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Assessment and Benchmark of the performance of the Moroccan industrial ecosystem and those of emerging countries

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Abstract

To cope with the uncertainties affecting the highly competitive global supply chain and the cyclical risks associated with globalization, companies must innovate in their own internal and external supply networks. The stakes are all the greater for developing countries, where the factors influencing the evolution of the local supply chain as technology, where the offer for example is not yet mature. We have observed in recent years, which the aerospace sector in Morocco took off through the accumulation of foreign direct investment, and visibility throughout the world with strategic partnerships like the last one signed with Boeing in 2017, on the creation of a new ecosystem of suppliers. Except that if it observes the nature of these companies, it turns out that they are largely foreign, where very few purely local SMEs participate as actors to these ecosystems installed. Unlike Morocco, other emerging or developing countries seem to be more successful in this challenge. Through this article, we will attempt to compare factors of impact or influence on the performance of an industrial ecosystem in a developing country or region. We rely on bibliographical readings on the concept of ecosystems and clusters. Following this, we analyse the positioning of the Moroccan aeronautical ecosystem by a Benchmark, in this context of global supply chain.

Keywords: *Global supply chain, clustering, technology transfer, Benchmark, emergent countries*

1. Introduction

The dominant theory in the supply chain with structure, configuration and coordination in a given ecosystem [1] touches on other strategic, policy and governance aspects [2].

The results of global value chain research, studies and policy development, economic geography, economic history and purchasing networks are based on sectorial analyses, different perspectives, different analysis as well as more horizontal approaches.

After following the evolution of the aeronautical chain in Morocco, we will show the factors that influence the future of an industrial ecosystem composed of several companies (rank 1, 2, etc. ... that produce products / capacities). Secondary data is at stake, it is the level of "clustering" and the performance of these industrial networks to meet the market requirements and commercial uncertainties and operational risks that we want.

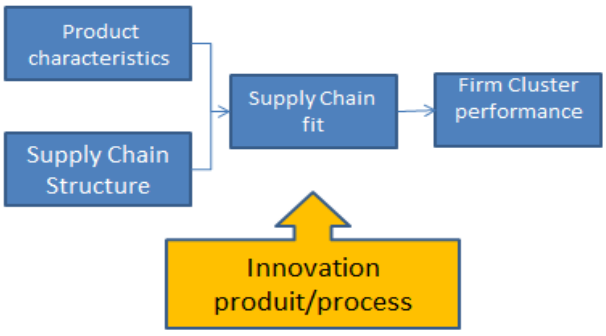

Fig. 1 How supply chains should be structured to achieve superior performance and an innovative proposition for its products. Source Peter J.SheraPhil Y.Yangb.

2. The concept of ecosystems and their main characteristics

Several terms have been designated to describe the industrial environment: Ecosystems, industrial cluster, cluster, competitiveness cluster, industrial park, technopole, district, or niche.

This definition of the cluster (industrial cluster) was studied recurrently since the time of the Marshall industrial district concept taken up by Italian economists, Becattini 1975, Brusco 1982, until the 90s with the Porterian conception, and criticized by several hypotheses that have, in turn, participated in its enrichment. For example, the performance of a cluster would be correlated with its size; in terms of the number and density of actors, the homogeneity and complementarity of the Activities. Cooke P. and Huggins R. (2003) [3], where they add to these definitions the notion of complementarity of activities by belonging to the same value chain.

The question is how to measure this complementarity of values of these connected actors in the form of a network making this notion of cooperation sustainable and efficient, we will come back to it. In most southern countries, the main source of technology is abroad, where production sites are often run by foreign management at the local level, or remotely. To the extent that the value produced in many cases depends on constant inflows of imported products, innovation in processing and technology transfer.

In a subcontracting context, an ecosystem must combine the deployment of imported technological capabilities with that of local technological capabilities, depending on the resources available. Cohen and Levinthal (1989 [4] argue that the technology gap does not play by itself, but that lagging companies must have absorptive capacity that will determine the magnitude of the benefits of through technology transfers.

Regional innovation cluster policies play a crucial role in the growth of lagging economic areas (Cooke, 2004) [5], where they play the role of facilitators and facilitators of transfers of innovative business capabilities (Lagendijk, 1999) [6] and consequently to a positive transformation of territories in difficulty.

Others have put their finger on the strategies of companies in the same cluster, which rely on actions to improve their competitiveness seem to converge through the mimicry of good practices (Martin and Sunley, 2003). [7]

3. The limits of cluster theory and negative impacts

These cluster theories that have emerged and evolved in emerging or developed countries on their value chain, seem to be better adapted to the local specificities of mature regions that would be better organized for. Indeed, models such as Cassidy and Collab 2005 and innovative cluster (D.Leducq and B.Lusso 2010 [8] complete these characteristics adding impact factors such as political and public programs, business climate and collegial governance. Operational and futuristic, with a more long-term vision of the not-immediately-tradable, but these theories may seem limiting for SMEs, very small one in difficulty of the southern countries, also geographically and historically with the artisanal heritage of the developing region who are exposed to strong competition.

This thinking model would then create a narrow collective vision, reducing the potential for innovation [9] and the ability to respond autonomously to an uncertain environment. One of the main strengths of this theory is to show that the cluster, supposedly beneficial, can in fact reduce in some cases the adaptability of large tier 1 firms by making them inert and inflexible compared to non-agglomerated firms, reducing ecosystem to a closed circle and inaccessible to new local entrants.

Other parameters specific to the country hosting clusters of foreign companies with an eco-systemic projection, as socio-cultural aspects and their contribution to the life cycle of the ecosystem in question, as well as structural (participating in the design of its supplychain existing) would not have been conveniently cited as impact elements to measure on ecosystem performance. Indeed, our problematic prompted us to focus on the "clustering" level taking into account all of these elements that would induce the performance of an industrial network to meet the market requirements and the economic uncertainties and risks of exploitation in an industrial sector.

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4. Benchmark study of the success factors of industrial ecosystems in emerging countries Malaysia, Mexico

Indeed (McCarthy, bloom, olhager) 2016 [10], showed several models in the development of traditional supply chains, as their process matures (Stevens, 1989), also on the different profiles and levels of integration into intra- and inter-company networks (Hakansson and Snehoca, 1995) [11]. Complemented by the technological aspect of production to be integrated as a major factor of transformation in a mobile logistics chain. We thus looked at the particularities of the aeronautical ecosystem of other emerging countries such as Mexico and Malaysia to compare the good practices that they operate on their cluster strategy strengthening their value chain by creating new links value-added.
Mexico is interesting because it is significantly ahead of Morocco in its aeronautical development. It is also geographically positioned close to one of the largest aeronautical market (US), like Morocco with France. Finally, it is much related to the orders of a big builder (BOEING), as is Morocco with AIRBUS...
Malaysia is interesting to compare for its dynamism, its position at the door of the world's most dynamic market tomorrow (CHINA / ASIA) and its policy of economic development, clearly liberal.

4.1 The success factors of the Malaysian aviation industry

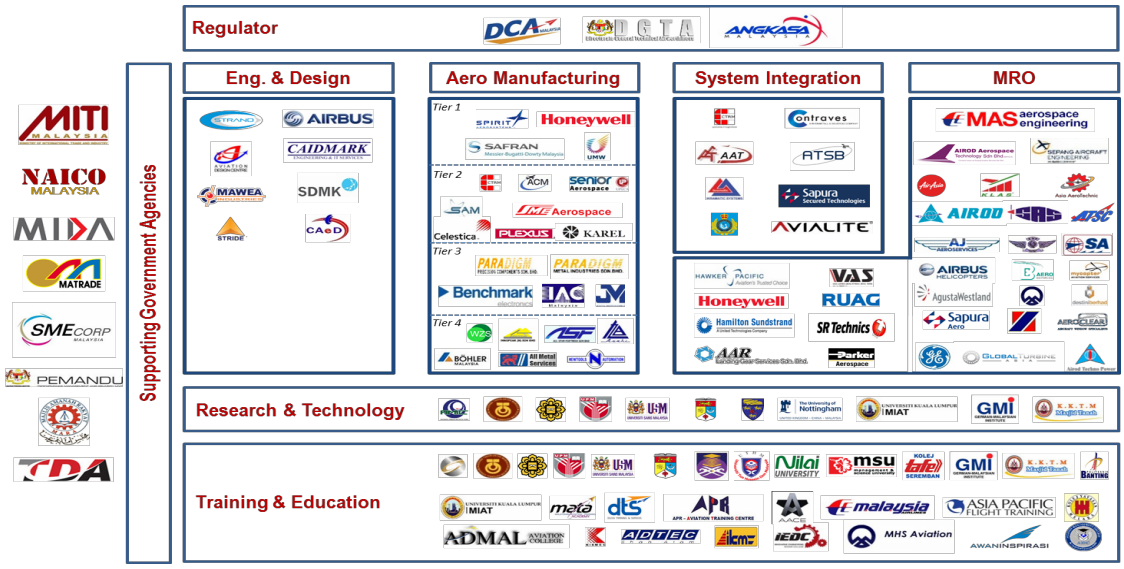

Fig. 2 The aerospace value chain of the Malaysian cluster Source: NAICO Analysis

"Key" industrial experiences in aeronautical development in Malaysia that we listed as points synthesized below:
- The initial presence of many SMEs in the semiconductor and automotive industry which, through capacity absorption through technology transfers, have been able to migrate the machinists to the aeronautics industry.
- A strong public initiative towards the composite (CTRM - public investment), linked to the implementation of SPIRIT (having benefited from "non-standard" incentives), then HEXCEL in Joint venture.
- The will to highlight national champions, including the group / conglomerate UMW, having signed a single agreement with ROLLS ROYCE for a single source aircraft engine parts plant (fan case), with again, a very strong involvement financial state.
- Explosion of aircraft orders (AIR ASIA 1st AIRBUS single-aisle customer), having "pushed" the development of a powerful MRO ecosystem, based on an interesting regional logistics (airport and maritime hub for the zone)
- An ambitious "Blueprint" strategic state program from a stable country on its policy and control of macroeconomic aggregates.
- Lower labour costs than its neighbour Singapore.
- A real investment and financing facility for local businesses helped by flowing procedures (see "doing business" ranking), as well as secure investments.

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4.2 The key success factors of the Mexican aerospace industry

The Mexican aeronautical zone is composed of different ecosystems distributed in the 23 regions made up of clusters of aeronautical companies, 330 companies in total.
Overall, this has facilitated business growth in these regions:

Fig. 3 Geographical distribution of the aerospace ecosystems in the 23 Regions of Mexico

a- Regulatory harmonization

The Bilateral Agreement in 2012 BASA resulted in the creation of the National Aerospace and Defense Contractors Accreditation Program (NADCAP), which represents mutual recognition of aerospace standards between the United States and Mexico.
The AS9100 aerospace quality management system, the American equivalent of the European standard EN 9100, certifying an aeronautical and space quality assurance system.
Certifications of the Federal Aviation Administration (FAA) of the United States and its Mexican counterpart, the Dirección General de Aeronaútica Civil (DGAC) giving them access to trades and capabilities with high added value.

b- Development of the commercial aviation sector (air transport)

Another factor in the growth of the Mexican aerospace industry is the rapid growth of the country's aviation sector. Mexican commercial aviation and related maintenance, repair and overhaul (MRO) demand was driven by several factors, including the expansion of low-cost carriers such as Volaris and Interjet, the 2016 approval of the Delta-Aeromexico partnership, the 2015 conclusion of the bilateral air transport agreement between the United States and Mexico (hereinafter referred to as "open skies") and the increased use of Mexico as a regional hub.
The Open Skies Agreement removed restrictions on flights between the two countries, allowing passenger airlines and all-cargo carriers to serve any combination of city pairs in the United States and Mexico.

c- Research centers:

Recently, research centers have been created to support research and development, not only for new turbines, engines and components, but also to pilot technological solutions for other complex systems, software and engineering applications in manufacturing process.

In early 2018, the Center for Aeronautical Technologies of Querétaro (CENTA) was inaugurated with the support of the National Council of Science and Technology (CONACYT). It will provide services to the aerospace industry and support new projects led by small and medium-sized businesses. In mid-2017, INDRA (Spain) also opened a new technology development center to expand its offerings in the areas of transport, infrastructure, energy and other industrial sectors.

d- A national strategic program

The program aimed first to elevate Mexico among the top 10 global suppliers of the aerospace industry by 2020, with projected exports of $ 12 billion and the creation of 110,000 jobs. Pro-Aero establishes policies for market development, national and international promotion, technology and human resource development, and vertical integration. Then the second set more ambitious targets for local Mexican SMEs in the development of their competitiveness.

In summary, we have deduced these elements that have made the success and evolution of emerging ecosystems studied:

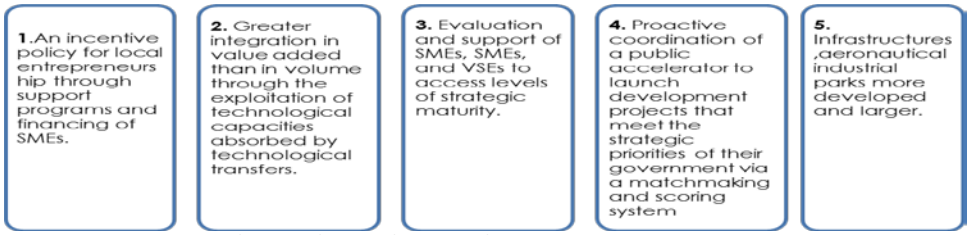

Fig.4 Synthesis of the key factors of success of the Mexican and Malaysian aeronautical cluster

4.3 Comparative study of the influence factors of the ecosystem performance in Morocco

The methodology of our Benchmark was focused on international measures and best practices that could be adapted and transposed, concerning the measurement of the performance of a given ecosystem respecting the socio-industrial environment in Morocco. This Benchmark on these 3 countries allowed the development and understanding of their value chains through a series of interviews with the aeronautical professional federations (MITI for Malaysia, FEMIA for Mexico), third-party DOs 1 and local companies interviewed for feedback on their entrepreneurial career, as well as business experts.

Qualitative indicators alone are not enough to choose for our comparison, it is important to look at certain quantitative elements, which we have chosen through our synthesis of the key factors of success in emerging countries and also in the bibliography concerned.

The notions raised by the state of the art on the question of the performance of a cluster, we retain mainly:

- Cluster dynamics: profile, cluster size in terms of number and density of actors, similarity and complementarity of activities in the same value chain.
- Ability to absorb technological and human skills, through cumulative technological transfers in a strategic way for late companies.
- Network of information and relational interactions
- Role of regional cluster policies in innovation and support program for local SMEs.

Selected comparison criteria:

1. Absorption during technological transfers, degree of technicality, technological contributions, ability to exploit these technological capacities
2. Degree of openness National player, coordination, cluster acceleration role
3. Degree of entrepreneurship incentive locally
4. Integration rate, Profile, Professions, nature of the cluster, growth, density of actors

We will treat here two significant examples through fig 5 and fig 6 which represent these criteria of comparison between the 3 Benchmarked countries:

Table 1: Comparative table 3 M on the degree of local entrepreneurship incentive

	 Mexico	 Morocco	 Malaysia
Criteria for comparison: degree of local entrepreneurship incentive			
Local labour costs	425 $	363 $	746 $
Overall return on investment (top 10 Aerospace country 2017)	10th place	6th place	7th place
Existence of a strategy to integrate SMEs/local initiatives	yes	No	yes
Number of local companies	15	4 (8 others are very small service entities)	18

Table 2: Comparative table 3 M on the systemic density: Integration rate, Profile, Professions, nature of the cluster, growth, density of actors

Comparison criterion: Integration rate, Profile, Professions, nature of the cluster, growth, density of actors			
Number of companies,	360	140	230
supplychain Rank	Boeing had 26 Mexican suppliers, Airbus had 36 and Embraer 13. Composed of OEMs, Third Parties 1, 2 and 3, SMEs and VSEs and research centers. FDI $3.2 million (including 61% US, 26% Canada, 7% France and 3% Spain and others)	Tiers 1, 2 and 3, Foreigh SMEs and VSEs	Airbus Group Malaysia, Spirit Aerosystems Malaysia . GE Engine Services Malaysia . Safran Landing Gear . Honeywell Aerospace Avionics Malaysia . RUAG Aviation Malaysia Celestica Malaysia. Singapore Aerospace Manufacturing Hamilton, SR Technics Malaysia, Tier 1 and 2
Capabilities represented	- 80% assembly and manufacturing - 11% MRO - 9% Engineering, design offices	-18% assembly, -33% MRO, -18% manufacturing, -Electric 24%, -7% other	-80% MRO 20% divided between: manufacturing/ Equipment/ engines and Engineering & Design
Number of employees	50 000 jobs	16700 jobs	40 210 jobs
Exports / growth evolution	$8.5 Million +11% increase compared to 2017 estimated at 18% (according to the Gimas definition)	1.7 million $ 1.7 million +20 % 34 %	5.6 million USD + 5% Unknown
Number of employees	50 000 jobs	16700 jobs	40 10 jobs

5. Analysis of the Benchmark result and interpretation

This Benchmark allowed us to measure the indicators of influence and impacts of an ecosystem in its performance to position the Moroccan aeronautical ecosystem among those of Mexico and Malaysia being part of the emerging countries, in the form of radars we have tried to illustrate the differences and similarities found on the selected influences or impact factors see below:

5.1 Absorption during technological transfers, degree of technicality, technological contribution, ability to exploit these technological capacities

On this first fundamental indicator, we observe that Malaysia has the best rate of technological absorption, because of the intensity of the demand for innovation of these customers rank 1, the technicality of installed trades as the MRO (Maintenance, repair and overall) to 80% of its activity, which propels it to cover maintenance and overhaul capabilities

for aircraft, engines and equipment, in addition to manufacturing and engineering. Malaysia has several aircraft and engine maintenance centers with a national fleet that allows for this fluctuation and offset strategies with aircraft manufacturers that transfer these technologies more easily. We note that Malaysia holds the first place in the creation of 100% national companies to 18 companies, Morocco in last position behind Mexico to 15 at least, which represents a slight incentive for the moment on the creation of aeronautical companies to Morocco, be it private or public initiative.

5.2 Degree of national player openness, coordination, cluster acceleration role

The coordination of actors and organizations is a key point, the power of coordination "in Helix" (state, industrial, academies) has greatly advanced the level of maturity of the various actors on many topics and strategic objectives., Mexico as Malaysia is at the same level, Morocco also provides investor-buyer linkages in the form of seminars, thematic workshops, and also with the watch in international trade shows as one of the main axes industrial acceleration program coordinating the deployment of structuring actions on priority ecosystems.

5.3 Degree of entrepreneurship incentive locally

Due to the existence of a real strategy inspired by Brazil, to boost entrepreneurship in Malaysia and Mexico in the last 10 years, we are seeing a certain advance on the subject compared to Morocco, where we count a number of companies creates in Malaysia that exceed both countries. A better investment facility, helped by flowing procedures (see ranking doing business) and secure investments. Financing facilities for local businesses (for example: a simple letter of intent to purchase credits for new resources). Incentives centred on CAPEX (INVEST in capital, machines, technology transfer and training of the workforce, but also in "aeronautical culture" (ex how to treat a RFQ, (request for quotation). improvement to be gained by gaining feedback from these comrades on the following points:

- Training in the general sense (culture, sector, market, certifications (PPCI program, the rules of the game fund, NADCAP, 9100 and support through consultants on certification and preparation of certification)
- Support for strategic processes by giving the SMEs concerned special treatment (in terms of tax exemption, financial support, certifications, etc.)
- Fluidify funding / grant files must go through cluster agencies

5.4 Integration rate, Profile, Professions, nature of the cluster, growth, density of actors

Paradoxically, what one would think, Morocco has the best rate of growth from the youth and the potentialities of its emerging ecosystems, is also distinguished by the highest rate of integration. Explained by the work done so far on the priority and strategic links to be installed but anyway this approach should progress if one improves this detection and this watch by a logical links missing and a better complementarity of the local value chain and its future ambitions for reinforcement.

6. Conclusions

The Moroccan aeronautical ecosystem, although it is less important in terms of intensities of demand for innovation, technological opportunity with high added value, is distinguished by its rate of integration on the aeronautical trades. Indeed, the local value chain covers the main industrial capabilities that must move upmarket via a better absorption of innovative capabilities during technology transfers. Also a growth rate that exceeds those of Malaysia and Mexico, highlighting the potential for development of its supply chain structure by the multiplication of public private program to allow the establishment of aid and support systems of local manufacturers in their quality and design approaches to gain industrial maturity.

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