The Fruit Fly and the Jumbo Jet

From genetics to the theory of industrial cycles applied to the aircraft industry

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By which stretch of imagination can you compare a fruit fly to an A380 Jumbo Jet? One is tiny; the other one gigantic, their only common trait is that both can fly. It is hard to imagine that studying the first can contribute to predict the latest's future. And still!

The aircraft industry holds a special place in economic and social debates in Europe. Airbus, after announcing an industrial reorganization plan took the spotlight in the French 2007 presidential election campaign. As a matter of fact, political considerations in France as well as in Germany regarding EADS and Airbus corporate structure have historically dictated industrial organization choices.

The announcement of the cost savings Power8 plan in 2007 has generated a lot of misunderstanding among the public and employees. Indeed, how can we explain that this prosperous industrial company could within a few months, due to delays on the A380 program, undertake a drastic reorganization and be partially stripped from some of its productive capacity?

Far from the political debates and beyond the generic cost cutting justification, could we, instead, explain the current changes using a different approach? Beyond the short term difficulties that Airbus is facing, an approach that focuses on deep industrial dynamics could cast a light on fundamental reasons for the undergoing reorganization.

Each industry or economic sector follows its own dynamic but all of them are ruled by common mechanical laws. In order to approach and understand the dynamic of permanent change let's take a deep dive into industrial cycles and analyze some components of underground working forces.

With the help of an expert on fundamental laws of change within industries, we'll analyze the moving parts and forces at play and describe his model. Then we'll apply this conceptual framework to the aircraft industry and identify upcoming foreseeable consequences.

The fundamental forces that moves the wheel of change

Charles Fine is a professor at the MIT. His specialty is Supply Chain, which consists in organizing, planning, and managing flows of raw materials, work in progress, finished goods, and information in enterprises.

Using genetics as a source of inspiration to discover the laws of organization evolution, Charles Fines published his research in a fascinating book: Clockspeed. (Clockspeed: Winning Industry Control in the Age of

Temporary Advantage – MIT Sloan School of Management- 1998).

Like living organisms follow the rule of genetics, planets the law of gravity, enterprises and industries evolve following laws whose principles are quite universal.

While studying the factors influencing changes in industries he came up with the revolutionary idea to apply genetics principles to his research by using fruit flies as an examples for his observations.

Species such as elephants, turtles and humans have a life span in the range of 80 to 100 years. At the other end, fruit flies have a life cycle comprised between 10 to 15 days. What could explain such differences? Biologists and experts in genetics showed that different species have internal clocks whose varied speeds explain the different life cycles. Clockspeed is thus defined as the internal speed of living creatures' metabolism. For researchers in genetics, fruit fly is the perfect candidate for observation: it allows the observation of a large number of generations in a time frame reasonably short to identify some rules applying to the species.

During his research, he found out that all industries follow specific rhythm of evolution within 3 dimensions: products, process, and organizations. Automotive, aircraft or mining industries for instance have relatively slow cycles spanning over several decades.
At the opposite end of the spectrum, however, the computer or electronic components industries follow rapid changes, with products as well as manufacturing processes running 6 to 18 months lifecycles.

Additionally, Fine noted that for a given industry, the pace of evolution changes over time. There are acceleration phases but also phases of slow-down. He asked why.

He then focused his effort on industries with rapid rhythm of changes. Changes in industries such as computers or media/entertainment are quite visible in a short timeframe.

The laws of industry evolution that Fine discovered can be summarized as follows:

∞ There is no permanent domination. All domination is temporary.
∞ Each industry evolves at its own specific pace.
∞ The faster the rhythm of change of an industry, the shorter the reign of the dominant company.
∞ The internal rhythm of change of industries is determined by certain forces at work as well as their intensity.
∞ There is no permanent domination. All domination is temporary.

Some of these forces include:
∞ **Competition level:** the more intense the competition level, the faster the changes in the industry. Each player must adjust quickly to what competitors are doing, hence a state of permanent change.
∞ **Technology Innovation:** impacting either products or manufacturing processes it pushes the boundaries of possible and challenges established orders.
∞ **Regulation** coming from governments aiming at driving economic behaviors.
∞ **Environment**: nature imposes contraints. Current climate changes are powerful enough to already impact economies.
∞ **Demography**: demographic trends represent underlying forces of economic evolutions in most countries.

Integration and Desintegration

Observation over several decades shows that industries follow alternate cycles of integration and disintegration.

After identifying the forces driving change within industries, Charles Fine explained how these forces operate. Still using the parallel with genetics he built a model he called “the double DNA helix”.
During integration cycles, products are more integrated and industries tend to become vertical. During disintegration cycles, products become modular, and industries become horizontal. And each industry is positioned at any moment somewhere on the wheel of change. It can be totally vertical or horizontal, or in an intermediary state.

In verticalisation phases, firms gain control of a greater part of the added value. During these phases, when products are integrated, companies tend to develop and produce internally as many components in order to maximize their margins. Forces at play are determined by several factors. These include for example the technological advance of a firm on its products or its manufacturing process; or a situation of market domination by one or a few suppliers prompting a need to regain internal control over part of the activity; or the existence of a proprietary technology that provides exclusivity and then increases its profits.
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But, due to competitive pressure, margins end up shrinking. This phenomenon results from several factors. Niche competitors develop, industries evolve according to more complex dimensions, or due to growing organizational rigidities, yesterday’s champion lost its operational efficiency; or a new business model emerges making old organizations obsolete. During this phase, products become modular, which means that entire components are sourced from external suppliers.

In order to maintaining profits, strategies will focus on what the company does best: its core business. The firm will buy externally some components that don’t contribute to differentiating itself. Doing so, suppliers end up capturing a greater share of the added value. Over time, this trend will give more power to some suppliers. By controlling an increased part of the products they also capture a greater part of the final products.

While this situation intensifies, the manufacturer’s aim at regaining control over its activity by re-integrating critical know-how.
Then, a new phase of the double DNA helix cycle begins. Movements of acquisition or consolidation in the industry lead to a new cycle of integration. Depending on the nature and intensity of the forces at play, the duration of these cycles can vary. There can even be period s of relative stability when an industry reaches maturity.

The computer industry provides a typical example of this permanent double revolution.
At one time, IBM, used to control almost all steps from design to manufacturing of PC.
Then clones from Asia arrived on the market. In order to face the tough competition, cut costs and reduce its time to market, IBM began sourcing from outside suppliers. This is how DOS, sold by a young company named Microsoft, became the operating system of choice on almost all PCs in the world. This move started the Microsoft and Bill Gates saga. Additionally, as IBM started an in-depth change toward modularization of its products, it handed the sourcing of its processors over to Intel. This made Intel’s fortune. Intel has enjoyed until recently a near monopoly on every PC in the world. While perfectly illustrating Fine’s theory, Microsoft and Intel have become the almost mandatory suppliers of the personal computer industry. During this disintegration phase, when entire modules are outsourced, Microsoft in a dominant position tends to expand its offer to ever more applications and increase its power. Computer manufacturers lost control over their products; the brand of a PC or a notebook is not the most important: today labels « Powered by Microsoft” and “Intel Inside » matter most.
Eventually, after years of struggle, IBM sold its

PC division to a Chinese firm in order to focus its resources on more promising activities.

In the 1990s, Dell leveraged the internet and introduced a new business model, changed the rules and became market leader. Then, HP, after reinventing itself during the last 2-3 years, took over the lead.

This overview gives us an idea of how the Integration/Disintegration revolution works. Its laws apply to nearly every industry such as automotive, bicycle, medical equipment, telecommunications, media, content provider, and aircraft. For the players in an industry, the key is to identify the critical elements that will generate maximum control, and thus profits.

There is no permanent competitive advantage; every competitive advantage is temporary; all the more that the internal change in an industry is fast. Each industry evolves at its own pace; the pace of evolution is susceptible of change especially under the influence of competitive environment in one sector and technical innovations; but also regulations, ecological environmental changes and geopolitical changes. When an industry reaches maturity, its internal rhythm of change is likely to slow down. At the opposite, an increase in competition will mechanically trigger acceleration in change.
The faster an industry evolves the most temporary the competitive advantage. The key of success for firms is to choose the right competitive advantage, repeatedly, over and over. This is the "clockspeed effect".

The case of Aircraft Industry

This conceptual framework enables us to « read » what is going on in the aircraft industry. Airbus was placed in the center of the French presidential campaign. Mistakes at the executive levels have captured the public's attention and subsequent reorganization plans have been perceived as unfair to the employees. It is possible that without the cables network problems on the A380, everything would have been fine and that the Power8 reorganization plan would not have occurred. This is possible but unlikely. Because Airbus doesn't operate in a closed loop and that deep industrial forces are inexorably playing. Not only does the company belong to the global market, but it directly contributes to it. Indeed, don't large aircrafts, by facilitating transportation of people and goods across continents facilitate globalization?

Let's take a look only from an industrial perspective.
Airbus is facing a single competitor, Boeing. The American manufacturer itself faced its own structural challenges during the 1990's and early 2000's: inadequate aircraft product line, low development of new aircrafts, productivity issues, high manufacturing costs etc. Looking at the "double helix" from Charles Fine, we can consider that Boeing was on the top of an integration phase and that market forces, especially competition from Airbus have thrown the model off balance. While numerous components, such as engines, were already purchased outside the company or outsourced, the firm used to develop and manufacture many parts and components itself, and assembled nearly all the aircrafts on site.

Boeing's response was to adopt a modular organization as a new strategy. For the new 787 "Dreamliner" under development, most of the components are now outsourced from outside suppliers. These are becoming more partners in a network that simple equipment manufacturers. These partners not only develop and test components but also manufacture and assemble entire modules. Thus Boeing is becoming a giant integrator that develops an aircraft and assembles modules entirely manufactured outside. When the model is rolled out, the new aircrafts will be assembled in only 3 days. In this model, the core competency of the aircraft company is to design

new aircrafts, plan, coordinates its partners and manages industrial flows.
In making its products modular, Boeing is also entering a new phase on Fine's "double DNA helix": it is now a horizontal and modularized. This change enables the firm to reduce the design time of new aircraft, cut the development costs by transferring part of the investment burden on its industrial partners, and reduce the execution cost by reducing the Work In Progress.

The consequences of these movements are major. They impact the entire aircraft industry. Airbus, in order to remain competitive, must engage in a similar path and develop partnerships to develop its new wide body A350. Again this is an industrial and commercial issue of time to market and economic efficiency. The goal here is not only to develop new aircraft models but also to be able to make and sell them. And no-one can escape this competitive pressure.

By implementing a new business models that mainly relies on partner networks, both aircraft manufacturers have triggered an explosion of the capabilities to make components outside their firm. But if they gain in cost and lead-time, they also lose exclusive control over the process and competency. This is why Airbus began its reorganization by a thorough review of all critical components that should remain internal.

Long Term consequences

In the long-run, consequences are mechanical. We can unfold the upcoming scenario as a movie preview. It is foreseeable that within a decade or so, the duopoly of Airbus and Boeing on large aircraft (over 100 seats) will end. Indeed, there are enough competencies and capabilities around the world to support new initiatives from other aircraft manufacturers or groups of companies in the aircraft industry, supported by governments or large investors, like the Europeans did, to come up with a new aircraft of their own. This is a question of time but this change is bound to happen.

In order to illustrate the analysis, let's mention that in early 2008, Chinese aircraft industry companies AVIC I (maker of a 70-100 seat aircraft) and AVIC II announced a partnership to develop a 150 aircraft by 2020. They are supported by the Chinese government and both are…suppliers of Airbus and Boeing.
Meanwhile, Bombardier, the regional aircraft maker announced a project to develop a 100-120 seat aircraft. We could also imagine various other scenarios of alliances involving companies from Brazil, Russia, Japan, India, not to mention Airbus and Boeing themselves. In most countries aircraft components or regional jets industries already flourish.
All kind of components, parts and manufacturing capabilities are already available on the global market: aircraft design software, wings, engines, landing gear, tires, seats and interior features, evacuation equipments, navigation instruments and thousands of parts and components.
In the upcoming years, we can anticipate a movement of consolidation in the sector of aircraft equipments manufacturers. These will merge in order to afford the development of larger pieces or modules and increase their influence on the sector.
All is needed now is a great assembly company. Capital is not a problem on the global market. In addition, countries such as China, India, Russia or Brazil have the labor cost advantage.
This is a key driver for Airbus strategy to invest in manufacturing capabilities in India and China.

Conclusion
To conclude, the necessity for industrial firms to adapt is not only to satisfy short term profitability goals but mostly to reposition themselves on the competitive field. Today's performance is the result of yesterday's decisions, and is not guaranteed in the future. Their responsibility is to permanently organize and reorganize their activities portfolio in order to gain an absolute or relative advantage, for a limited time. This balance will last until a new situation of instability drives firms to adjust their business models again. Any attempt to block the wheel of strategic adjustments

will lead to no less than leaving the competitive field.
Due to the Clockspeed effect, the undergoing modularization of the aircraft industry is inevitable. The choice that Airbus, its employees and the governments are facing is also the choice of any industrial or commercial industry. It is the choice of a war of position or a strategy of movement turned toward the future in order to survive and thrive on its markets. PL