activity depends on components and parts which can be widely dispersed in terms of both industry and location. Transportation costs of these components are not relevant in overall aircraft costs. Also, demand (market) is not geographically bounded(Niosi and Zhegu, 2005).

Clustering and dispersion of industry are submitted to opposing forces. Centripetal forces that tend to concentrate industry in a few geographical regions and centrifugal forces that push in the opposite direction. Supply chain management is the vehicle of knowledge spillovers in this industry.

This chain is basically international and its management includes such dimensions as technical specifications, concurrent engineering, strategic engineering alliances, quality control and product(Niosi and Zhegu, 2005).

3.3 Anchor Tenant Concept

The classic anchor tenant is the large department store in a retail shopping mall that creates demand externalities for the other shops. (Agrawal and Cockburn, 2003) apply the approach to large firms within clusters, defining anchor tenant as a large firm that is: (1) heavily engaged in R&D in general and (2) has at least minor absorptive capacity in a particular technology within a particular region.

Anchor tenants can be very important in both creating and capturing externalities within local innovation systems, are likely to be important in stimulating both the demand and supply sides of local markets for innovation and may be an important channel for transmission of spill overs (Baglieri et al., 2012). One important factor appears to be the role of universities as sources of research spill overs. As academic and industrial research interests have converged in areas such as computer science, electrical engineering and biotechnology, it has become clear that university research plays a key role in regional innovation performance. Second, anchor tenants must be large firms. This makes them likely to be large, direct consumers of university research, but above and beyond this, their size may have important indirect effects. Third, the anchor tenant may also indirectly stimulate innovative activity by enhancing both the supply and demand sides of the market for new technologies. Anchor tenants create externalities by thickening markets and stimulating demand. They capture externalities by directly and indirectly increasing the absorptive capacity of the region for early-stage university-based research (Agrawal and Cockburn, 2002).

3.4 Research Questions and Hypotheses

Based on the discussion of the previous sections and the work of Martinez (Romero, 2011a); (Romero, 2011b) on Mexican aerospace's context, we propose empirical hypotheses regarding the questions posed in the introduction section.

Question 1: What are the main reasons for aerospace firms for migrating to Morocco, and how they overcome limitations of the local environment, which has a nascent aerospace industrial infrastructure?

Hypothesis 1a: Stringent quality and safety standards required for aerospace activities, including manufacturing, firms are likely to require external technical assistance at one point. Due to the limitations of the Moroccan system, the more likely source of this firm-external knowledge would be located abroad.

Hypothesis 1b: Even though manufacturing is the more likely activity to be transferred, some sort of innovation will certainly be introduced at the firm and country level, innovation at the world level will be almost non-existent in the short and medium run.

Question 2: Do Moroccan aerospace sector presents similar centripetal forces found in other well-known aerospace clusters or sectors to maintain Moroccan competitiveness in term of attracting and retaining aerospace companies?

Hypothesis 2: Attraction forces are related with low cost operations and the manufacturing capability of the country. (Industrial infrastructure, the skilled labour force, the low operation costs...Etc)

Question 3: Are there firms that might be considered Anchor Tenants?

Hypothesis 3: Since no substantial R&D activity is expected, it is unlikely to find an anchor tenant firm.

Question 4: Does Moroccan government policy towards the sector, proposes similar measures taken by other successful countries?

Hypothesis 4: The measures taken by Moroccan government toward the sector through «National Pact for Industrial Emergence» have encourages foreign firms to take the risks to transfer more complex activities to their subsidiaries in Morocco.

4 EMPIRICAL RESEARCH

4.1 Data

Given the small size of Moroccan aerospace firms, the sampling method used is the exhaustive list. It consists of querying all the individuals in the population studied. The Moroccan aerospace industries association (GIMAS, 2013) list includes almost the majority of companies operating in the aerospace industry in morocco. The targeted population as a basis for this research includes 107 companies. However, companies operating in the air service, trade service or are only a commercial representations of their main companies were excluded because they present no interest in our

research. Therefore, the observed population is 75 companies whose main activity is aerospace industry, research and engineering.

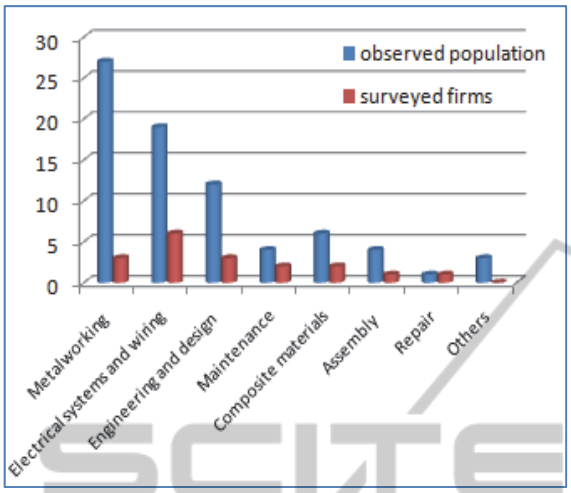

Figure 2: Activities distribution of aerospace firms.

Given the low response rate (8 responses), all companies that are installed in the Casablanca region, Bousekoura, The questionnaire was emailed to the observed population from January 16th to Feb16th of 2013. Customized questionnaires were sent to the attention companies' director explaining the objectives of the research. Nouacer were approached directly while others were contacted by phone during the period of May 1st to 30th of June 2013. This approach allowed us to have 18 answers.

4.2 Method and Results

The survey asks for general information about the enterprise, attraction factors, local advantages, innovation and source of knowledge. Secondary data sources include aerospace publications of the Moroccan Ministry of Economy and Ministry of Industries and New Technologies.

4.2.1 Type of Activities, Innovation and Sources of Knowledge

To check the first hypotheses (1a and 1b), there are questions that ask firms about their external and internal sources of knowledge than, the level of innovation of their new products. The answers to these questions will illustrate if these firms have internal and external sources of knowledge that in some way helped to develop that novelty and achieve some level of innovation in their activities as well.

Even if internal sources of knowledge are important, the ability to obtain sources of knowledge external to the firm is crucial in this high technology sector. Table 1 shows the different sources of knowledge external to the firm according to the location of those sources. It is clear that headquarters are the main sources of novel ideas for the aerospace firms in Morocco with 66.7%. The second most cited source of ideas are clients located outside the country with 22.2%. Global and national suppliers with global consultant were mentioned by 16.7% of the firms. We can notice the low level contribution of the research institute and university as external source of knowledge.

Table 1: External sources of knowledge that had an impact in the new products and processes introduced.

External sources	Nb	% Obs.
Headquarters	12	66,7%
Global companies	4	22,2%
Global consultants	3	16,7%
Global suppliers	3	16,7%
Local suppliers	3	16,7%
National customers	2	11,1%
Local Businesses	2	11,1%
Local consultants	2	11,1%
Local research Institutes	2	11,1%
Global competitors	1	5,6%
National research institutes	1	5,6%
Research institutes worldwide	0	0,0%
Local universities	0	0,0%
World Universities	0	0,0%
Total	**18**	*

*Sum of percentages is different from 100 due to multiple responses and suppressions

Thus we have a situation in which knowledge external to the firm comes from agents located outside the region, or for that matter outside the country. The only local sources of knowledge with some relevance were the local research institutes.

Table 2 shows which part of the firms were the most important to tackle the obstacles that new products represent. In a scale of 1 to 5, firms were asked to evaluate the importance of these four firms' departments in their contribution to undertaking new products. The Management followed by engineering departments were considered by almost all firms as very important. This is consistent with the idea that most of these firms have to manage and tackle engineering problems to manufacturing processes for products made elsewhere. It is important to note that the low values of R&D and Marketing are due to the fact that a lot of firms gave a value of zero to that question. Thus we can say that the hypothesis 1a

is true.

Table 2: Internal sources of knowledge that had an impact in the new products and processes introduced.

Firm's departments	Average contribution
Management	32,2%
Production Engineering	26,4%
Marketing	20,7%
R & D unit	20,7%
Total	**100,0%**

Table 3: Novelty degree of new product or process.

Degree of novelty introduced	Nb	% Cit.
World level	10	58,80%
Firm level	4	23,50%
Country level	3	17,60%
Total	**17**	**100%**

Table 3 shows that almost all firms produced at least one new product. 58.8% of the firms declared that the new product they manufactured was a world novelty. Thus we can say that the hypothesis 1b is false and the Moroccan based aerospace firms contribute to the world novelty by a new products and processes.

4.2.2 Regions' Advantages and Interaction among Firms

There are two pieces of information in the survey that are relevant to answer research question 2 about the centripetal forces of aerospace region in Morocco. First, there is a question that lists possible local advantages, and asks firms if they benefit from those advantages or not. Second, there is an open question about why the firm chose that specific region to establish in the first place, and then the diverse reasons given by the respondents were compared and grouped.

Table 4 captures the local advantages that firms consider they have by being located in a Morocco aerospace region. The local advantage most cited with 87.5% of positive answers is the existence and quality of industrial areas. The second most cited advantage was the labour force with 82.4%. The infrastructure, financial and clients' proximity were cited advantages by over 50%. While proximity to suppliers and being close to other aerospace firms have received less positive answers. Also we can notice that local incentives receive only 27.3 % of positive answer and are not considered as key factor to the choice of being installed in a specific region.

Table 5 shows the original attraction factors that firms took in account before establishing in Morocco. All surveyed firms, declared that the low cost of the labour force was the main attraction factor flowed by Europe proximity with 88.2 % and Low operation costs with 61.5%. Thus we can say that the hypothesis 2 is true and the main attraction factors are labour cost and proximity to the Europe.

Table 4: Local advantages.

Advantages	Yes		No	
	Nb	% Cit	Nb	% Cit
Labour	14	82,40%	3	17,60%
Industrial Areas	14	87,50%	2	12,50%
Suppliers proximity	1	9,10%	10	90,90%
Clients proximity	7	58,30%	5	41,70%
Co-location	2	20,00%	8	80,00%
Infrastructure	9	64,30%	5	35,70%
Universities and Research Centres	2	22,20%	7	77,80%
Financial advantages	8	61,50%	5	38,50%
locales Incentives	3	27,30%	8	72,70%

Table 5: Former attraction factors.

Attraction factors	Yes		No	
	Nb	% Cit	Nb	% Cit
Europe proximity	15	88,2%	2	11,8%
Low labour costs	18	100,0%	0	0,0%
Experience in industrial sectors	5	41,7%	7	58,3%
Low operation costs	8	61,5%	5	38,5%

4.2.3 Anchor Tenant

There is also information about the inputs and outputs flows of the firms, which will be very useful to explore their degree of connectedness to the local environment. 54.2% of the firms declared that the France was one of their sources of specialized inputs. The next is Europe and USA with 16.7% of the firms. Few firms sourced inputs from Morocco and Asia. Tables (

Table 6-*Sum of percentages is different from 100 due to multiple responses and suppressions.

Table 8) show the countries to which Moroccan firms send their exports or source their inputs, while other firms mentioned more than one country.

Table 6: Morocco's aerospace firms' inputs origin.

Inputs origin	Nb	% cit.
France	13	54,20%
USA	4	16,70%
Europe	4	16,70%
Morocco	2	8,30%
Asia	1	4,20%
Total	**24**	**100,00%**

Table 7: Morocco's aerospace firms' sales (outputs) destinations.

Sales destinations	Nb	% Cit.
Europe	18	100,0%
North America	2	11,1%
Others destinations	6	33,3%
Total	**18**	*

*Sum of percentages is different from 100 due to multiple responses and suppressions.

Table 8: Others Morocco's aerospace firms' sales destinations.

Sales destinations	Nb	% Cit.
Middle East	1	14,3%
Morocco	4	57,1%
Africa	2	28,6%
Total	**18**	*

*Sum of percentages is different from 100 due to multiple responses and suppressions

As we have seen in section 3 that an anchor tenant should be heavily engaged in R&D and has absorptive capacity in a particular technology within a particular region. Although world innovations exist (Table 3) there is no major system integrator located in Morocco, and most inputs are imported, it is difficult to claim that a firm can act as an anchor tenant. As we have seen, the majority of the subsidiaries do not carry on R&D activities. These firms are concentrated in manufacturing. Perhaps a first step to consolidate an anchor tenant firm will be precisely to strengthen the manufacturing capacity. Policy measures should be taken to build a technological infrastructure and to deliver a set of incentives able to encourage firms to carry on R&D activities. Thus we can say that the hypothesis 3 is true.

4.2.4 Government Vision and Policy Measures

With the emergence strategy (NPIE, 2009); (ProgEmer, 2006), Morocco has focused its efforts on industrial recovery pathways for which the country has clear competitive advantages and usable through development programs dedicated. Also, in order to capture the full potential of Morocco in the Aerospace, the government decided to support the development of the sector through the implementation measures to build a platform for targeted businesses. These measures relate in particular to(NPIE, 2009):

- The development of special offer for the aerospace sector investors.
- The establishment of a training program tailored to the Aerospace sector
- The establishment of integrated industrial platforms,

The estimated potential of these measures is approximately 4 billion Dirham of additional GDP and would result in the creation of approximately 15,000 new direct jobs by 2015. To achieve this goal an Institute of Aeronautical Metiers (IAM) opened in 2011 in the vicinity of main Casablanca airport and aerospace Zone. Its mission is to provide local aerospace firms with pre-employment training operators, technicians and middle managers as well as refresher courses on the job in order to meet the needed skills (GIMAS, 2013). There is also the establishment recently (September 2013) in the same area the Institute of Specialized Aeronautical Professions and Airport Logistics (ISMALA) providing training in aeronautical metiers. Next to Casablanca aeropole was created a Free Zone called Midparc. The Midparc industrial zone offers long-term leases to industrialists working in various fields such as aerospace and electronics.

Table 9: Government's incentives for aerospace sector.

Main National Pact measures	%
Training and recruitment	28,6%
Training adapted to needs	25,8%
Free Zone status	23,9%
Real estate offer	21,6%
Total	100,0%

Table 9 shows the incentives that government offers through "National Pact for Industrial Emergence 2009-2015". The most mentioned incentives were training and recruitment and training adapted to needs with 28.6 % and 25.8% respectively. It seems that hypothesis 4 is confirmed and the Pacts measures contribute to attract, maintain and help aerospace subsidiaries to develop their activities in Morocco.

5 CONCLUSIONS

The Moroccan aerospace firms consist mainly of French subsidiaries looking for local advantages in morocco regions. The surveyed firms considered that, beside Europe proximity, the existence and quality of industrial areas and labour force cost are the main attraction forces. Even though these firms shared the same locality there is no interaction between them, and the main source of knowledge comes outside the region, especially from headquarters.

The subsidiaries localisation in morocco may be considered as an experiences to get access to aerospace technologies and to be upgraded in Global value chain from elements production and subsystem assembly manufacturing to modular integration (Benhar et al., 2007). As (DEPF, 2012) requested, there is a need to foster cooperation between Moroccan engineering schools and universities to pool their resources and establish joint laboratories with the aerospace industry.

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