A Strategic Framework for establishing Aerospace value chains in Emerging Markets.

By

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Master of Science in Engineering and Management

In conjunction with the System Design and Management Program

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June 2008

[February 2008]

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Abstract:

Background: CEO's and top management teams of large corporations in developed countries acknowledge that globalization is the most critical challenge they face today. They are also keenly aware that it has become during the past decade to identify internationalization strategies and to choose which countries to do business with. Still most companies have stuck to the strategies' they have traditionally deployed, which emphasize standardized approaches to new markets with some local twists. As a result they are struggling to come up with successful strategies. Aerospace as a sector has traditionally been much localized to the developed world. This makes leveraging globalization even a bigger challenge.

Correlations can be drawn to the field of systems engineering, where specific processes and tools are employed to understand the stakeholder interactions and hence treat Aerospace and emerging markets as a system. EA, System Dynamics, clock speed and Game theory are some of the tools that can analyze such a system accounting for unskilled intermediaries and less skilled legal and contract enforcing systems.

Results: The thesis suggests a framework that can help organizations identify the institutional voids existing in Emerging markets and Aerospace sector as a system. An

introduction to Aerospace manufacturing and the emerging markets help understand the advantages and disadvantages. The framework is able to do a thorough qualitative assessment of all the potential aspects of building a new value chain. Further, it shows that the framework is flexible enough to accommodate the unique aspects of Aerospace as an industry and Emerging countries as a market.

Conclusions: Despite the fact that the thesis does not develop a full fledged system dynamics model and do a complete case study, it is still a beneficial framework. It provides a sound process that could be used to design and implement robust value chains. It will help organizations understand the institutional differences between countries thus being able to choose the best market to enter, the most optimal strategy and make the most out of operating in Emerging markets. It also leverages each of the system tools such that they deliver most value by providing the best suited magnification lens.

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Acknowledgements:

The author would like to recognize and thank all those who have contributed to the project and to the research documented in this thesis.

I would like to give thanks to my parent company for their continued support of the System Design and Management program. To my project advisor, Dorothea Wong who chose to get personally involved, to my supervisor Giezi Colon who gave me the flexibility to use the framework for some of the initiatives organization was evaluating.

Thanks are also owed to Dr. Charlie Fine, my trusted academic advisor. Your guidance kept this project on track and allowed me to learn even more about myself than I learned about Emerging markets and Aerospace value chains.

Finally, the author gratefully acknowledges the support and resources made available to him through the MIT System design and management program.

Dedication:

For a married man, the decision to go back to school after almost five years in the workplace is not made alone. I am blessed to have an incredibly understanding wife. Without her constant support, this would never have happened.

This thesis is dedicated to my wife, Kanan for maintaining a cohesive family even though when your husbands work life balance has completely changed.

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1 Introduction

Advancements in Globalization coupled with desire of organizations to operate in emerging markets provide a significant opportunity to qualitatively evaluate operation strategy for these markets.

Many firms choose operation strategies for the wrong reasons, relying on everything from senior managers' gut feeling, behaviors of competitors to short term gains. Corporations also depend on composite indexes to help them make decisions. But these analysis can be misleading; they don't account for vital information about the soft infrastructures (example: Degree of openness, Social System, Product/ Labor Markets) in developing nations. The institutional variation between countries and product families needs to be understood, to establish aligned value chains. By developing an operations strategy to each country's contexts, a company can take advantage of a location's unique strengths and then evaluate if the risks of adaptation are too great, then determine the contexts in which their operations could be adapted.

Complementing this is the fact that Asia would be a major driving force in the growth of global aerospace industry. Aerospace organizations need to be well aware of this fact and be well positioned to take Advantage of this growth. But aerospace as a domain has some unique characteristics, such as high level of regulations, which must be considered when entering an emerging markets.

Hence long-term success, in emerging markets, requires far more than simply making minor adjustments to existing products, picking up suppliers and developing new sales channels. Thus a framework that focuses on strategic elements while expediting current issues is extremely useful. Systems view will enable us to adequately mesh an operations strategy for Emerging markets into the existing business development initiatives for an organization and improve our qualitative judgment

1.1 Thesis Overview

This thesis is divided into four main sections and a closing fifth section. The first section is devoted to outlining the thesis itself. The second section provides background on value chains, Aerospace and Emerging Market's. The third section walks the reader through the different tools namely system dynamics, Game theory and EA that will be used in developing the framework . The fourth section defines the frame work and describes each step of it. The last section discusses the conclusion and defines areas of future research.

1.2 Problem Statement

Even though Aerospace is one of the most international sectors in terms of application, manufacturing is still largely concentrated in North America and Europe. With the emergence of the new markets in Russia, Asia and South America, this will change. These new Markets have several advantages and disadvantages and Aerospace as an industry is very unique. If an organization has visibility on what they are up against they can react appropriately else there is high likelihood they will be surprised and will falter in meeting there goals. Hence, there is a need for a detailed approach that

allows organizations to have alignment with advantages and have counter measures in place for the disadvantages

One of the other problems lies in executives' expectations and goals. Initially it is the hesitation to embrace new markets and once beyond that it is the speed with which the new operation can be set up and generate returns. Firms also miscalculate their synergy calculations with new ventures and are not able to account for the non-monetary elements that are required to capture hoped synergies. These soft factors are what distinguish developing countries apart even though they may rate similar on composite indices. The market infrastructure is very different in these countries and companies need to have different strategies in each market.

With a system based analysis each stakeholder can be assessed individually and as a combination with all the interdependencies in action. This will help develop an approach that manages the system as a whole in its different operational scenarios and future states. The increased alignment with a better understanding of institutional contexts eventually will create better stakeholder commitment towards what needs to be an organization wide initiative.

1.3 Hypothesis

The hypothesis for this thesis is that system tools are applicable to analyze the system represented by Emerging markets and Aerospace manufacturing. Emerging markets & Aerospace manufacturing present unique challenges, and these can be

understood and managed holistically with the set of system tools. Three situations will be analyzed.

1. Analysis of Emerging Markets and Aerospace manufacturing as an Industry
2. Use systems engineering to develop a frame work that performs a thorough assessment and formulates a rigorous decision process.
3. Create a standard work and substantiate it with examples

1.4 Methodology of Research

The project was completed under guidance from the Business development & Supply Chain Strategy organization at a large diversified Aerospace manufacturer. In addition, the author is currently employed in the supply chain organization of a major Aerospace systems supplier which provided him access to additional research data and examples.

Firstly, the author reviewed relevant literature and interviewed the Executives to evaluate the current business development process and developed an understanding of Aerospace operations. Author's current employment in Strategic Global sourcing provided him with data and contexts for each emerging market. Author was able to use as an example some of the value chain initiatives that were being evaluated. This provided data to verify the analysis. In addition, the author's current role provided him a crucial understanding of product families for Aerospace systems and provided opportunity to apply and hence validate the standard work

In order to ensure that the author's analysis does not disclose any proprietary information of the organizations involved, it was decided to mask all identifying information about the organizations. All related mission statements and company histories have also been modified by the author to convey the original intent while disguising the originating companies.

1.5 Conclusions

All three conditions for proving the hypothesis for this thesis were met. A Porters analysis of the Aerospace Industry was performed and characteristics of emerging markets were successfully assessed. The framework was built with bottoms up approach. The goal was to achieve *risk intelligence* built into the developed approach that creates a systematic process. Each tool in each stage had its unique advantages and provided the right amount of magnification required at each step. The study definitely opens up opportunities for future work, specifically refinement of system dynamics model and a more thorough application of EA to business development in Emerging Markets. There is also an opportunity to do a case –study for an entire value chain in an organization with the suggested framework.

2 Concepts and Market Overview

2.1 Value Chain

A value chain describes the full range of activities that are required to bring a product from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer.

Global value chains are ones in which activities are divided among multiple firms and spread across wide swaths of geographic space. Thinking about value chains when establishing a global supply chain is important because it gives an overall perspective. Value chain analyses step through the company's processes and help understand how much value each step adds. Through this type of analysis, one can discern possible synergies among various units of an organization and determine which value activities are best outsourced and which are best developed internally. The value activities are grouped into nine categories, as indicated in the exhibit above.

Primary activities create the product or service, deliver and market it, and provide after-sales support. The categories of primary activities are inbound logistics, operations, outbound logistics, marketing, and sales and service.

Support activities provide the input and infrastructure that allow the primary activities to take place. The categories are company infrastructure, human resource management, information systems, and procurement.

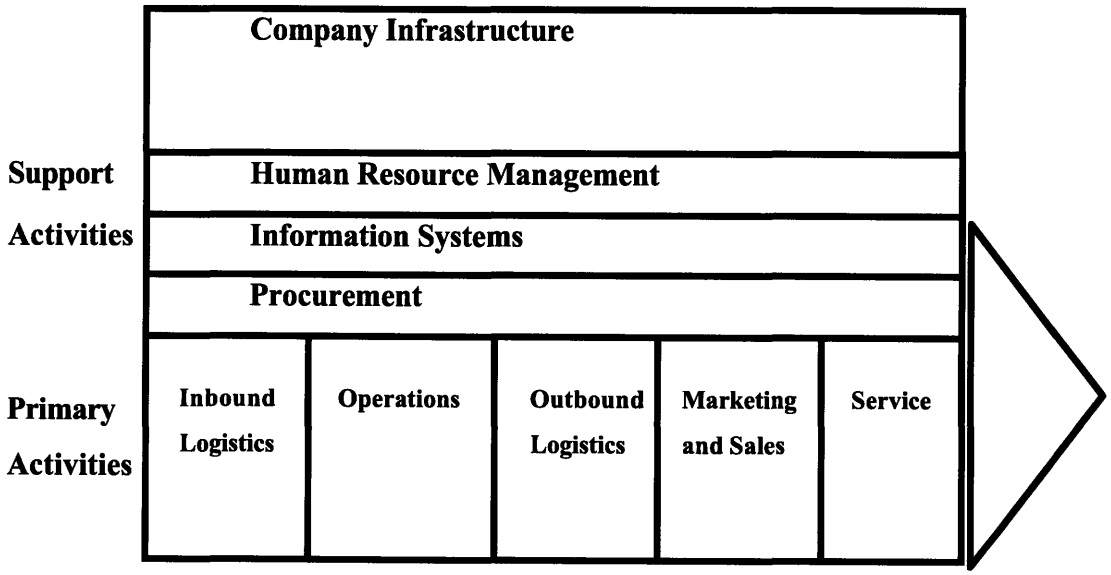


Figure 1: Value Chain Layout

2.2 Supply Chain

"The process of planning, implementing, and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."

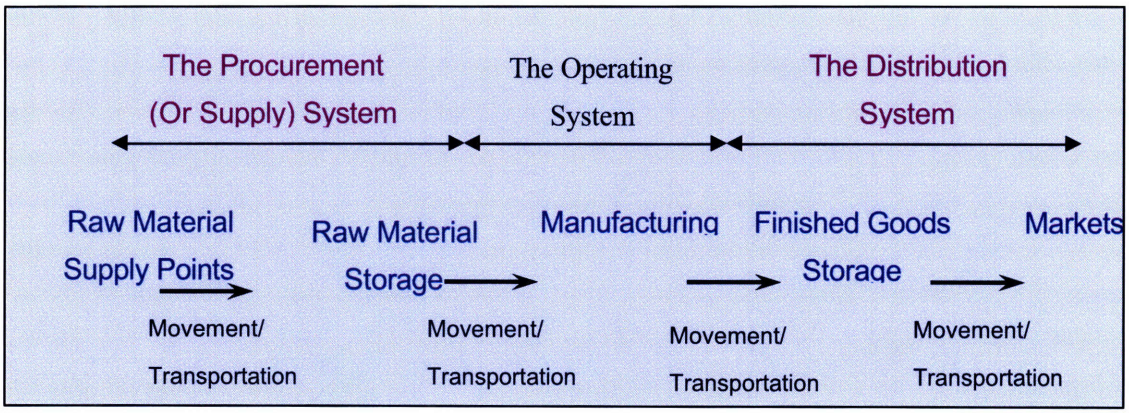


Figure 2: Supply Chain

Some of the main reasons why a company decides to outsource are

- Capability
- Manufacturing competitiveness
- Technology
- Internal cost structure and cost competitiveness

Two most important reasons for not seeking sourcing are:

- Competitive knowledge
- Customer Visibility/ market Differentiation

Sourcing hence create two categories of dependency

- Dependency for capacity: The Company could make the item in question but for reasons of time, money, space or management, it would extend the capacity by means of a supplier.
- Dependency for knowledge: The Company presumably needs the item but lacks the skills to make it, thus it seeks an expert supplier to fill the gap. Supply chain is growing to be the most important competency in a firm. The nature of competition has changed: In the past companies competed. Now, supply chains compete.

In the past (e.g. 1950s and 60s), problems were solved by vertical integration (buying, owning and operating the pieces of the chain). During the 1970s, as global competition intensified, businesses that were too vertically integrated were disadvantaged, leading many to divest. Today, companies are trying to get the benefits of the integration, without owning pieces of the supply chain: THIS IS THE CHALLENGE: Is this achievable? If so, how and how are the costs and benefits shared among the players within the chain?

Traditional modes of competition such as cost, quality, and speed still apply, but they now apply to the **entire chain** rather than just firms.

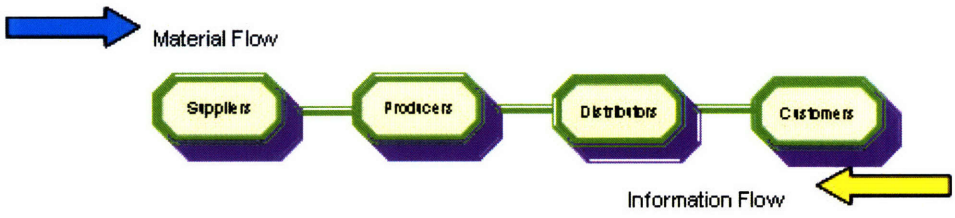


Figure 3: Material and Information flows in a supply chain

2.3 Motivation- Why is this a systems problem?

Every organization wants to reduce cost and try to be closer to its end customers. There are internal (Executive) as well as external (Shareholders) pressures on the organization moving it in this direction. Emerging markets present a clear cut solution but also have a very dynamic environment.

Many Corporations make decisions relative to these new markets by gut, herd instinct, anecdotal evidence or just by looking at composite indices. They completely disregard the right institutional context for each market. Organizations try to use the same strategy that they use in the developed world in these markets taking several supplementary things for granted. So when it comes time to see the results, reality falls much short of expectations. It either takes much longer than the initial plan or one never reaches the cost targets that were set or a wrong market is selected and competitors move ahead of and cannot react because of the commitments already made.

Parallels can be drawn to engineering systems where system performance has similarly trailed expectation. Engineering systems have become increasingly complex as firms drive to push technological limits, create more integrated products, and employ globalization strategies. Boundaries between different engineering specialties are often considered inflexible to simplify analyses. Expectations for system-level performance are often overestimated due to a lack of understanding on how individual systems will integrate with one another. Engineered systems have addressed these challenges by implementing Systems Engineering, a discipline devoted to managing the interfaces

between disparate functional areas. The fundamentals of systems engineering have also been applied to manage the dynamics in emerging markets through System dynamics and EA.

Game theory takes it to next level by providing a magnified view and making sure all stakeholders who are part of one's game (system) are represented. It further helps one to expand on other system concepts like boundary (Scope) and constraints (rules). Added value helps one to position itself at the system level where maximum benefits exist. It also adds some quantifiable rigor to the analysis.

On the Alliance side of things the BD process analyzes the target company primarily at the micro level. Due diligence is frequently very concentrated with little time devoted to allow subject matter expert to share the unique aspects of his or her analysis. One individual, typically someone with experience in past leading the due diligence team, may be the only person tasked with identifying and developing system-level solutions. The degree to which system-level solutions are identified and evaluated is very dependant on the skills of this due diligence team leader. It is the author's supposition that many of the opportunities and risks associated with a potential alliance may be hidden across these functional boundaries and that a more holistic analysis of the potential alliance would provide a much more accurate estimate of the potential synergies.

2.4 Overview of Emerging markets

The recent emergence of BRIC countries as highly advantageous places to do business is dramatically reshaping the global economy, forcing executives to rethink their strategies, their operations and organizations. The last few years have witnessed a dramatic shift in the manner in which business is conducted around the world. Firms have shifted away from a hierarchical, one-dimensional supply chain entity to a fragmented network in favor of strategic partnerships with external entities to gain capacity and cost savings.

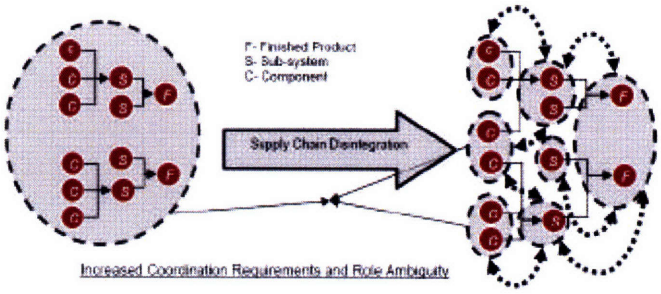


Figure 4: The New fragmented Supply Chains

Because firms are able to locate operations anywhere in the world, based on where it is most efficient to do so, vast amounts of production capacity in industries other than Aerospace has already moved to places like China, India and South-East Asia, driving growth in those countries. In case of Aerospace to a large degree, Boeing and Airbus still conduct final assembly of components manufactured (and in many cases designed and engineered) by their suppliers. The fact that components used can be heavy and bulky doesn't mean that Original Design manufacturing in these sectors has to be close to home. In fact, components for Boeing's new 787 are being made as far away as Japan.

What are Emerging Markets?

Emerging markets are the new wave developing countries, which driven by the globalization have become a viable solution both as customer and solution to the developed world. The backbone of the formidable GDP growth has been the evolution of capital, labor and product markets in these countries. This has been complemented by the development in the Political/ Social systems and openness. Brazil, Russia, India and China are a representation of these markets. Underlying the new wave of globalization are some key things happening and corporations need to understand them well to generate maximum advantage. To tap the full commercial potential of emerging markets, organizations will need to innovate in these key areas:

- **The growth in emerging markets**
- **Cost and capital advantages in Emerging Markets**
- **Development of talent and capabilities**
- **Migration of Customers**
- **Emergence of Emerging Market based global competitors.**

By assessing how business will be affected due to changes in each of these areas individually and collectively, the leadership team can be positioned to develop comprehensive and effective globalization strategies. While this is a huge challenge, the business opportunities are compelling.

Companies at the forefront of globalization need to realize that their cost-saving strategies are inextricably linked to their operational decisions about redesigning plants and processes to employ local capabilities in novel and creative ways.

For example :Companies that originally designed their plants to handle only sourcing for export need to gear up to serve rapidly growing local markets, and vice versa.

The growth in Emerging Markets

As discussed earlier the emerging markets are experiencing an enormous growth activity

This growth will mean substantial consumption of consumer and industrial goods. Already China is the largest market in the world for refrigerators and air conditioners, the second largest for energy consumption, the third largest for consumer electronics, the fourth largest for packing products, and the fifth largest for automobiles—all growing at 15 to 35 percent per year. Other Emerging markets are also picking up scale and momentum. While the United States, Western Europe, and Japan are expected to grow by about $3 trillion in collective GDP from 2004 to 2010, the key Emerging markets will grow by more than $2 trillion. According to Goldman Sachs projections just four of the largest emerging markets (known as BRIC's, for Brazil, Russia, India and China) will overtake the seven largest industrialized countries, the G7 (United States, Japan, Germany, France, UK, Italy and Canada) by 2040. Including the next group of eleven emerging markets, the fifteen leading emerging markets will together be larger than the G7 soon after 2030. There combined GNP is projected to reach $41 trillion, compared with the G7's $43 trillion after taking account of probably slowing in China to less than half its current growth rate.

Years	G7	All developed	BRIC	Next 11	Top 15 emerging markets
2005	27.3	32.4	4.2	2.9	7.1
2015	33	39.6	10.2	5.6	15.8
2030	43	51.6	28.2	12.5	40.7
2050	64.2	77	90	35.5	125.5

The rise of BRIC's and other emerging markets (Trillions)

Projection based on Goldman Sachs data on BRIC's and eleven major countries. Goldman Sachs assumes the growth in emerging markets will slow and the exchange rates in these markets will generally appreciate as their purchasing power increases.

The biggest advances in developing nations are yet to come. From 2007 through 2014, an estimated 1 billion people throughout Asia will enter the middle class for the first time, and middle class income levels will rise significantly. This surge in demand is fueled both by commercial buyers—which invest heavily in manufacturing and service operations, infrastructure, and real estate and by growing pools of consumers with swelling purchasing power.

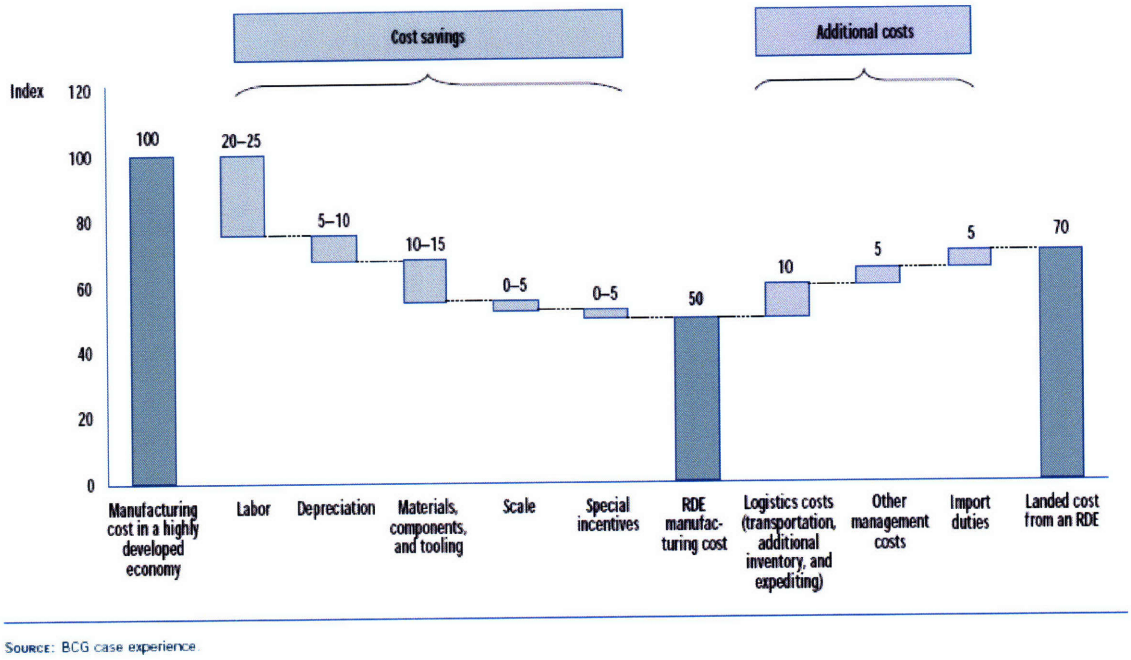
Specific to Air ravel, today, the BRIC countries account for almost 1.5 billion middle class consumers, and, together, they add some 80 million new consumers every year to the addressable market for air travel. As a result, demand for air travel in the BRIC countries has been growing at 9.9% per year for the last ten years. This surge in demand has resulted in their airlines' fleets growing from 1,800 in 1996 to 2,450 aircraft in 2006. Brazil, Russia, India and China represented only 5% of the world's annual aircraft orders until 2004, but by 2005 their share had jumped to 35%. Given their potential for growth, it is anticipated that the emerging countries will continue to

represent an important share of the orders into the future. The propensity of people to travel in each country depends on their social, cultural and geographical characteristics, but is mostly correlated to the output per capita of their countries. As the GDP per capita increases in a particular country, the number of trips per capita increases along a typical air travel propensity curve. This is backed by aggressive financing terms from banks eager for a piece of the emerging markets; even the youngest companies are buying new planes, sometimes by the dozen.

Fast-growing airlines in developing markets tend to have newer fleets than their competitors in countries where air travel is well established. The average age of China Airlines' fleet is 5.1 years, for example, and that of Emirates is 5.4 years — about half that of Western carriers like American Airlines . Because the demand of aircrafts is growing the local industry for aerospace manufacturing is also being developed (Aerospace industry is historically concentrated in Developed markets).

Cost and capital advantages in Emerging Markets

A major driver of the move to Emerging markets remains the opportunity to make very large and sustainable—reductions in both operating costs and capital investments. Companies that globalize their cost structures to include emerging markets can realize savings of 20 to 40 percent in the landed costs of their products while reducing capital requirements by similar amounts.



Source: BCG case experience.

Figure 5 : Typical Net Cost Difference from Rapidly Developing Economies

Most existing aerospace system manufacturers either driven by offset requirements or by low cost want to have a presence in the emerging markets. Investment in resources to develop outsourcing in Emerging markets has better payback than any other Business ventures. Typical ROI (Depending on the product family) is 1-3 years.

Lower Operating Costs. Clearly, a major element in the emerging market cost advantage is the difference in labor rates. A factory worker in the United States or Europe costs $15 to $30 or more per hour, depending on where the factory is located, whether it is unionized, and the extent of benefits it provides. In contrast, a Chinese factory worker earns approximately $1 per hour—offering a cost advantage today of fifteen-fold or more. Wages in Mexico and Central and Eastern Europe are two to eight times those in China but still far below U.S. and Western European wages. The realized

net savings after logistics costs, other management costs, and import duties for products such as electric motors, transformers, and compressors, for example, are between 20 and 40percent. In highly labor-intensive sectors, such as services, the cost advantage to be gained by outsourcing is up to 60 percent, as reflected in recent experience with call centers, business processes, and R&D services outsourced to India.

While actual cost savings can vary widely (depending upon the existing capabilities in supply base, change in macroeconomic condition like forex), the magnitude of the cost differential between developed countries and emerging markets cannot be ignored. Moreover, companies doing business in Emerging Markets also benefit from the labor advantage indirectly, through lower domestic sourcing costs for support services, such as facilities management. And the cost advantage is further amplified by the fact that many Emerging markets suppliers are willing to accept relatively low profits in the short to medium term in return for strong growth.

The cost gap between Emerging markets and developed countries may lower in some cases within the next decade. But this affect will be countered in many cases, as companies operating in many Emerging Markets consistently lower their purchasing costs over time, achieving annual reductions. In addition, the growth of wages in China and India will be limited because of demographics: there are very large numbers of underemployed people in those countries. (However, temporary shortages and rate spikes will occur over the next two to three years in tight labor pools, such as for highly experienced engineers or senior managers, until the labor market balances supply and demand.).The "hidden" costs of going global—including, for example, one-time setup

costs and ongoing risk-management costs—will shrink as companies scale up, ascend the learning curve, and stabilize their supply chains.

Lower Capital-Investment Requirements. Another important and often overlooked source of the emerging market advantage is lower capital-investment requirements. (Though they need additional resource allocation) Whereas bwer labor costs benefit the P&L, lower capital investments can mean significant savings on the balance sheet. In terms of total return on capital, the combination of lower product cost and lower capital investment can have a big impact on the total economics of a business. Two fundamental factors reduce the need for capital in emerging markets: first, less expensive plant infrastructure, machinery, and equipment; and second, the opportunity to replace substantial amounts of costly technology with human labor.

Development of talent and capabilities

Companies moving towards globalization movement can seek to build second-order benefits to reinforce the cost advantage, improving the effectiveness of their offerings and operations by tapping into the rapidly developing base of human talent in these countries.

By 2010, China, India, and Russia will likely provide more than 2 million new scientists and engineers a year, compared with about 400,000 in the United States. Moreover, in the traditional manufacturing disciplines, Emerging Markets provide large pools of skilled workers who are eager to apply their talents as "craftsmen." In both blue- and white collar labor pools, Emerging Market work forces have demonstrated that they are talented, trainable, and eager to move up the skill ladder.

Leading organizations can make use of this skill as an advantage in three ways:

- *Increase in overall business effectiveness*: Emerging market vendors can be used to do tasks that would have been too expensive to perform in the home countries. One can use this to do projects that were below the waterline with one's existing operations.
- *Address unmet customer needs:* The greater use of skilled, flexible labor in place of machines can help companies manufacture more customized products less expensively than is feasible in highly automated settings. Such Emerging Markets based customization can open up higher price niches, provide better competitive differentiation, and boost overall profitability. In addition, companies can often produce smaller batches than would have been economical in more automated plants. This fits aerospace very well because of the fact that it is a low volume industry.
- *Drive new product development :*The much lower cost of engineers and skilled research staff in Emerging markets allows companies to dramatically increase the amount of R&D they do often achieving three to five times as much development for the same budgets. The R&D currently being conducted in Emerging markets is directed both at serving the respective countries' growing domestic markets and at developing products and manufacturing processes for global sourcing and research. While the various markets compete aggressively for R&D investment in general, they will at the same time position themselves as clusters of deep expertise in particular disciplines. For example, China is known for mechanical engineering, computer graphics etc; India for embedded software,

drugs, and chip design; and Russia for aerospace, energy, and chemistry. The biggest challenge for companies conducting R&D in Emerging markets is the protection of intellectual property. Sixty-five percent of executives surveyed by the Economist Intelligence Unit view IP as a significant challenge for the globalization of R&D.

Migration of Customers

As more and more manufacturing companies move their production to Emerging Markets it creates major implications for the suppliers in home markets. If these suppliers do not take action quickly, their businesses will inevitably shrink; the only questions are how fast and by how much. Most companies need to develop a twofold strategic plan: to fill market gaps at home, and also to follow selected customers to their new locations. Obviously, the new competitive realities mean that all companies must aggressively pursue capital productivity and operating efficiencies in all their existing operations to ensure that they are as competitive as possible. But in those categories where they are at a structural long-term disadvantage in their home countries, suppliers need to retest their midterm strategies.

Aerospace is like any other industry where the customers would prefer to continue working with their established suppliers if the latter set up operations in the Emerging markets. This is particularly true for critical supplies, for which local suppliers may still need to be qualified (Most of aerospace manufacturing currently), though the existing supplier may not transfer the entire cost savings to the customer in this case. In

case of key systems the suppliers are given fixed contracts for the entire life of the aircraft hence replacements of suppliers is not possible. But because end customers are moving to these markets, the Boeing and Airbus are looking to have local value chains in order to make a sale. The figure below shows the sale of Aircrafts in each of the countries.

Top ten countries (2006-2025)

	Passenger aircraft demand		By $ value (billions)	
1	United States	6,628	United States	538.1
2	People's Republic of China	2,929	People's Republic of China	349.3
3	United Kingdom	1,282	United Kingdom	145.9
4	Germany	1,041	Japan	117.8
5	India	935	Germany	108.7
6	Russia	811	India	100.9
7	Japan	646	UAE	71.6
8	Mexico	620	Russia	69.6
9	France	543	France	68.4
10	Spain	519	Australia	63.2

Figure 6: Future Aircraft sales (Source Airbus Analysis)

However, transplanted suppliers should be aware that they will enjoy only a short grace period before they will need to compete head-on against truly local alternatives. To maintain preferred supplier status, they must perform at least as well as local competitors on cost, quality, and service. As customers get more accustomed to local sourcing, and as local sources move up the quality curve and down the cost curve at increasingly impressive rates, the opportunity for transplanted suppliers to establish themselves shrinks.

In any case, companies settling into Emerging Markets usually need to adapt their operating models to make full use of the labor and equipment cost differentials inside those countries. Only if transplanted companies "go local" in the way they make use of

a country's unique resource configuration can they effectively compete with their local counterparts. Companies in developed countries that take their existing cost and asset base structures overseas and merely cut short-term costs can be setting themselves up for failure down the road.

Emergence of Emerging Markets Based competitors

As the Emerging Markets continue their breakneck growth, they are giving rise to a new generation of large-scale global competitors: This is mostly of concern to Aerospace component manufacturers as the airframe and major systems are locked in with OEM's over the life of the program but then even they could be challenged for the new contracts. These new companies are going global in several ways, systematically extending their presence. They will also transfer back to their domestic businesses the international best practices they acquire or develop: How to manage complex supply chains, how to manage product and service quality for maximum consistency. This transference will make it harder for transplanted suppliers to develop local positions based on product & business process superiority.

2.5 Overview of Aerospace Industry

The commercial airline industry has always been particularly vulnerable to economic and political changes. In times of crisis, people travel less while fuel may cost more. The deregulation of the U.S. airline industry in 1978 was a watershed event that led to intense price competition, and several factors conspired in recent years to make the goal of profitability ever more difficult for major airlines to achieve. The stock market crash

of 2000, the tragedy of 9/11, rapidly rising fuel costs and intense competition, among other problems, bankrupted several airlines and threatened many more with similar fates. As a group, U.S. airlines had a reasonably good year of operating profits (or reduced losses) in 2006, after posting $5.7 billion in losses for 2005. More than $35 billion was lost by U.S. airlines from 2001 through 2005, according to the Air Transport Association.

With more capital at their disposal, the top five U.S. carriers are investing in improvements in equipment and service. Delta, for example, is spending $25 million per year to undertake thorough cleaning of each plane in its fleet on a monthly basis. American is refurbishing its fleet, investing in maintenance equipment and sprucing up its terminals in New York, Chicago and Miami.

One of the secrets to improved operating results has been very strong flight schedules from the U.S. to foreign destinations. Major airlines have also been expanding their regional jet fleets and/or making new alliances with regional carriers to serve smaller markets more efficiently. Brazilian manufacturer Embraer is enjoying great success with its 72-seat Embraer 170 jet and 100-seat model 190.

Market Size

Airlines' profitability and long-term fleet planning are the primary demand drivers for large commercial aircraft. Fleet planning, in turn, is based on overall air traffic forecasts combined with each airline's route structure and age of existing aircraft.

The global end market for new aircraft comprises about 500 major airlines. According to Avitas Inc., a civil aviation research and consulting firm, at year-end 2005, these airlines operated a total of about 16,115 wide-body, narrow-body, and regional jet aircraft. About 40% of these aircraft were based in North America and another 25% in Europe. While the United States and Europe possess more than 65% of the world's passenger jet fleet, they make up only 17% of the world's population. In contrast, India and China together represent 37% of the world's population, but Asia and the Middle East combined have only 20% of the world's passenger jet fleet, according to Avitas. With developing economies around the world growing well, we expect aircraft demand to increase from regions such as China, the Middle East, India, Eastern Europe, and Latin America, areas where populations are high but jet fleets are still small. The wide variety of business models in the world these days are leading to the evolution of several airlines.

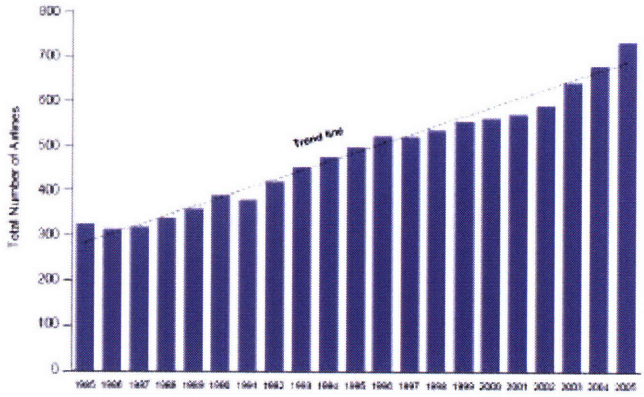


Figure 7: Growth in number of Airlines in the world (Source: Business Monitor)

Commercial aircraft orders (including both Boeing and Airbus) peaked in 2005 at 2,140, with Boeing receiving 1,029 orders and Airbus receiving 1,111. There has been a big change in market conditions in this cycle

- Every previous cycle from1960-2003 were driven by two major global regions – US & Europe

US Fleet As % Of Total World Fleet

	1970	1980	1990	2000	2006
US/World	67%	49%	51%	44%	37%

- Current Aerospace cycle Driven by Three Regions Including Asia/Middle East, --. Asia/Middle East the only major market that isn't saturated but prolonged for sustained growth

2006 World Fleet Breakdown by Region

	Units	% Total
US	5993	37%
Europe	3606	22%
Asia	3384	**21%**
Middle East	661	**4%**
Latin America	1100	7%
ROW	1639	10%
Total	16383	100%

Aerospace Manufacturing

Aerospace manufacturing is an industry that produces "aircraft, guided missiles, space vehicles, aircraft engines, propulsion units, and related parts,'No other industry is more international than commercial aerospace. Yip identifies industry globalization drivers in four areas: market, competitive, cost, and government (1992, 31-65). The aerospace industry ranks first out of twelve industries (including automobiles, computers, and pharmaceuticals) in market and competitive globalization drivers and second for cost globalization drivers.

Aerospace is a strategic industry:

- ❖ It has a strong relationship to national security because many aspects of commercial aerospace can be applied to military aerospace development and production programs.
- ❖ Commercial aerospace imparts large-scale systems integration and other engineering skills that can be helpful to the economy.

The commercial aerospace industry ranks highest for market globalization drivers because customers (mainly airlines) in different countries have nearly the same needs for the product and customers search the entire world for suppliers. Competitive globalization drivers are highest for commercial aerospace due to the industry's very high exports and imports and the large number of globalized competitors from different continents and countries. Cost globalization drivers in aerospace outrank almost all other industries because of global economies of scale where no single national market is large enough for competitors to effectively do business. The enormous cost of product development in the aerospace industry drives companies to amortize those costs across markets around the globe. The use of a single currency, the U.S. dollar, for virtually all commercial aerospace contracts also shows the extremely high level of internationalization in the industry.

The aerospace Industry can be divided into four major players: Airframe manufacturers, Engine Manufacturers, system manufactures, sub-system and component manufacturers.

The global commercial aerospace industry currently has very few prime contractors that manufacture aircraft and engines. The American firm Boeing has the largest share of

worldwide market for planes seating more than 80 persons. Airbus, a consortium of English, French, German, and Spanish firms, has been gaining rapidly and currently holds the remaining of the large aircraft market. Airplane engines, which account for about 25% of the value of advanced aircraft, are manufactured by only three companies. U.S.-based Pratt & Whitney is second to General Electric for the market lead, and Rolls-Royce in England runs a strong third. There are more prime contractors involved in the smaller-size market for commuter and executive aircraft and engines, but the number of competitors is still quite small. The third category of players supply avionics, Air management system, propulsion, control system etc to the airframe manufactures and engine manufacturers.In addition to the prime contractors, the global aerospace industry has numerous medium- and small-sized suppliers of components and subsystems. These are the manufacturers of castings, harnesses, transformers, machined parts etc. There is a significant overlap in the fourth category from first, second and third category players as the prime contractors decided to keep such capability in-house. This is mostly driven from how the aerospace sector evolved. Most of the organizations were highly vertically integrated and hence did several operations in-house. The component suppliers were the last to evolve in most case in the development of aerospace industry. This was also driven by the fact that most companies wanted to outsource these lower operations in the last 3 decades so that they can focus on their core competency. The figure below provides a cost allocation of an aircraft.

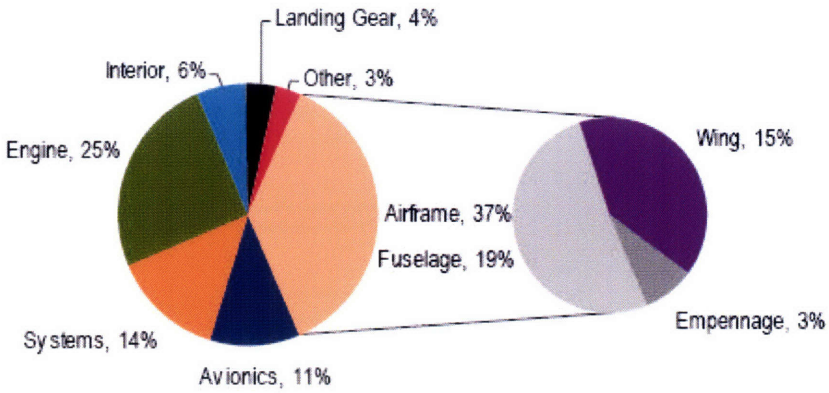


Figure 8: Cost Allocation in an Aircraft (Source Merrill Lynch-13)

Another key characteristic of the aerospace value chain is that an engine manufacture and system suppliers typically enter into exclusive supplier contracts with aircraft manufacturers. In such arrangements, the engine maker or system supplier becomes the sole provider of jet engines or major systems for a specific aircraft model.

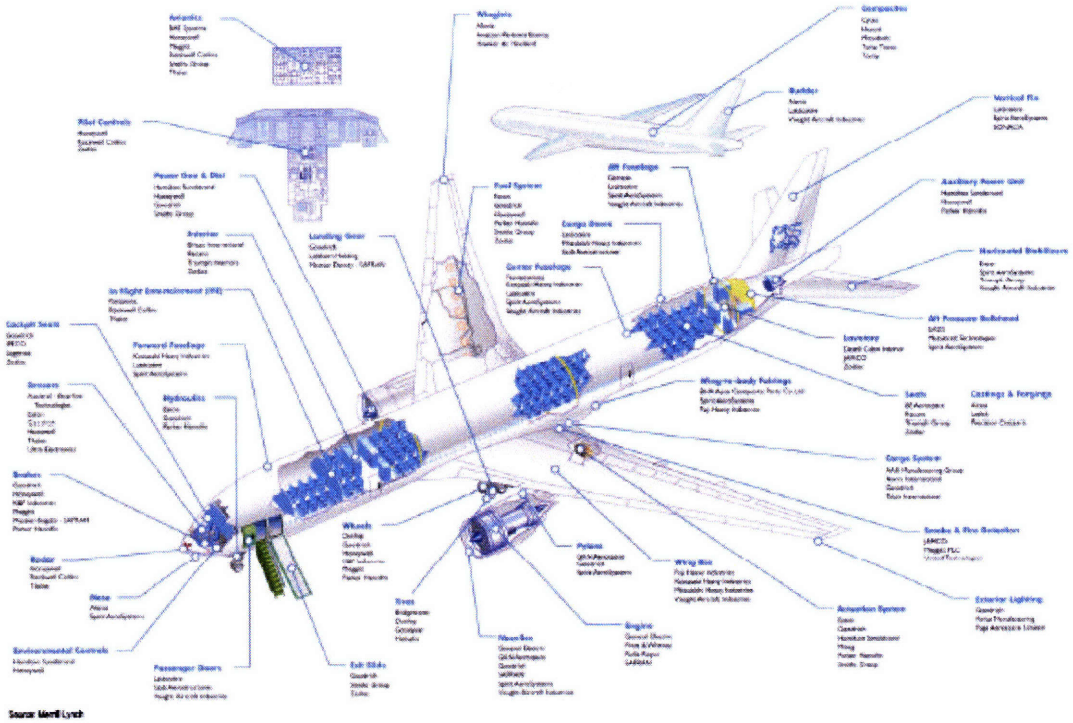


Figure 9: Major Players in Aerospace manufacturing (Source Merrill Lynch-13)

The engines specifically and systems need a much longer term commitment to recover the development cost they incur. Customers in some cases have a choice to select the engine (in case two engine manufacturers have been selected) or some of the major systems (like APU) after they have made a selection of the aircraft but most other systems are installed based on the selection made by the OEM.. The big engine makers also enter into joint venture agreements to share expensive development costs. For example, GE and Pratt & Whitney jointly developed an engine for the Airbus A380. This venture competes with Rolls-Royce, which produces the Trent line of jet engines.

The system and engine manufacturers very rarely trickle down life contracts to the component manufacturers as they want to have an opportunity to reduce cost later in the

program and the financial strength of the supply base. With globalization this is changing to some extent for two major reasons.

- Ability of sub-system manufacturers to take up more of the financial burden and provide low pricing from day one, hence taking ownership of the risk. This is because of the impressive growth in the financial strength and size of sub-system manufacturers.
- Growth in capability of supply chain which has driven System manufacturers to outsource more and more of the sub-system value chain. This is because they want to shorten the development time by focusing on the higher value added portion.

Most major players in Aerospace are customers, competitors, partners and suppliers of each other in different scenarios. From the manufacturing perspective this is because as each company was making most of the components in house for its systems, it also was able to sell this capacity for component manufacturing to other complementary system suppliers that happen to use the same components. Now these complementary suppliers may have been competitors, or in a reciprocal customer-supplier relationship during the bidding process. Another reason was that most system manufactures grew with time (through M& A or organically) to have other interests besides being system suppliers for Aerospace frame manufacturers. Hence they are key component suppliers to their customers.

3 Overview of the Tools

3.1 System Dynamics Overview

Introduction

System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems. In fact it has been used to address practically every sort of feedback system. While the word system has been applied to all sorts of situations, feedback is the differentiating descriptor here. The elements of system dynamics diagrams are feedback, accumulation of flows into stocks and time delays.

System dynamics focuses on the flow of feedback (information that is transmitted and returned) that occurs throughout the parts of a system—and the system behaviors that result from those flows. For example, system dynamicists study reinforcing processes—feedback flows that generate exponential growth or collapse—and balancing processes—feedback flows that help a system maintain stability.

In addition, system dynamicists study the impact of delay on systemic behavior. Specifically, what are the implications when a cause takes a long time to exert its effect, and when cause and effect are physically far apart? For example, if one's organization raises prices on its products beyond the comfort level of its customers, it may take a while for customers to get fed up and stop buying. If it takes a really long time for one to notice this feedback, one may not realize that customer buying habits are connected to the price hike one instituted "way back when." (In fact, one might even panic about declining revenues and hike prices up even higher to try to save the business!)

The methodology:

- Identify a problem
- Develops a dynamic hypothesis explaining the cause of the problem,
- Builds a computer simulation model of the system at the root of the problem,
- Tests the model to be certain that it reproduces the behavior seen in the real world,
- Devises and tests in the model alternative policies that alleviate the problem, and
- Implements this solution.

Rarely is one able to proceed through these steps without reviewing and refining an earlier step. For instance, the first problem identified may be only a symptom of a still greater problem. The field of system dynamics gave rise to and serves as the bedrock for systems thinking. Systems thinking looks at the same type of problems from the same perspective as does system dynamics. The two techniques share the same causal loop mapping techniques. System dynamics takes the additional step of constructing computer simulation models to confirm that the structure hypothesized can lead to the observed behavior and to test the effects of alternative policies on key variables over time.

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1) ***Systems are fundamentally dynamic in time.*** A static "snapshot" of a system reveals the size of the Stocks at that instant, but discerning the role of the Flows, or of the feedback loops that control them, requires a period of time during which they will

exhibit their influence. It is this evolution of the system in time that is its primary characteristic, not its state at any instant.

2) ***The behavior of a system is ultimately controlled by its structure***, which is by the combination of Stocks and Flows of which it is composed and by the positive and negative feedback loops that control the Flows.

3) ***Systems are defined by their Stocks and Flows*** (or by their Accumulations and Rates). Stock and flow (or Level and Rate) diagrams are ways of representing the structure of a system with more detailed information than is shown in a causal loop diagram. Stocks (Levels) are fundamental to generating behavior in a system; flows (Rates) cause stocks to change. Stock and flow diagrams are the most common first step in building a simulation model because they help define types of variables that are important in causing behavior.

$$S_t = \int_{t_0}^{t} (Inflow - Outflow)ds + S_{t_0}$$

Figure 10: System Dynamics -Stocks and Flows

4) ***Controls of systems are circular feedback relationships, not linear chains of cause and effect***. Looking at systems means abandoning those simplistic, linear, one-way chains of cause and effect that lead to a final answer, such as:

A ===> B ===> C ===> D

System Dynamics teaches that the most interesting causal relationships are, in fact, circular, in that A influences B which influences C which in turn influences the original A.

5) ***These causal loops (or feedback loops) come in two basic "flavors."***

- *Positive* feedback loops (perhaps better called "reinforcing" loops) are those where, if one "pushes" factor A in one direction, it leads to a cycle (causal loop) of subsequent activity that eventually results in A being pushed further in the original direction. A common example is a biological population: A population of organisms grows as new individuals are born into it; with more individuals now in the population, even more are born into it; which further increases the size of the population; which increases the flow of new individuals; which increases ...
- *Negative* (or "stabilizing") feedback loops are quite different. Push A in one direction and one sets in motion a sequence of events that ultimately leads to A being pulled back toward the position where it started. A simple example: As one fasts after the last meal or snack, the hunger increases. This eventually sets in motion events that result in one's eating, which reduces one's hunger. Hunger began by increasing, but the course of events ended by one's hunger being reduced back to its original low level.

3.2 Game theory

Game Theory provides a systematic way to develop strategies when there is significant amount of interdependencies involved. It makes it possible to move beyond the overly

simple ideas of competition and cooperation to reach a vision of co-opetition more suited to the opportunities that exist in today's business

There has been a growing recognition that game theory is a crucial tool for understanding the modern business world. In 1994 three pioneers in Game Theory were awarded the Nobel Prize. At the same time FCC used game theory to help design a $7 billion auction of radio spectrum for personal communication services.

Game theory focuses on the most pressing issue of all; Finding the right strategies and making the right decision. It goes right to the crux of things, showing one in strategic terms what best to do. Game theory is particularly effective when there are many independent factors and no decision can be made in isolation from a host of other decisions. It is particularly valuable to share across organizations because of its clear and explicit principles. It gives one and his colleagues a common language for discussion of alternatives. As decision making is becoming more complex and decentralized , such techniques for sharing strategic thinking are increasingly needed at all levels of business.

Game Theory is an approach one can expand and build on. It is not a particular prescription suited to a particular moment in business history. It is way of thinking that survives changing business environments. This makes it particularly valuable to come up with a strategy for product family resourcing in Emerging Markets. Game theory can help one structure the right strategically informed responses to rapid changes in markets and technology.

There are five fundamental elements of Game theory also referred as PARTS. To change a game, one needs to change one of its elements. This means each of the five elements: Players, Added value, Rules, Tactics and Scope – give one a way to translate and existing game into an entirely new one. If one searches for new strategies in a hit or miss fashion, it is possible one will miss the best opportunities for one's business. By going through PARTS in a deliberate way one leaves nothing out. Moreover it makes one to do the proper due- diligence when making a business move. The section below describes each of the elements in more detail:

PLAYERS

This is the fundamental element of the game of business. There are four categories of players: Competitors, Complementors, Suppliers and Customers. All these categories can be laid on a schematic map so that the whole game can be visualized. Such a schematic is called Value net which not only captures all the players but the interdependencies between them.

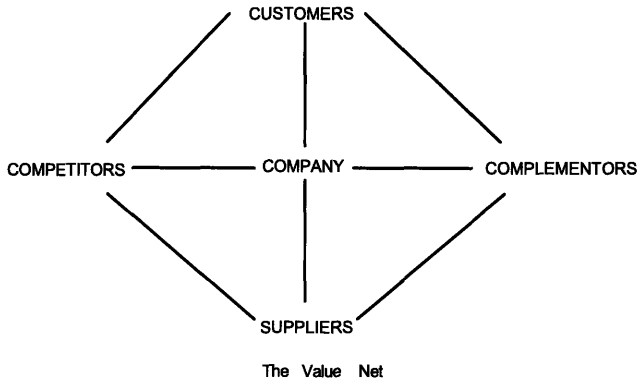


Figure 11: Value Net

The Value Net reveals two fundamental symmetries in the game of business. On the vertical dimensions, customers and suppliers play symmetric roles. They are equal partners in creating value. But people don't always recognize this symmetry. While the concept of listening to the customers has become a commonplace, the same isn't true when it comes to suppliers. Resources such as raw materials and labor flow from the suppliers to the company, and products and services flow from the company to its customers. Money flows in the reverse direction, from customers to the company and from the company to suppliers.

Along the horizontal dimension are the company's competitors and complementors. At the conceptual level, complementors are just the mirror image of competitors. That's not to say that people are equally good at seeing the mirror image. Just as people have been playing catch-up when it comes to thinking about suppliers, there's a lot more work to be done in recognizing and benefiting from complementors relationship.

The traditional approach defined competitors as the other companies in one's industry-those companies that make products similar to one in a manufacturing or engineering sense. As people think more in terms of solving their customers' problems, the industry perspective is becoming increasingly irrelevant. Customers care about the end result, not about whether the company that gives them what they want happens to belong to one industry or another. The right way to identify one's competitors is, again, to put one in the customers' shoes. Our definition leads one to ask: What else might my customers buy that would make my product less valuable to them? How else might customers get

their needs satisfied? These questions will lead to a much longer, and more insightful, list of competitors.

Thinking complements is different way of thinking about business. It's about finding ways to make the pie bigger rather than fighting with competitors over a fixed pie. To benefit from this insight, think abut how to expand the pie by developing new complements or making existing complements more affordable.

A player is your complementor if customers value your product more when they have the other player's product than when they have your products alone.
A player is your competitor if customers value your product less when they have the other player's product than when they have your product alone.

The top half of the Value Net deals with customers, the bottom half deals with suppliers. And, just as with customers, there are two sides to the game with suppliers. Other players can complement or compete with one in attracting supplier's resources.

A player is your complementor if it's more attractive for a supplier to provide resources to you when it's also supplying the other player than when it's supplying you alone.
A player is your competitor if it's less attractive for a supplier to provide resources to you when it's also supplying the other player than when it's supplying you alone.

The problem of missing complements is multiplied a thousand times over in the case of a new economy. This is the situation in much of the third world and in many of the

former communist countries. There the fate of everything – not just the company or industry but often the whole country-depends on complements. One industry will need complimentary industries so it can get going, but those complimentary industries will need the first industry so they can get going. It's a chicken-and-egg situation everywhere one looks. Everything has to happen all together, or nothing might happen at all. That's why some developing economies take off while others stall.

It's easy to focus on only one part of one's business, and miss others. The Value Net is designed to counter this bias. It depicts all four types of players one interacts with, and it emphasizes the symmetries between them-the symmetries between customers and suppliers, and between competitors and complementors.

ADDED VALUE

Added value measures what each player brings to the game. For example take the size of the pie when one and everyone else are in the game; then see how big a pie the other players can create without one. The difference is in one's added value. Thus added value measures what each player contribute to the game by joining it .It determines who has power in a game and who will get the biggest pay-offs.

In a competitive world, it is very hard to sustain and maintain added value. Companies find ways to make a better product and looks at using resources more efficiently. . Listen to customers to make products more attractive to them. Work with one's suppliers to discover ways to run the business more efficiently for one and more

effectively for them. One way to engineer added value is to make intelligent trade-offs. To find these trade-offs one have to depart from the business as usual and challenge the old, comfortable assumptions about how to operate. One such trade-off could be cost and quality.

Another way to increase added value is through trade-on. Example will be quality revolution where people improved the manufacturing process achieving cost savings as well as higher quality. Establishing a virtuous cycle is another route to creating trade-on. If a company has little competition, its added value is assured and then the strategic issue is how to limit the added value of other players in the game. Competitors are working to similar trade-on and trade-offs. This dynamic can erode one's added value. To protect one's added value organizations need to create relationships with suppliers and customers. As they provide a boost to the added value.

RULES

'When the rules of the game prove unsuitable for victory, the gentleman of England change the rules' - Harold Laski

Rules structure the way game is played .In business there is no universal set of rules; they can come from customs, contracts or law. A single clause can tilt the balance of power heavily towards or against one. There is no mechanism or algorithm for generating rules. One approach is to find a rule that works in one context and consider whether it will work on a different one. The value net suggests that for every rule towards customers, there's a symmetric counterpart with respect to suppliers. A rule used with one's customers can be put in place with suppliers.

Government has the power to make many rules of the game. The government makes tax laws, patent laws, minimum wage laws etc. These laws govern transactions among all the players in the economy. In addition to more direct regulation, the government makes the rules that say what rules other players can make. These could be termed as meta-rules. Even when a rule seems firmly established, a company always needs to remember it might get renegotiated. If one cannot control a rule, it's risky to base strategy on it. The most important rules are the ones usually taken for granted.

TACTICS

Any situation is greatly affected by how people perceive the situation. These differing perceptions are not just subtle influence on the way a business condition is handled. These are an integral part of the situation itself. Equally important are perceptions of perceptions of perceptions. By altering player's perceptions, one can alter the moves people make. The devices used to shape perceptions are called Tactics.

The job of managing and shaping competitor perceptions is an essential part of business strategy. Perceptions play a central role in any negotiations and most business agreements. Everything one does and everything one does not do sends a signal. These signals shape people's perception of the game. And what people collectively perceive to be the game. Organizations need to take account of perceptions to really know what game they are in and to be in control of how they change it.

SCOPE

Scope is defined as the boundaries or limits people implicitly impose on a situation when they define it. Although people often analyze situations in isolation, each situation could be invariably linked to others. There could be a larger game. The problem is that mental boundaries are not real boundaries. Every game is linked to other games, a game in one place affects games elsewhere and a game today can affect the game tomorrow

Understanding and changing the links between games is the final lever of strategy. Since PART describes the whole game, it also describes how the pieces fit together. Hence PART also classifies the links between games.

Anytime there is a player in one game who is also a player in another game, the two situations are linked. This can be an enterprise, a part family, a customer or a supplier; creating an overlapping value net. Links through added value can arise whenever one's customers or suppliers participate in more than one market. One may be increasing each other's added value or decrease it if one starts competing rather than complementing.

Rules impose constraints on what players can do, and these constraints can link what otherwise be separate games. Finally the two games can be linked because the people involved perceive it to be. Thus tactics by changing perceptions can change then links between games. Though it's too complicated to think of everything as being part of one large game, their should be strategies for linking games that other wise naturally be linked or for severing links between games that otherwise naturally be.

3.3 Enterprise Architecting

EA is a holistic, systems-level approach to analyzing, understanding, and improving the interaction and design of complex groups of stakeholders. At its core, EA is a framework that allows individuals or teams to distill these complex relationships into smaller, more manageable analyses without losing the opportunity for system-level benefits. EA has been successfully applied to a number of complex existing enterprises ranging, from academic programs to defense contracting organizations. However, it has not yet been applied to an acquisition process where the goal is to analyze two distinct organizations that are combining into one.

It is helpful to break the term Enterprise Architecting apart to understand each of its' components separately. Enterprise is best defined as "complex, highly integrated systems comprised of processes, organizations, information and supporting technologies" (Nightingale and Rhodes, 2004). The concept of examining companies as enterprises is not new and has been studied extensively by management and social scientists. Architecture, as applied to complex systems, can best be defined as "the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and principles guiding its design and evolution" (IEEE P1471). Combining these two concepts together creates a powerful ideology that can assist enterprise leaders in the thoughtful design and execution of their mission.

3.3.1 The EA Process

An EA is created through a series of analyses. They are:

1. Enterprise Boundary Definition
2. Strategic Drivers and Objectives
3. Stakeholder Analysis
4. Current State Enterprise Architecture
5. Future Vision
6. Creation of Multiple Potential Future State EAs
7. Down-select Process for Future State EAs
8. Final Future State Architecture

EA Framework

It is important to stress that enterprises can't be dissected and analyzed in parts. It is within the interaction of each of these pieces that system level synergies can be found. A framework for how these views fit with each other is included as Figure 12 (Nightingale and Rhodes).

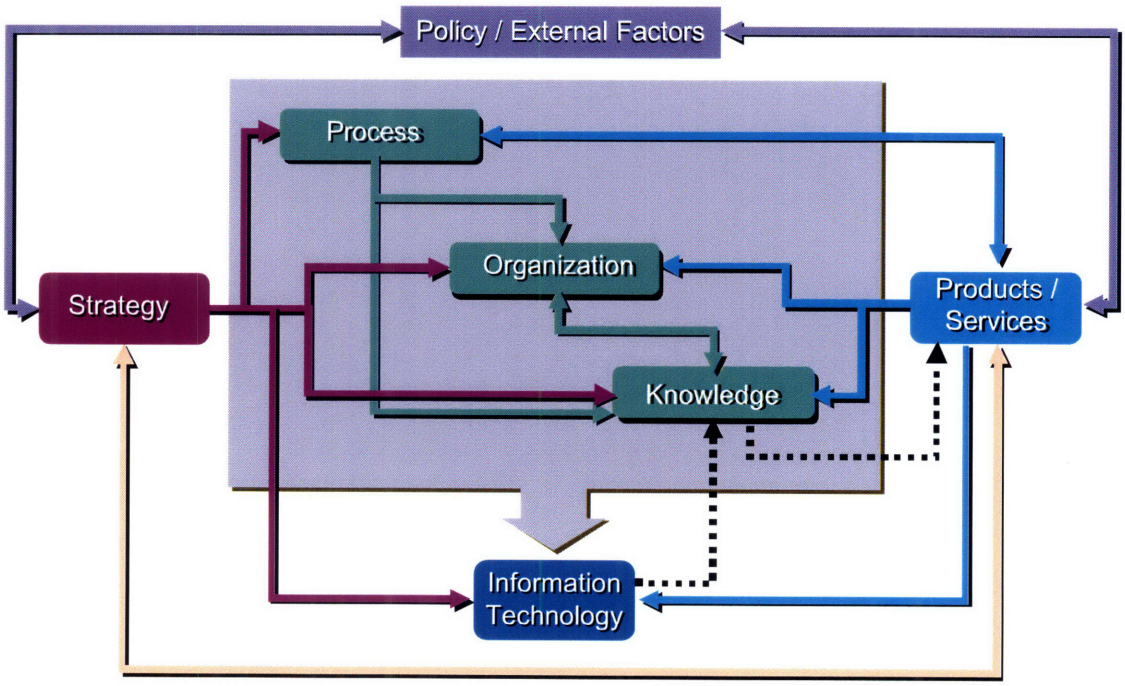


Figure 12: Enterprise Architecting Framework (Nightingale and Rhodes)

Customization of EA

For many elements of EA, there are multiple analysis frameworks and techniques that can be used to document and describe the relevant information. This thesis captures the author's preferred methods, but they are not intended to dictate a preferred analysis framework. The value of EA lies primarily in that each portion is analyzed, documented, and integrated with all of the other sections. If a particular EA participant has a favorite method for analyzing and describing a particular EA element, that method should be used.

3.4 Additional Tools

3.4.1 Robert's Familiarity Matrix

Roberts Familiarity Matrix helps one to look at a new venture and analyze it based on one's existing capability to find out what should be the strategy. Author intends to apply this in this study as a framework that can help one to look at the type of alliance (or not), a company should use when it selects to establish a value chain in an emerging market.

According to the framework, if the businesses in which company presently competes are its base businesses, then the markets factors associated with the new business may be characterized as base, new familiar or new unfamiliar. Here markets factors are the appropriate pattern of doing business that may lead to competitive advantage. Technologies could be characterized similarly.

Companies have historically approached new business in two ways internal development or acquisition. When an organization gets into a new low cost market for both operations and sales reasons whether a pure supply chain model should be used or an organization can use a mixed approach. There could be several reasons why an organization could use a hybrid model depending upon how the component/system in consideration is in the product architecture and capacity point of view and how fast one needs to get traction with the new partners. Joint Ventures in some cases provide a fast entry into a market-place but also provide increased corporate familiarity over time.

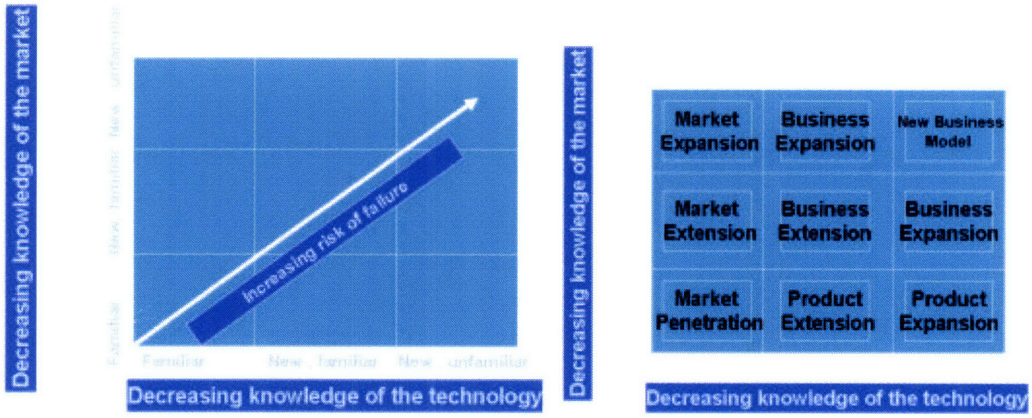


Figure 13: Robert's Familiarity Matrix (Roberts -14)

3.4.2 Double Helix

This is very useful framework for analyzing product architecture as dictated by market condition and evolution of the industry. With time each product/ organization moves from one side of helix to the other. One side represents the integrated architectures, while the other side represents modular.

The diagram also shows that once one reaches maturity in an integrated architecture it automatically creates an opportunity for a modular architecture and vice versa. In aerospace the timing of these events takes a very long time probably several decades due to the clock-speed of the industry.

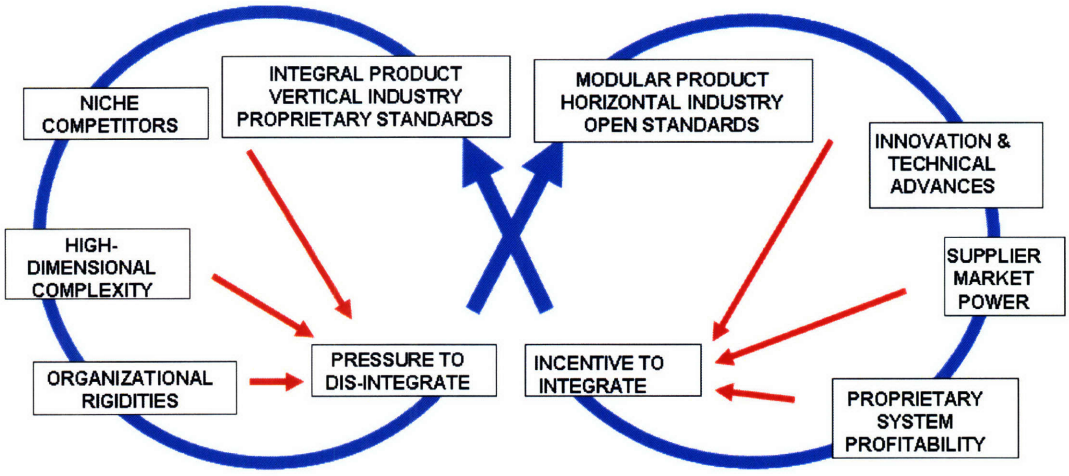


Figure 14: Product Architecture mapped to a Double helix (Fine –Clockspeed)

When the industry structure is vertical and product architecture is integral the forces of disintegration push towards a horizontal and modular configuration. These forces include

- Relentless entry of niche competitors hoping to pick discrete industry segments.
- The challenge of keeping ahead of the competition across the many dimensions of technology and markets required by an integral system
- The bureaucratic and organizational rigidities that often settle upon large established companies.

On the other hand when an industry has a horizontal structure, another set of forces push toward more vertical integration and integral product architectures. These forces include:

- Technical advances in one sub-system can make that the scarce commodity in the chain, giving market power to the owner
- Market power in one sub-system encourages bundling with other sub-systems to increase control and add more value
- Market power in one sub-system encourages engineering integration with other sub-systems to develop proprietary integral solutions.

3.5 M&A overview and EA

Mergers and acquisitions appear to be "an important, if not dominant, strategy for twenty-first century organizations" (Hitt, Harrison & Ireland, 2001,) since they apparently offer opportunities of fast access to new resources, markets, and new knowledge, and present a possibility of investing disposable financial resources in promising industries and companies (Bower, 2001).

For firms that grow through acquisition, the proprietary acquisition process they follow is often considered a competitive advantage. An entire industry of consulting, legal, and banking firms has developed to assist firms in developing strong acquisition skills. While different firms may approach acquisition and integration evaluation slightly differently, all follow a relatively generic process flow, which is detailed below:

- *Target Acquisition:* A potential acquisition can be identified in a multitude of ways, ranging from an announcement of the intent to sell to the culmination of a

long courting process, during which an acquiring organization may work for years to entice the target to sell. A target will usually exhibit some quantifiable synergy in order to be considered fully.

- *Target Profile Creation:* More information on the target is generated by combing publicly available sources of information (annual reports, industry assessments, periodicals, target company data packages, etc.). Known synergies as well as target bid prices should be identified and developed.
- *Due Diligence:* Detailed information on the target company is gathered by a small team of specialists to verify previously gathered information and confirm/expand expected synergies and identification of risks. Target bid prices should be refined.
- *Negotiation:* Given the expected synergies and risks, negotiations between the two firms to reach a mutually agreeable outcome are conducted.
- *Integration:* The target company should be integrated into the acquiring company per the plan developed throughout the rest of the process.

It is the goal of this thesis to verify how EA can be applied to approach the acquisition/collaboration process in Emerging markets. This will be done by analyzing the complex organizations that exist in Emerging markets with EA and then evaluating the kind of alliances should the Aerospace organization seek. The figure below shows the outline of the existing business development in a typical aerospace organization

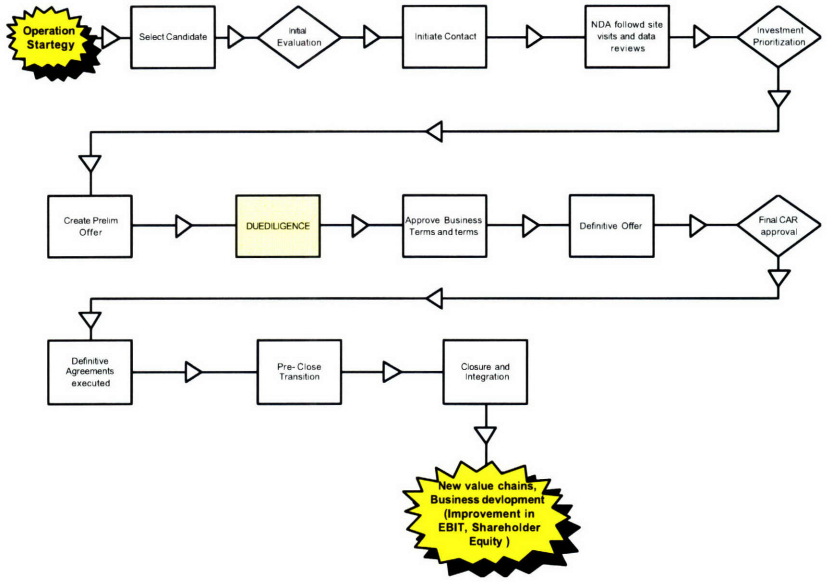


Figure 15: Example of Business Development Process

Using EA to evaluate two separate corporate entities that are looking to become one requires a certain amount of special consideration. Issues such as the timing of information availability from the target organization and the level to which reliable target information is available prior to the purchase can have an impact of the overall quality of the analysis.

Consideration for when data would be available to complete the EA led to the creation of Table 1 This highlights when various sections of the EA can be reliably created based on the information available. Given the restriction of data from the target organization, it is expected that several sections will need to be revisited after deal closing in order to reduce the risk inherent from false information. These elements are denoted with an "II" to indicate review and revision as required.

	Target Profile	Indication of Interest	Due Diligence	Purchase Decision	Integration
EA Process Implementation	Organization View	Enterprise Boundary Definition	Process View	Future Vision	Organization View II
	Product / Services View	Stakeholder Analysis	Information Technology View	Future State EAs	Future State EA II
	Strategic Drivers and Objectives		Strategy View	Down-select to Final Future State	Strategy View II
	External / Policy View		Knowledge Management View		Knowledge Management View II

Table 1 : EA Framework Creation Timeline

4 Framework

The framework suggested by the author for establishing value chains is divided into five stages

- First stage is the Assessment of Industry: Porter's analysis is used to assess the aerospace manufacturing industry.
- Second step is the Assessment of the existing Aerospace value chains and the product architecture. Aerospace being a slow clock-speed industry has a great deal of inertia for any change.

- The third phase is quantitative assessment of Emerging markets. Characterizing the markets based on all the factors (cost, competitors etc) that have led to growth in emerging markets. The internal competitive advantage of a market is also evaluated relative to Aerospace
- The fourth step is Selection of an Emerging market and mapping it to product. System Dynamics is used to create a qualitative model of the emerging Market. (This model may need to be configured for each individual market). This will help understand each market in light of the macroscopic trends. One can then see which emerging market has the best match to one's long term product strategy. Game theory with its parts framework is used as tool to access each product / component and allocate it to an emerging based on the knowledge base we have developed on each emerging market.
- The fifth stage is establishing the value chain and deciding whether an alliance is required or a straight out sourcing should be used. In case an alliance is seeked, Roberts Familiarity matrix can be used to get a perspective on type of alliance and then EA can be used to study the target organization. This will also help us to develop an understanding on the structure of the new organization.
- The last stage of the framework is to iterate thus improving the quality of recommendations and providing the ability to reflect back.

The reason for selecting different tools at each stage is driven by the amount of insight required in each stage. The use of product architecture and Porters analysis at the initial stage provides a much broader assessment of the industry. The system dynamics model of emerging markets is used to improve one's qualitative assessment and provides us

the ability to understand the trends and effects of multiple factors at a macroscopic level. The game theory homes in and relates the part family to characteristics of each market. It magnifies and provides some quantitative rigor to the framework. EA for business development is an excellent tool towards the end as it helps illustrate boundaries and different stakeholders together which would not have been possible to show with system dynamics or Game theory.

4.1 Industry Assessment

The stronger the global economy, the greater the likelihood that rising corporate and consumer discretionary income will lead to increases in air traffic. Industry observers forecast that the global economy will grow at moderately strong long-term rates. Global Insight, an economic research firm, projects that the world economy will see a CAGR of 3.2% from 2005 through2015, and Avitas projects that global passenger air traffic will increase at a 10-year CAGR of 6.0%. In addition, Avitas sees global air cargo traffic rising at a 10-year CAGR of 7.0%.

Aircraft manufacturing involves long lead times. According to Boeing, building a commercial jet aircraft takes about a year on average. Designing an aircraft takes about five years for a completely new model and about two years for a derivative of an existing model. Tooling costs typically comprise one-third to one-half of total development costs. Once the production line is up and running, the company must continue to spend heavily to maintain it. Production equipment, especially tooling equipment, wears out relatively quickly and must be replaced.

In terms of product technology Aerospace can be classified to have a clock speed of 10-20 years, with respect to process technology this is equal to 5-30 years and organization clock-speed is in the neighborhood of 20-30 years.

Aircraft	Development Costs*
Airbus	
A300	$4.3
A310	$2.0
A320	$2.5
A330/A340	$5.5
A380	$14.0
A350 XWB	$15.0
Boeing	
737-600/-700/-800	$1.0
747-400	$2.5
757 and 767	$2.5
777	$4.0
787	$10.0
Embraer	
E-170/190	$1.3

Source: Merrill Lynch, Forecast International
*$ in billions, then-year dollars

Table 2 : Development Cost of Major Aircrafts (Merrill Lynch-13)

The qualification and test requirements on each component make replacement a major challenge. The clock speed of airframe products and processes are much more directly influenced by investment rates and sales of aircrafts. Besides the long product cycles even the processes are long lasting, as are the supply chain relationships.

Porter's five forces—that determine the nature of competition in an industry provide an interesting assessment of Aerospace Industry. These competitive forces determine industry profitability because they influence the prices firms can charge, the costs they must bear, and investment required to compete in the industry (Porter 1990, 35). The following sections analyze each competitive factor separately in relation to the global aerospace industry.

Threat of New Entrants

Commercial aerospace has high barriers to entry due to the costs related to developing new products, government regulations and a unique customer base. The industry has become increasingly concentrated and underwent consolidation in the 1990s. Suppliers tend to have higher returns than aircraft primes.

Hence, the threat of entry to the commercial aerospace industry at the aircraft or engine manufacturer level is quite low. New airplanes and engines require extremely high investments accompanied with great risk and the inability to get a positive return on that investment for many years. A new 100-seat airplane would cost $3-4 billion to develop; whereas a new 300+seat airplane Boeing and Airbus are developing would require an investment of $10 billion or more. General Electric spent $3 billion to develop the GE90 engine for the Boeing 777. The aerospace industry's economies of scale, where global sales are required to recover the huge investments, deter entry to the industry by forcing the entrant to come in at a very large scale in order to succeed.

The threat of entry at the aircraft or engine manufacturer level is further reduced by several other factors. Aerospace manufacturing has a long learning or experience curve due to its complex assembly and testing operations and its high content of labor performing intricate tasks. Companies can only go down this learning curve after many years of large amounts of continuous investment in research and development. Companies may require government subsidies, either directly through grants-in-aid or indirectly through military contracts, to enter the industry. It is estimated that Airbus

received over $10 billion from European governments between 1970 and 1990 so it could get to the level today where the company can survive on its own. Now the worldwide aerospace industry has well-established firms with an abundance of resources to retaliate against any potential entrants. But lately a big change is emerging at the Airplane level for the regional jet market. Most Emerging markets countries drive by extensive growth in their economy want to develop their own aircrafts. Right now the focus is on the regional jet market which is supposed to expand extensively in these markets. Mitsubishi, the aerospace heavyweight announced the MRj-170 program. There are going to be much more competitors in this feld from Emerging markets. (Embraer and Bombardier own a big chunk of this market already) Boeing and Airbus both may be facing new competition when China begins manufacturing large commercial aircraft by 2020. The Chinese government succeeded in building its first commercial aircraft, a regional ARF-21 jet, which is due to begin service in 2008. Between 2007 and 2025, China is expected to buy 2,230 new planes, so the government is fast-tracking development of its own manufacturing facilities.

The barriers to entry are less for potential manufacturers of components or subsystems, but they are still quite high in comparison to many industries. During the past decade the aircraft and engine manufacturers have been drastically reducing the number of suppliers, which makes it even more difficult to enter the industry even as a manufacturer of components or subsystems. There are some key basic components like Castings where the prime suppliers are almost captive to their suppliers.

Threat of Substitute Products

Prime contractors (e.g., airframe manufacturers such as Boeing and engine manufacturers such as Pratt & Whitney) in the commercial aerospace industry face almost no threats of substitute products because of an airplane's uniqueness in speed and ability to travel over water. For short distances over land, airplanes may sometimes compete against automobiles and trains. The threat of substitute products exists at the part/component level in the aerospace industry. For example, new material technology can make obsolete the materials previously in common use in the construction of airplanes and engines.

Bargaining Power of Buyers

Airline companies often force cutthroat competition between the aircraft manufacturers, Boeing and Airbus, and the engine manufacturers, Pratt & Whitney, General Electric, and Rolls-Royce. Airlines ordering a large number of planes or even entire countries such as China, who combines orders from state-run airlines, can press for extraordinary concessions from the prime contractors. These orders are a relatively large percentage of the aerospace prime contractors' total sales, so buyers are in an advantageous position to demand price reductions. The switching costs for aircraft and engines are very low, which increases the buyers' power. Airline pilots and mechanics can quickly be trained on other planes and engines. The huge losses of most airlines in the early 1990s made them more desperate to reduce costs, which had a direct impact on the airplane and engine prices demanded by the airlines. Another interesting aspect here is the EBIT of each of the players in the value chain. The component/ system suppliers

who have managed to secure a niche due to the technical complexity or consolidation activity in the marketplace have the best EBIT and control a significant position in the entire supply chain

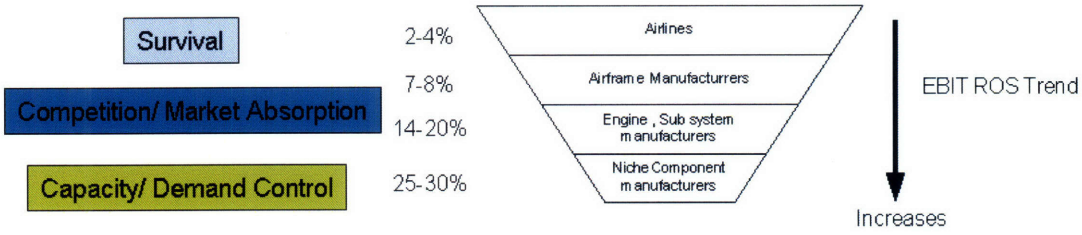


Figure 16: EBIT ROS TREND

Rivalry among Existing Competitors

Although the aerospace industry has only a limited number of prime contractors, competition is fierce for the reasons discussed in the above section on *'Bargaining Power of Buyers*'. Aerospace firms desperately seek to win large orders from airlines to try to recover their high fixed costs and their large investments required to develop new aircraft and engines. The industry's prime contractors are equally balanced and have very little differentiation in their product lines, which increases even more the intensity of the competition.

Bargaining Power of Suppliers

The bargaining power of aerospace suppliers is not that strong, but there are exceptions where a supplier may possess key technologies. In general, the prime contractors in the aerospace industry have several suppliers from which to choose. But this trend goes the other way when one goes to the bottom of the value chain like investment castings and

the existing supply base is significantly consolidated and they control the leverage. Because of how EBIT ROS of the industry is today (Figure 17), the players at the top of the value chain have the most cost pressures.

4.2 Assessment of Product family and existing value Chains

To be successful in leveraging globalization requires significant changes in how companies organized. This is most evident on the frontlines, where managers charged with leading such operations are struggling to cope with expanded responsibilities. Responsibilities need to be expanded from "just" managing local relationships, handling distribution, and qualify low-cost suppliers to have the capability of building markets quickly; creating flexible, fast, high-performing organizations that are well integrated into the company's global network; managing major facilities; developing a world-class local talent base; and making strategic decisions with far-reaching impacts.

Product Architecture

Product Architecture based analysis is the first step towards understanding the value chain of any product. It will also help to understand integrated / modular nature of its products. Building Supply chain architecture based on the product architecture is a much richer concept than the traditional make/buy or vertical integration, which focuses primarily on ownership of assets in the supply chain. This concept is also essential in extending the integral modular distinction from products to supply chain. An integral supply chain will strive for close proximity among its elements. Proximity is measured among four dimensions- Geographic(Electronics communications have drastically

reduced the need of this, but even then in some cases designs warrant this), Organizational(can be constructs of ownership, managerial control and interpersonal and inter-team dependencies), Cultural(Commonality of language, ethical standards and laws), Electronic(The virtual vicinity). A modular supply chain exhibits low proximity along most of the dimensions. Extremely low level of proximity in all of the dimensions would render a supply chain unmanageable in any kind of clock speed industry so some level of close proximity is absolutely required in one or more of the dimensions for survival.

Aerospace today is somewhere in the middle between integrated and modular architecture. The supply chain is at a different stage depending upon whether we talk about engines, frames or sub-systems. Electronic proximity can be a given in most cases even if we go to complete modular architecture in other dimensions and that is one of the reason organizations are able to go global rapidly. But to be successful in an arena like Aerospace which is currently unknown to the emerging markets thought must be given on how to create proximity in the other two dimensions(cultural or organizational) when one is building a value chain. In essence product and supply chain tend to be mutually reinforcing.

Product architecture should be then mapped to customers to understand whether the product family has overlap between components, across customers. This will also help to understand whether the current manufacturing process or source is dictated by the customer or not and whether a same type of component has different type of test requirements in different top level assemblies.

Analysis of the product architectures relative to its position on the double helix shows that the whole industry is at different stages. This is because when-ever a change happens in the specific stage of the supply chain there is delay for it to tickle down to the lower stage. Most of the industry can still be placed in the left portion of the helix with each stage of supply chain at a different step. Some of the metal casting manufacturers like Alcoa still have significant incentive to integrate and are probably towards the tale end of the cycle.

Value Chains

Elements in value chains should be thought of as capabilities, each of which can be nourished to grow. Every time an organization makes a sourcing decision, whether internal or external it is developing a capability that can grow into a power organization capability. A suppliers relationship with its customers helps determine whether the company will become more independent or more dependent with respect to the technology in question. In case of in bound sourcing, the decision strengthens internal capabilities. In case of outsourcing, the suppliers are encouraged to develop capabilities leading the customer to become dependent upon the supplier. This capability development is directly proportional to the clocks peed of the industry.

As aerospace is a slow clock speed industry it takes significant time for the production chain to get up to speed with the requirements of the industry. This is one of the other reasons why Aerospace is towards the tail end of manufacturing globalization.

It is very difficult to displace the existing supply base for what positions they have attained in the value chain.

Mapping of Value Chains

There are three levels of mapping that can be used to identify various pitfalls and opportunities in the value chain. The first level is mapping the organizational supply chain. This can be a huge task because of the large amount of entities in the chains of many organizations. For example in case of a System Manufacturer like Pratt and Whitney the chain may look as

Figure 17. Several of the downstream manufacturers are also part of other value chains and their may be several instances that PW may end up at the same copper mill through another value chain for a different component.

The second and third level are Mapping the technology supply chain and the business capability chain. Data for this typically will reside within the people who are involved with these functions within the organization.

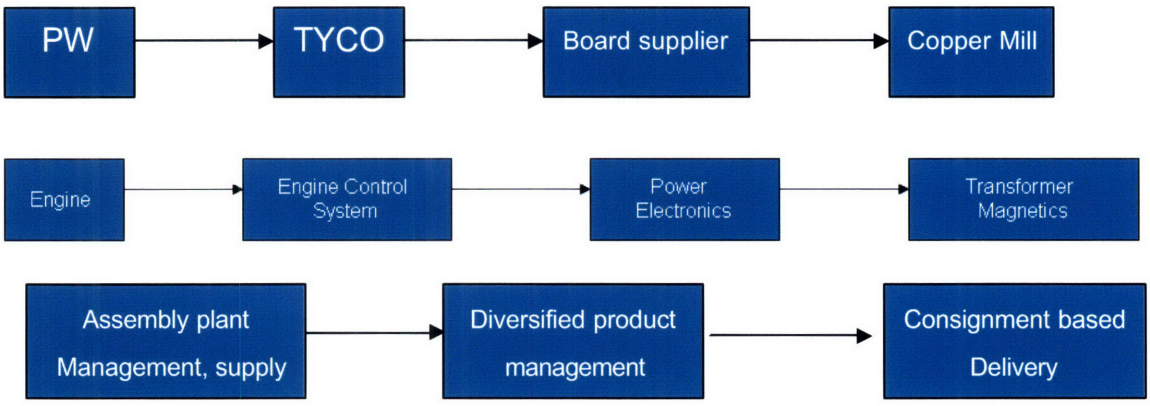


Figure 17: Organization, Technology and Business Capability Chain

Chain mapping affords a valuable tool for revealing risks and opportunities in the value chain. The organizational value chain map arrays the entire set of organizations – all the way from the uppermost supply tiers – that add value in the chain to the final customer. Most Aerospace companies will have significant organizations as part of their extended enterprise. Mapping all these will be a monumental task hence the most important need to be identified and explored. These will be the ones with clear strategic importance and fast clock-speeds since fast clock-speed domains are most likely to create dramatic industrial restructurings and also have a faster impact.

Drawing such a map and taking a product or process view of organization, one can begin by enumerating each of one's suppliers who provide raw materials or components that a company uses to provide its products and services. Next trace any connections that these suppliers may have with each other. Such an analysis is valuable for pin pointing possible future conflicts if suddenly supply of that Raw material is jeopardized or one is trying to figure out RM supply for a component that is planned to be resourced to an emerging market.

Next enumerate suppliers in the next tier. This can become extremely complex very fast as one goes further downstream. The essential value of the map lies not so much in the details of its intricate connections, but in the accuracy of predictions it allows one to make about the organization; how it is going to expand in the future and leverage emerging markets.

Illustrating and capturing the key technologies deployed in the company's value chain helps one to not only visualize the connections between technologies and one's company's capabilities, but also plan for alternatives in case the technology fails or is not available. Just like organization, technology value chain also will be very vast, therefore thought must go in identifying the high-leverage, high clock speed elements in the chain.

The most conceptually challenging is the business capability chain but it will help close the loop to make the most educated decision and develop a deep enough understanding. To map it will require people who have a deep understanding of one's organizations key processes need to be involved. The figures above just show three specific instances of different value chains. These can further help to understand the best operation strategy for the organization and relook at what is being sourced Vs made internally.

Also one can understand who is at the driving seat depending what is most valuable to one in the value chain and what will be the impact once one goes to a new source in an emerging market for a specific stage.

Example

Each part family could be plotted on a 2x2 matrix which identifies the present situation of sub-system/parts in terms of globalization and technical complexity helping one to prioritize and strategize the part families.

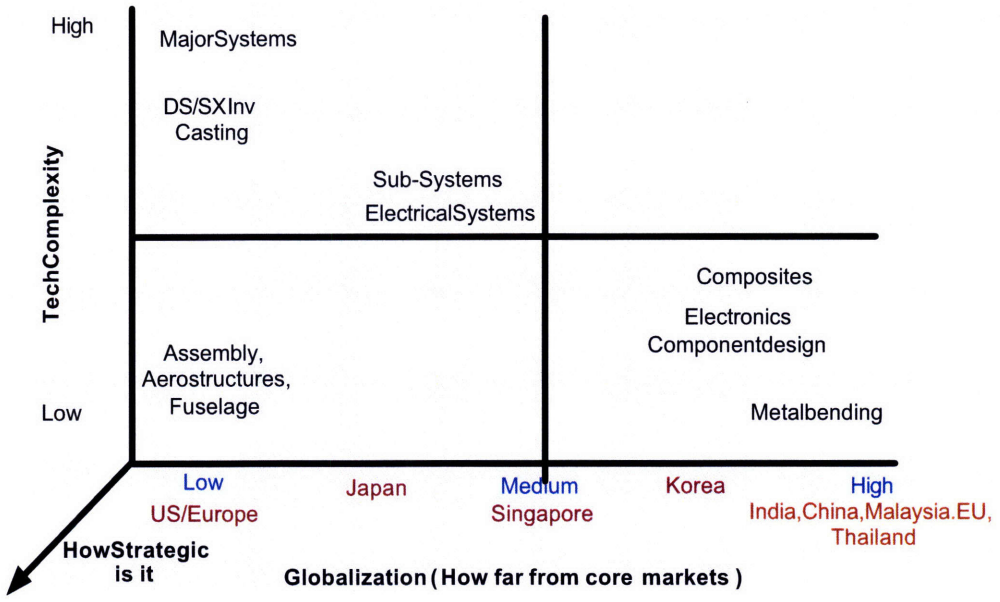


Figure 18 : Assessment of Some Aerospace Part Families

4.3 Assessment of Emerging markets

Today emerging markets have different charteristic than past

- Risk has decreased : market volatility is lower , economic policies are sounder and companies are not only more competitive and better managed but in a much better financial shape
- Companies are no longer second rate but are becoming word class. The leading emerging market companies are often as global and competitive as their developed country counterparts and many have return on equity, operating margins and debt to equity ratio in line with their counterparts.

- Change in Macroeconomic discipline: Improved economic policies, vastly increased forex reserves and healthier corporate balance sheets have made the companies less crisis prone. Moreover creditor to debtor role reversal has happened.
- Better corporate governance: Disclosure of information by individual companies in emerging markets is still inferior compared to Western standards but is improving very fast.

Relative to Emerging markets Aerospace could be considered most developed in Russia. In Russia, large aerospace companies like Oboronprom and the United Aircraft Building Corporation (encompassing Mikoyan, Sukhoi, Ilyushin, Tupolev, Yakovlev, and Irkut which includes Beriev) are among the major global players in this industry. Due the closed Russian economy most of these players are just focused on the Russian Aerospace.

In People's Republic of China, Beijing, Xian, Chengdu, Shanghai, Shenyang and Nanchang are major research and manufacture centers of aerospace industry. China has developed extensive capability to design, test and produce military aircraft, missiles and space vehicles. Just recently China just launched its first indigenous civil regional jet.
In India, Bangalore is a major centre of aerospace industry, being the place where Hindustan Aeronautics Limited, the National Aerospace Laboratories and Indian Space Research Organization are headquartered. In Brazil Aerospace industry is mostly focused around Embraer.

How to determine Competitive advantage?

Porter identifies four determinants of national competitive advantage: factor conditions; demand conditions; related and supporting industries; and firm strategy, structure, and rivalry.

Nations are most likely to succeed in those industries where the determinants as a system are favorable. Within an industry, a nation's circumstances favor competing in particular segments and with certain competitive strategies. A company's home nation shapes where and how it is likely to succeed in global competition (Porter 1990, 72, 598, 599).

Factor Conditions

Although aerospace companies compete on a global basis, they almost always carry out production in their home countries and export their product, which makes domestic factor conditions very significant. Factor conditions relate to the factors of production such as human resources, capital resources, physical resources, knowledge resources, and infrastructure. This is changing very fast because major companies are establishing operations in Emerging Markets (EADS is establishing an assembly line in China and PW establishing a engine assembly plant)

Offset (In order to win a contract from a foreign country, the contractor typically must build a portion of the system in the buyer's country) which involve transferring jobs or skills to build the systems or facilitating agreements to help the country export its goods are increasingly becoming common as customers move to these markets . This is

forcing major developed manufacturers to take initiative in developing local aerospace capabilities both themselves and requesting their first tiers to the same.

Demand Conditions

Porter's discussion of demand conditions focuses on home country demand conditions for the industry product (Porter 1990, 86-100), and he argues that effectively competing in home country markets builds international competitiveness for firms in the industry. Not only is the nature of domestic demand important, the size of the market is critical to national competitive advantage for industries, such as aerospace, that have significant economies of scale and learning curves.

- US remained the largest aerospace manufacturing market in 2006 by registering a growth of 8% and this is expected to continue in 2007 also when it is expected to grow by 5.98%.
- Asia-Pacific is anticipated to dominate the growth of global aerospace industry largely due to emerging economies such as India and China. The growing economic impact of these countries will result in increased demand in air traffic.
- Low cost economies such as china and India will the major driving factor for global aerospace industry from this it can be realize demand for low cost products will be increase rapidly due to this role of aerospace industry player is shifting to tailor-made products.
- The demand for aerospace industry varies from country to country. For e.g., it is expected that in Brazil, helicopter demand will outperform the demand for other products due to increasing use of helicopters in agriculture and corporate

executive purpose, whereas in China and India, will be dominated by airlines demand with rapid growth in civil air traffic.

Related and Supporting Industries

This determinant of national advantage relates to the presence in a country of supplier industries or related industries that are internationally competitive..

This is where Russia has a significant lead over the other countries as Russia had a very mature Aerospace industry during the cold war. Most of the infrastructure relative to this is in bad shape today but it is not non-existent.

Firm Strategy, Structure, and Rivalry

This fourth determinant of national competitive advantage relates to how firms are created, organized, and managed as well as the nature of domestic rivalry. This intense domestic competition creates pressure to improve and innovate in ways that will create and sustain competitive advantage, both at home and in international markets. (1990, 411-415). An intense level of domestic competition is notably lacking in all the emerging markets.

Role of Government

Porter considers government's role in national competitive advantage is in influencing the four determinants previously discussed, rather than government being the fifth determinant of national competitive advantage.

China has several initiatives in place to facilitate the development of domestic aerospace industry (AVIC1 and AVIC2). Indian government established the network of public companies to develop the aerospace sector but is not aggressively pushing it ahead by giving it the necessary financial support. Russia government is spending limited resources to resurrect its old infrastructure. The government in Brazil is not driving any initiatives so far.

Appendix A provides several key questions which when answered for each Emerging market will help build a detailed quantitative assessment of each market. Another aspect is the political and regulatory environments in emerging markets which are often in flux. In 2005, more than 3,000 new laws were promulgated at national and provincial levels in China. Changes can occur even more frequently at local levels. In many countries, there is vigorous debate on the level of state participation in commerce, the appropriate level of foreign investment, and the need to preserve and expand employment. Governments and quasi governmental organizations can promulgate technology and other standards that can effectively constitute non-tariff barriers to trade. Manufacturers have to monitor these changing environments and to join with other companies to advocate for open standards and fewer barriers to competition.

Currency and other market risks that can reduce the purchasing power of buyers are another concern, and these are often affected by government policies. For example, a number of analysts expect the yuan to appreciate against the U.S. dollar, and India is beginning to consider the full convertibility of the rupee. These changes could significantly affect the costs and profitability of operations in China and India.

4.4 Selection of an Emerging market

The selection of an Emerging markets for an assembly or a component is defined as a two phased step. In the previous section a generic analysis was stated to evaluate the emerging markets in terms of cost, competitors, product differentiation and competitive advantage. Emerging markets are very immature in terms of aerospace manufacturing but lots of things are in the favor for the future. Aerospace companies should look at Emerging markets both as an urgent threat and huge opportunity, and the clock is ticking. The critical task is to understand exactly how business will be affected over the next several years, so that one can be positioned to capture global advantage. Companies need to ensure that they are organized to address the opportunities and threats arising each aspect of emerging markets as well as from the interdependencies among them.

The first step is to develop a system dynamics model to develop a qualitative assessment of each emerging markets. The second step is the correlation of this qualitative assessment to each component/ part family/ sub-system under consideration using principle of Co-opetition and Game theory

4.4.1 Phase 1: System Dynamics Model

In the first phase of selection of an emerging market a system dynamics model is created which has tunables so that the model has the ability to be customized to each emerging markets. (Only the BRIC countries are considered in this study).

The base Model has one flow defined – **Cost Reduction and Globalization**: It is authors understanding that this is the only positive inflow in the model. This feeds into the Stock which is defined as **Campaigns in Emerging Markets.** The stock is used to represent the accumulation with the positive flow. An initial value of 25% is assumed for cost reduction capturing the minimum cost advantage an emerging market offers.

There are two independent variables that drive the flow for **Cost reduction and Globalization.** These are **cost pressure**s from **existing contract** and **new contracts** in emerging markets which are driving one to move closer to the customer. The **New contracts in Emerging markets** also lead to the creation of **Job offsets in Emerging markets**. This is also positively impacted by the Stock **Campaigns in Emerging Markets**. This stock also directly impacts **Sourcing of Non core capability** variable. This is also positively influenced by the variable **job offsets**. Sourcing of Non Core capability is also positively impacted by the **supplier capability.** Considering there is a handful of suppliers available this sourcing will be negatively impacted by **competition for capacity.**

Increase in **sourcing of Non Core capability** will Increase the **Aerospace capability** of the supplier which will lead to the increase in **Complexity upgrade** at a supplier. This will further increase the **supplier capability** (as defined initially) and the **competition for capacity.** In case there are not enough IP laws in place increase of sourcing will negatively impact the **Cost reduction and Globalization.** Figure below shows the relationships in the model so far.

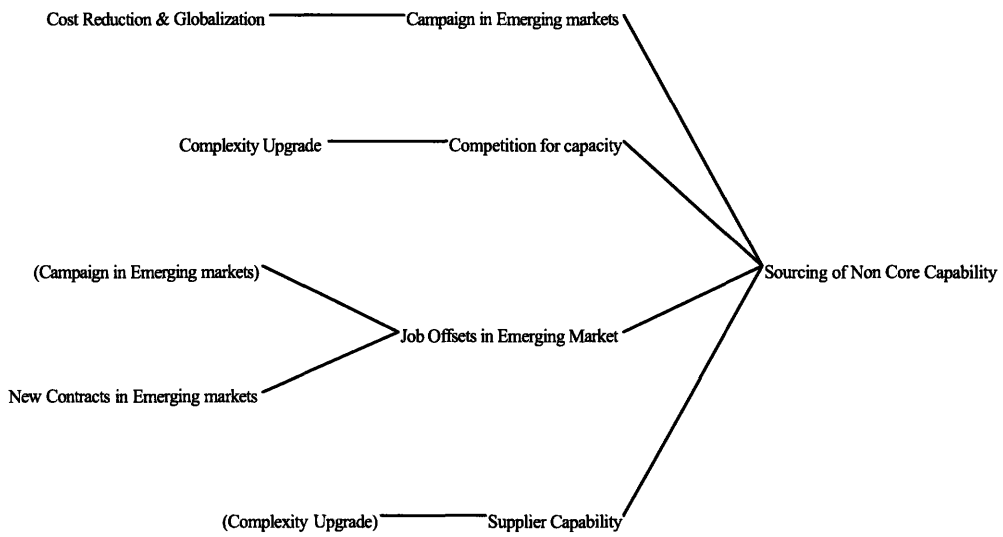


Figure 19: Reasons for Sourcing of Non Core Capability

The **Increase in Aerospace capability** in a supplier will increase the speed of **creation of Center of Excellence (COE)** but this will also increase **attrition** negatively impacting **the creation of COE. Creation of COE** will help the organization to **become native** in the area and further increasing **cost reduction and globalization** initiative in a re-iterating loop. The loop below is the primary loop (*cost savings*) which shows how emerging markets can continuously generate cost savings.

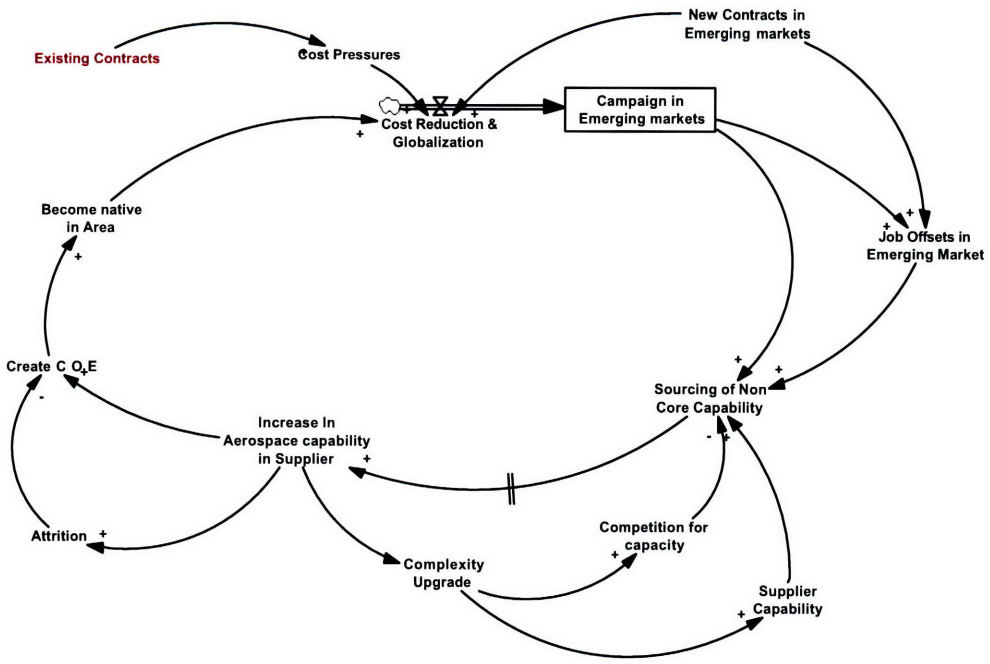


Figure 20: Initial System Dynamics Loop

Complementing this main loop is the *supplier capability* improvement loop. The three balancing loops are the *attrition* loop, IP loop and the *competition* loop.

There are two additional changes that were made to this main loop. The **increase in aerospace capability** in a supplier can immediately impact **cost reduction** increasing it. In addition it will also positively increase **cost due to market maturity**. This **cost increase due to market maturity** will negatively impact the **cost reduction and globalization** initiative.

The tunables defined for the initial model are

- *Forex changes*: This is defined as average rate of change of forex rates per year. This will affect the model by increasing the transfer cost (Speeding the increasing in cost due to market maturity)

- *Average Time*: This factor introduces a delay by which the improvement in supplier capability will impact the increase in cost due to market maturity.

- *Delayed*: This factor delays the affect of sourcing of non-core capability to the increase in Aerospace capability in a supplier

- *Availability of Technical resources:* This variable is a measure of technical resource availability in each market (configurable from 0 to 1)

- *Upgrade Delay:* This tunable delays the affect of increase in Aerospace capability on the complexity upgrade variable.

-*Process Improvement*: This tunable is defined as a constant and affects the creation of COE with time

- *Table for Manufacturability:* This tunable convert's supplier capability and competition for capacity into sourcing of non core capability per a predefined proportional relatio nship which could be different for each emerging market

- *Initial Supplier capability:* This tunable is the initial value of the supplier capability and could be higher for markets which are more mature

-*Infrastructure and Supporting Industry*: This tunable is an indicator of the supporting industry in each emerging market required for aerospace manufacturing and affects the supplier capability

- *Political Stability:* This tunable is an indicator of the political stability in each emerging market. Higher the value of parameter more favorable it is for globalization.

- *IP:* This tunable represent the Intellectual property security for each market. The lower the value, more laws are in place to protect the Intellectual property.

-*Table of Nativity:* Plots the COE into nativity for a company

-*Existing contracts*: This is the relative number of contracts available for an emerging market

The modified model is displayed in the figure below and all the loops are labeled

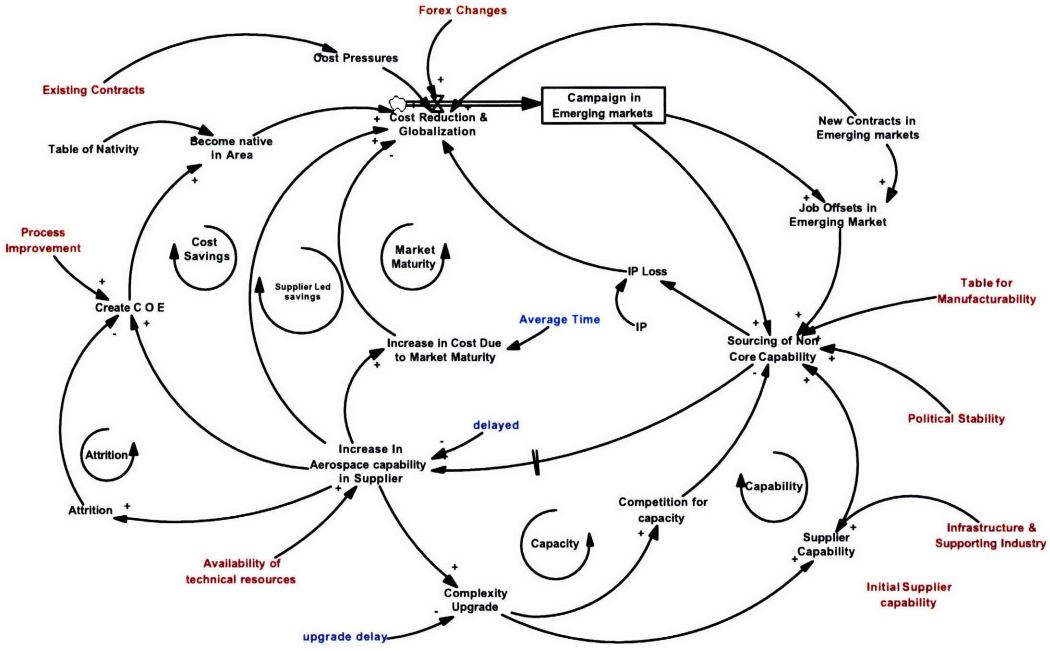


Figure 21: System Dynamics Model

All the relationships leading to cost reduction and globalization are shown below.

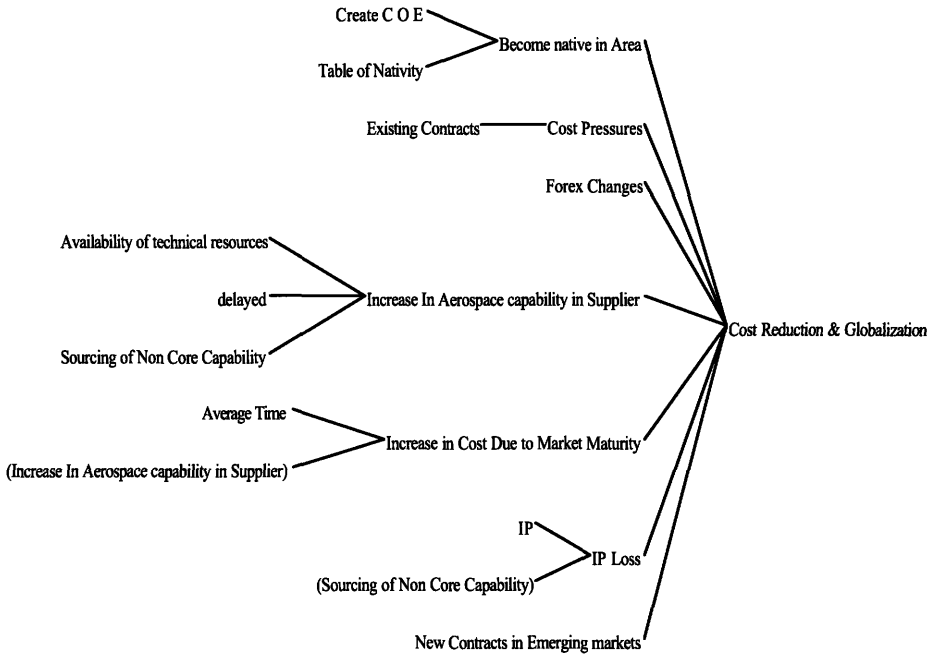


Figure 22: Factors Leading to Cost reduction & Globalization

The following facts can be used to come up with tunables which relate to delays and manufacturability for each of the emerging Markets.

1. Business Conditions: Doing Business a subsidiary of World Bank publishes this rating that stacks different markets on base of ease of doing business. Economies are

ranked on their ease of doing business, from 1 – 178, with first place being the best. A high ranking on the ease of doing business index means the regulatory environment is conducive to the operation of business. This index averages the country's percentile rankings on 10 topics, made up of a variety of indicators, giving equal weight to each topic.

Economy	Ease of Doing Business Rank	Starting a Business	Dealing with Licenses	Employing Workers	Registering Property	Getting Credit	Protecting Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Closing a Business
Australia	9	1	52	8	27	3	51	41	34	11	14
Belgium	19	19	37	36	161	48	12	65	48	22	9
Brazil	122	122	107	119	110	84	64	137	93	106	131
Canada	7	2	26	19	28	7	5	25	39	43	4
China	83	135	175	86	29	84	83	168	42	20	57
France	31	12	17	144	159	36	64	82	25	14	32
Hong Kong, China	4	13	60	23	58	2	3	3	3	1	15
India	120	111	134	85	112	36	33	165	79	177	137
Italy	53	65	78	56	49	68	51	122	62	155	25
Japan	12	44	32	17	48	13	12	105	18	21	1
Malaysia	24	74	105	43	67	3	4	56	21	63	54
Mexico	44	75	21	134	71	48	33	135	76	83	23
Netherlands	21	41	84	92	22	13	98	36	14	36	8
New Zealand	2	3	2	13	1	3	1	9	16	13	16
Russia	106	50	177	101	45	84	83	130	155	19	80
Singapore	1	9	5	1	13	7	2	2	1	4	2
Switzerland	16	35	29	20	12	26	158	15	37	25	33
Taiwan, China	50	103	128	148	24	48	64	91	29	92	13
United Kingdom	6	6	54	21	19	1	9	12	27	24	10
United States	3	4	24	1	10	7	5	76	15	8	18

Figure 23: Ease of Doing Business Index (World Bank)

2. Forex: The following data shows the changes in forex from last year. This can be used to come up with a value for forex tunable for each specific market.

Foreign Exchange Market Data in USD			
Countries	**Currency**	**Dec-07**	**2006**
Argentina	Peso	3.142	3.0698
Brazil	Real	1.772	2.134
Chile	Peso	499.7	534.25
Colombia	Peso	2014	2239
Mexico	Peso	10.829	10.849
Peru	Sol	2.975	3.195
Venezuela	Bolivar	2144.6	2144.6
Hong Kong	Dollar	7.798	7.774
China	Renminbi/Yuan	7.370	7.8065
India	Rupee	39.34	44.26
Indonesia	Rupiah	9328	8985
Malaysia	Ringgit	3.312	3.527
Pakistan	Rupee	61.15	60.87
Philippines	Peso	41.11	48.99
South Korea	Won	930	930
Taiwan	New Taiwan Dollar	32.37	32.52
Thailand	Baht	33.59	36.1
Morocco	Dirham	7.76	8.47
Czech Rep.	Koruna	17.98	20.84
Hungary	Forint	172.9	191.5
Poland	Zloty	2.462	2.911
Russia	Rouble	24.52	26.3351
Turkey	Lira	1.175	1.409
Slovakia	Koruna	22.841	26.207
Egypt	Pound	5.502	5.705
Israel	Shekel	3.965	4.211
South Africa	Rand	6.770	6.990

Table 3: Foreign Exchange variation :(Business Monitor)

Example:

A test case for Indian market was run to analyze the model to determine the sensitivity of cost reduction and globalization to factors like forex exchange. The units on the y-axis are just for reference and only indicate relative percentage differences. The following values for the tunables was assumed

-*Forex changes*: 5% a year looking at the past trends and GDP growth proposed for India

- *Average Time*: 3

- *Delayed*: Considering the average lead time in Aerospace is high a value of 1.5 was chosen

- *Availability of Technical resources:* .5(Medium availability of technical resources)

- *Upgrade Delay:* 2

-*Process Improvement*: 10% a year

- *Table for Manufacturability:* A logarithmic curve fit was chosen

- *Initial Supplier capability:* 10% of US supplier capability

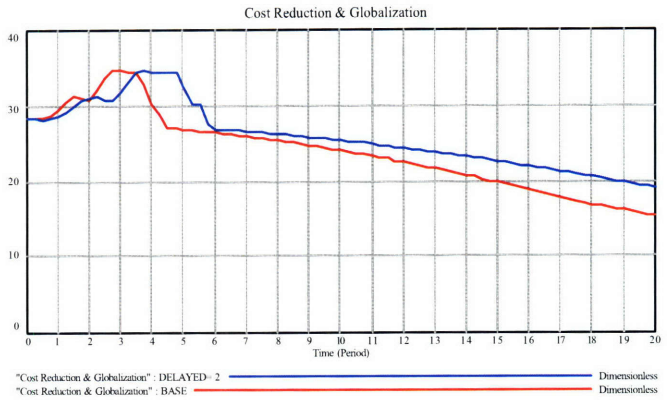
-*Infrastructure and Supporting Industry*: 15% of the capability in US

- *Political Stability:* .8

- *IP:* The initial value of .1 was assumed meaning there is sufficient protection in place but is not perfect.

- *Table of Nativity: an exponential curve with an initial value*

The curve below shows cost reduction and globalization for the Base values and for value of delayed to be 2 years. The cost reduction is achieved sooner for shorter delay but also falls more as market gets mature faster and cost increase is higher.



The following figure shows sourcing of non core capability when the political stability falls to 50%

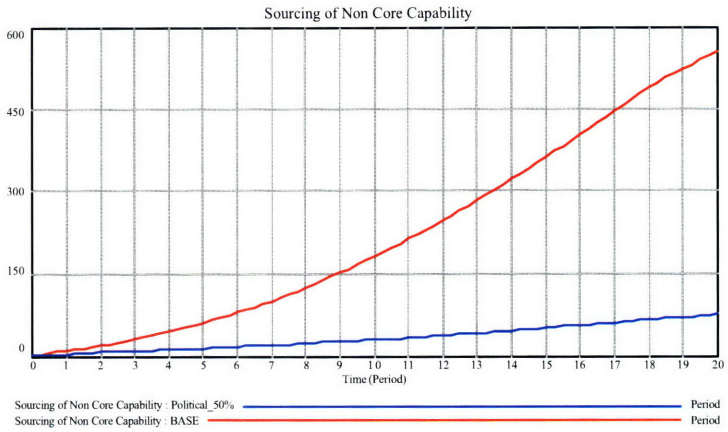


Figure 24: Sourcing of Non Core Capability VS Political Stability

Figure below shoes the impact on the globalization goals when Forex changes from 5% to 10%

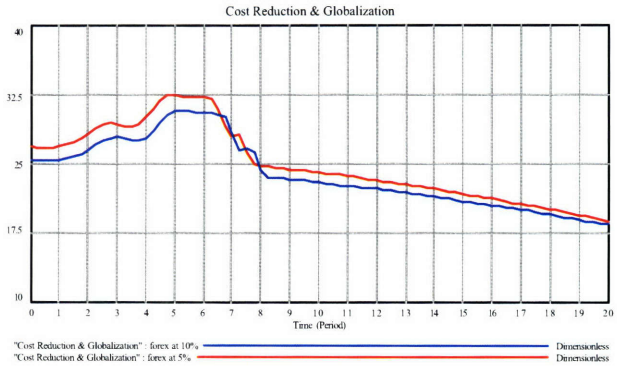


Figure 25 : Impact of Forex Variation

4.4.2 Phase 2: Correlation with Co-opetition

The system dynamics model in phase 1 will provide the trend on each Emerging Market. The table in Appendix A outlines reasons for strategic prioritization of an emerging market.

The tool synthesized for co-relation has different elements. The first component is the part family to be considered for the Emerging Market. The part family is selected based on the study of product architecture and dependency matrix. The Markets section of the tool is to put ratings specific to each market for Game theory's PARTS framework. For the scope of this study only five Markets are considered. The first four are the BRIC countries as defined earlier; the fifth is others (to cover the rest).

On the Game theory side, all markets are rated for PARTS for each part family being considered. One can give a 0-5 rating to each market per a specific criterion or simply use text and highlight top three Markets for each of the elements of game theory.

The main building block of Game theory is the PARTS based structure. Questions have been defined for each element and the answers to these relative to each part family in each market can help one to come up with ratings. The market that has the best answer for an emerging market should be the preferred market.

P as defined earlier stands for Players. Players are the value net: Customers, suppliers, competitors and complementors. It also includes the company itself.

- Draw a Value Net for the organization, taking care to make the list of players as complete as possible?
- Look at the opportunities for cooperation and competition in one's relationships with customers and suppliers, competitors and complementors?
- Is their a possibility to change the acts of players? In particular, what new players could be brought into the game?
- Who gains if one becomes a player in a game? Who stands to lose?

A as defined earlier stands for Added value. One can have added value when more synergies are created in other areas by creating an alliance in a specific area. The other side of this equation is when by entering another game one ends up competing rather than complementing oneself.

- What is one's added value?
- How added value can be increased? Is there an opportunity to create loyal customers and suppliers?
- What are the added values of the other players in the game? Is it in one's interest to limit their added values?

R stands for rules. Rules impose constraints on what players can do and these constraints can link what otherwise be separate games.

- Which are favorable rules which are not favorable?

- What new rules would one like to have? In particular, what contracts does one want to write with one's customers and suppliers?
- Does one have the power to make these rules? Does someone else have the power to overturn them?

T stands for tactics. By changing perceptions, links between two games can be changed-This is tactics.

- How do other players perceive the game? How do these perceptions affect the play of the game?
- Which perceptions would one like to preserve? Which perceptions would one like to change?
- Does one want the game to be transparent or opaque?

S stands for scope. Scope defines the boundaries that one needs to operate under. A company needs to understand whether an Emerging markets provides an opportunity to widen the scope.

- What is the current scope of the game? Does one want to change it?
- Does one want to link the current game to other games?
- Does one want to delink the current game from other games?

The table below captures the template for application of game theory

PART FAMILY	MARKETS	Game Theory Analysis				
		P *PLAYERS*	A *Added Value*	R *Rules*	T *Tactics*	S *Scope*
	B					
	R					
	I					
	C					
	O					

Table 4 : Game Theory Based Template

Example:

Game Theory as a framework is used to analyze Composites as a part family. Metal is a big constituent of commercial aircrafts and lately there has been a continuous increase in use of composites. Composites are about 20% lighter than aluminum alloys and composite structures also typically have superior fatigue and corrosion resistance compared to most metals. The main barrier to increased composite use is their cost. Composite structures require more complex manufacturing processes than similar metal

components and are more expensive to repair. They also exhibit non-uniform structural properties and require more advanced non-destructive evaluation techniques for quality control and maintenance.

This is being looked at from a perspective a major aerospace system supplier who has significant spend in Composites but has historically outsourced the product and is both technically and capacity dependent on the suppliers.

The value net looks as follows.

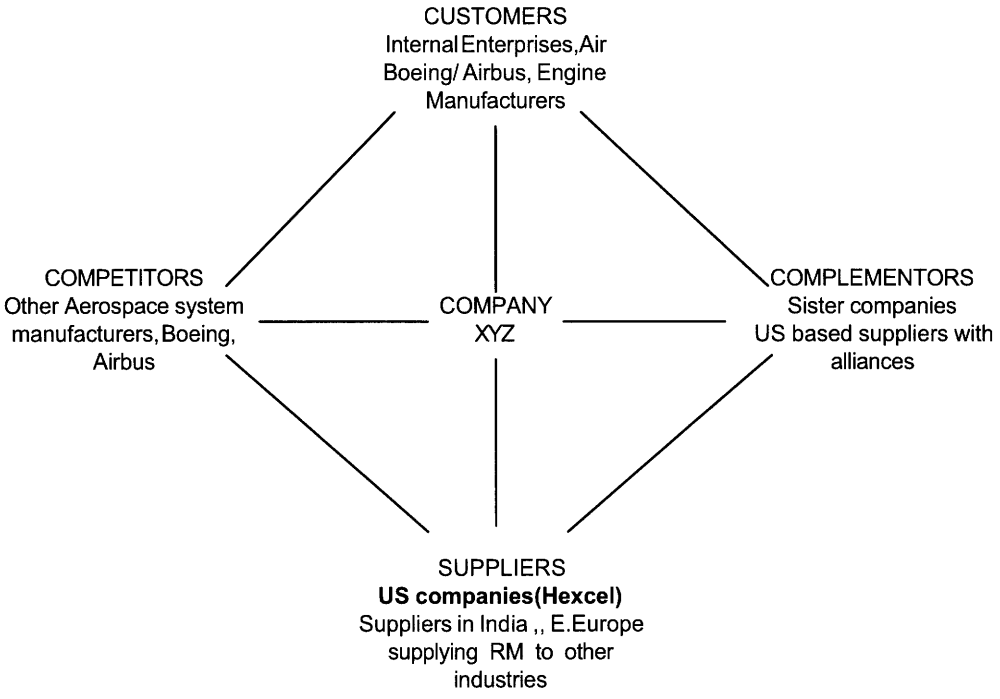


Figure 26: Composites Value Net

Each of the markets is ranked from 0-5 based on there rating of each economy to PARTS framework.

Boeing /Airbus are both customers for the company XYZ but also competitors for capacity considering the wide use of composites in the aircraft. Boeing may act as a complementor as well when one is looking at filing capacity at a supplier that becomes available. India has several players as suppliers to other industries. Eastern Europe has couple of US suppliers with satellite manufacturing operations but the cost advantage may be small term.

Boeing has committed $1B in outsourcing to India from its value chain, which means it can be a strong complementor for India. Brazil does not have any such initiative in place and China does not have any supply base in composites today.

Considering that the company xyz is overly dependent upon the suppliers and it has sister company that also has a composite business it may make sense strategically for XYZ to have a quasi- internal operation in composites. This will improve the added value. Eastern Europe has the strong added value in this case because of existing suppliers establishing business their. India's added value will be in offsets that Boeing/Airbus have signed up for to sell aircrafts in India

Rules are pretty much the same everywhere and perception is that an internal operation is very important strategically.

Brazil (Embraer supply chain) offer the best scope as one can extend the composite part family to other complementing industries like chassis, may be sheet metal etc

India has some major players available for alliances. These players also have operations in other part families and XYZ may be able to use this complementary capability.

The following table outlines the rankings

PART FAMILY	MARKETS	Game Theory Analysis				
		P	A	R	T	S
		PLAYERS	*Added Value*	*Rules*	*Tactics*	*Scope*
Composites	B	2	2	2	2	3
	R	1	1	2	2	1
	I	3	2	2	3	4
	C	2	1	2	2	1
	O	3	3	2	2	2

Table 5: PARTS analysis for Composites

*India has the best score for this part family. This selection needs to be validated per the strategic point of view.

4.5 Establishing the value chain

After the Emerging Markets selection is made, the next step is how to go about establishing the value chain for a part family. This needs to be a different business model compared to how an organization operates in Developed markets.

A fundamental question that each company must confront is whether to go it alone or instead to enter into a joint venture. For their first entry into an emerging market supply

base Aerospace companies can enter into a joint venture with a local supplier to get some initial traction in the market place and at the same time get insight into the local market, regulations, business culture and language if local internal operations are desired. In other cases, the decision to enter into joint ventures in order to establish operations in certain markets is mandated by government regulations. In China, for example, equity ownership by foreign companies in some industries is limited to a maximum of 50 percent.

In general, competencies that are, or will be, strategically important should *not* be outsourced (these could be considered for internal operations in emerging markets). If the company does not currently own this competency, or is at a competitive disadvantage in performing it, it should reengineer the process to improve it or seek a strategic partner. All other capabilities should be outsourced, unless the company has a competitive advantage in one of these capabilities, in which case it should determine how it can leverage this advantage in a substantive manner. The strategic outsourcing matrix provide a mature framework to help make an appropriate transition

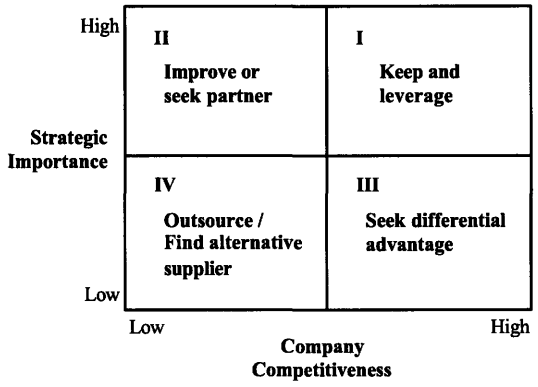


Figure 27: A Framework for Strategic Outsourcing

If an internal venture due to technical complexity, capability of the market or because of strategic importance is chosen, then Roberts Matrix could be used to decide the type of alliance. The figure below provides the optimum strategies with respect to the familiarity of market and technology.

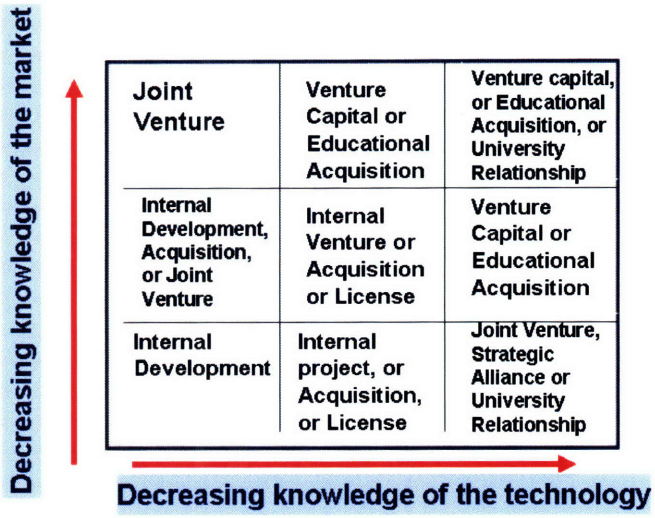


Figure 28 : Business Strategies from Robert's Familiarity Matrix

4.5.1 Application of EA

EA will be used to analyze the alliance and partner in an emerging market in case that is the preferred route chosen per analysis above. EA could not be considered as a replacement of existing evaluation processes. Major sources of potential synergies can be mapped into the EA framework to ensure all current potential synergies would be captured. The results are shown in Table 6. Note that potential areas of synergy are mapped into the section of EA where they would mostly likely be discovered. Most potential synergies have benefits and costs in multiple areas within EA.

EA View Framework	Potential Synergy
Policy / External Factors View	• Governmental policy changes
Strategy View	• Access to capital • Strategic vertical supply chain considerations
Process View	• Employee reduction due to redundant departments • Improved access to markets
Organization View	• Production facility rationalization • Economies of scale
Knowledge View	• Intellectual property
Information Technology View	• Improved technology use
Products / Services View	• Leveraging brand equity to new product lines • Bundling opportunities within product lines • Complementary products

Table 6: EA Inclusion of Current Process Synergy Identification

4.5.1.1 Enterprise boundary definition

Enterprise definition helps the process by narrowing the portion of the company that needs to be considered. For multi-faceted companies, the portion of the firm that is pursuing the alliance is most involved with the synergy analysis. They may be supported by a central business development group that makes sure synergy opportunities in other areas of the business are identified and developed. The process

of formally documenting the enterprise boundaries should help define the analysis team and make sure that all potential stakeholders are identified and become involved early in the process.

4.5.1.2 Strategic Drivers and Objectives

Understanding an industry's potential industry earnings, industry barriers to entry, power distribution in the vertical supply chain, and the nature of competition are all key factors to evaluating an industry's attractiveness. The different organizations may have common strategic drivers and similar objectives, making it easier for different stakeholders to understand what will drive the enterprise after integration. Alternatively, the organizations might have strategic drivers that are counterbalancing, providing risk mitigation for both institutions.

4.5.1.3 Stakeholder Analysis

Although the rest of the current state enterprise analysis methodology is completed independently, stakeholder maps could be better drawn with the two organizations shown together. This simplifies the identification of common stakeholders. These maps will be used both to help determine the magnitude of cultural change within each organization and to identify any stakeholders who may be stretched too thin during the integration process.

4.5.1.4 Stakeholder Map

A physical depiction of the enterprise stakeholders and how they are connected to each other is an important communication tool among decision makers within the enterprise. By physically delineating the stakeholder relationships, a number of key discoveries can be easily identified and discussed. The following questions should be directly addressed:

- What stakeholders do the two organizations have in common? Are the product lines used by the same end users? If there are currently few shared stakeholders, are there any relationship synergies available?
- Are the stakeholder structures radically different between the two companies? Are there more stakeholders in one organization versus another? Are there any key stakeholders missing in one company? Could one organization adopt the other's stakeholder structure or will this cause cultural conflict?
- Are there stakeholders that seem to act as intermediaries between other stakeholders who might become choke points? Do all stakeholders communicate through one particular group?

4.5.1.5 Current State Enterprise Architecture

Overview

There are seven different "views" through which an organization should be analyzed as part of applying EA fundamentals. These views should be developed separately and then evaluated together per the framework shown in Figure 12 (Nightingale).

- Policy/External Factors:
- Strategy:

- Process:
- Organization
- Knowledge:
- Information Technology:
- Products/Services:

Having a defined, documented analysis of the underlying architecture of the organization is a critical component in determining what changes should be made in each organization and the benefits associated with each change. Documentation also serves to "level set" both the teams and allow for open debate in areas where individuals might not agree. Finally, the Current State EA is critical in determining which of the proposed future states will be easiest to implement and have the lowest risk of unintended consequences.

4.5.1.6 Future Vision

Overview

Alliances are typically pursued as part of the organization's future vision, most likely in terms of growth opportunities or strategic advantage. A perfectly aligned alliance would move an organization toward this future vision without changing the desired end state in any way. Therefore, re-evaluating the both organization's vision during and after an alliance would seem to be prudent given the near certainty of stakeholder relationship changes. When EA is applied to an existing enterprise, only one future vision needs to be created.

The future vision for the combined enterprise should also be defined prior to alliance. This is the most important output from this analysis, as it acts as the guiding document for the creation of different potential future state EAs and as one of the evaluation criteria to determine which of these potential future states are optimal in terms of benefit and risk.

4.5.1.7 Creation of Multiple Potential Future State EA's

At this point in the process, the proposed combined enterprise needs to be evaluated as a whole. Ideally, the idea grouping process will include all members from the due diligence team. Although it will be tempting to start quantifying synergies at this point, this might eliminate promising concepts before they have a chance to be combined with other concepts that might vastly improve their appeal.

4.5.1.8 Down-select Process for Future State EA's

Since certain future states will satisfy different stakeholders more than others, it is important to use an impartial down-select process to choose the optimal, system level future state. This helps stakeholders understand the other factors involved in the final decision and increases buy in. Typically, each proposed future state is judged against the criteria the enterprise deems is most important toward their continued successes. These criteria are often referred to as the "ilities"; such as profitability, flexibility, and survivability among scores of others (although not all of the factors need to end with "ility"). Each "ility" can be given a numeric weight based on how important it is to the

future enterprise. Each of the proposed future states can be subjectively scored in each of these "ility" attributes to guide the enterprise architect toward the optimal future state. Along with scoring against the "ilities", other important factors such as implementation costs and risks need to be quantified, where possible.

Particularly with the process, risk management is an important consideration for the EA down-select process. There are numerous, well defined risk management processes and tools that can quantify various risks allowing for easy determination of relative risk levels. Further, formal risk management allows for the definition and tracking of mitigation plans to either reduce risk consequence or likelihood.

4.5.1.9 Final Future State EA

While looking at an alliance, an EA framework should be developed using what information it has available. This information should both drive synergy identification and dovetail with other synergies identified during process. After closing, the document should be shared and reviewed mutually, both to verify the assumptions made during the analysis and create buy-in for the plan from the leadership team at both organizations.

It is important to realize that the EA process necessitates the complete evaluation of the portion of the companies included in the enterprise boundary. Identifying system-level synergies requires that a mutual optimal is chosen.

Example

From the discussion on the composite part family in the section on selection of emerging markets we found that India had the highest score based on the assumptions made in the analysis. From the strategic outsourcing framework, the strategic importance of Composites for XYZ is high while the current company competitiveness is low. It is hence suggested to looks for partnership. The type of venture can be chosen through the Robert's Matrix. Considering the company has high knowledge of market and requirements in Aerospace but minimal familiarity of the technology it is suggested to looks for a strategic alliance or a JV.

Most large size organizations in Emerging Markets are vertically integrated. The suppliers identified in India are analyzed, and one of them is selected for the next step. An EA framework is to get an insight into the enterprise boundary and stakeholders. Due to high diversity of interests this enterprise has high architecture complexity.

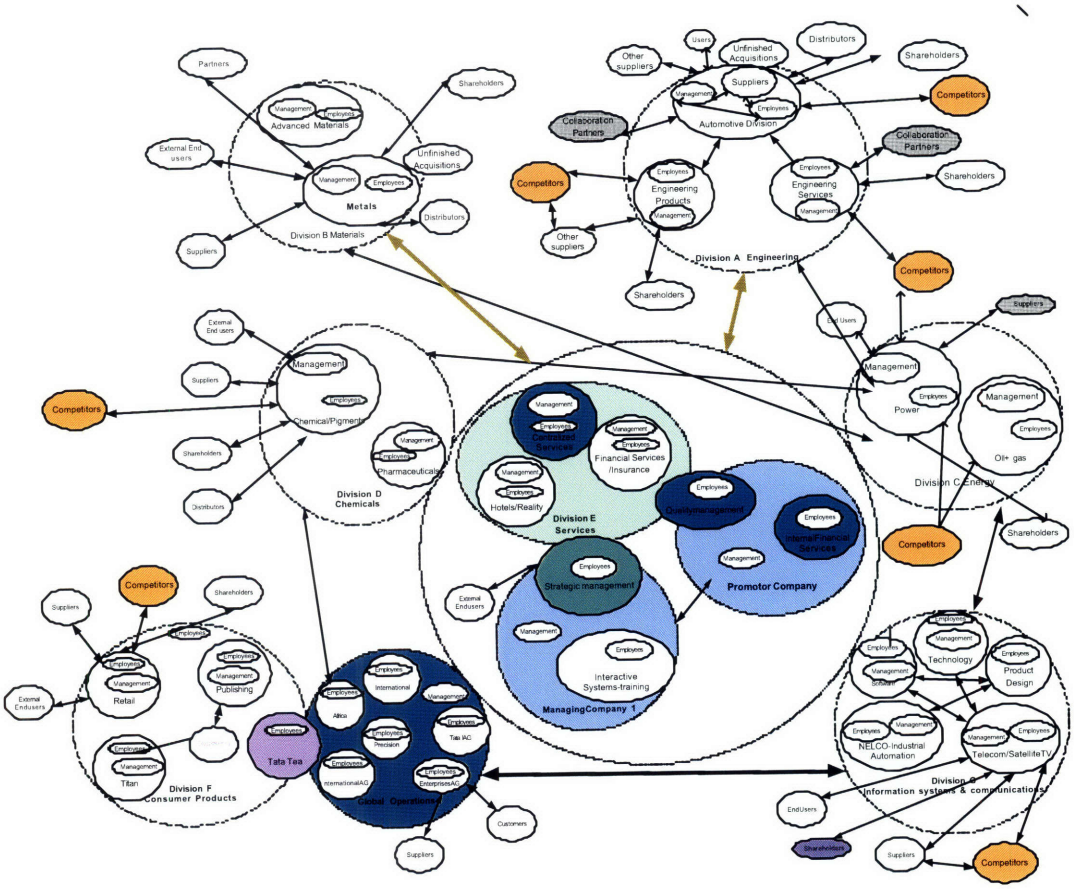


Figure 29: EA based structure for an Enterprise in Emerging Market

Analyzing this EA framework to see what will be the best way to structure the future state of the alliance such that it creates maximum alignment of stakeholders and synergies. Several future states were considered like an Alliance with just the division that does composites or just to be an investment partner in the alliance but an a partnership which spread across the sister companies provided the best future state. The figure below shows suggestion for such an alliance which will generate maximum coordination.

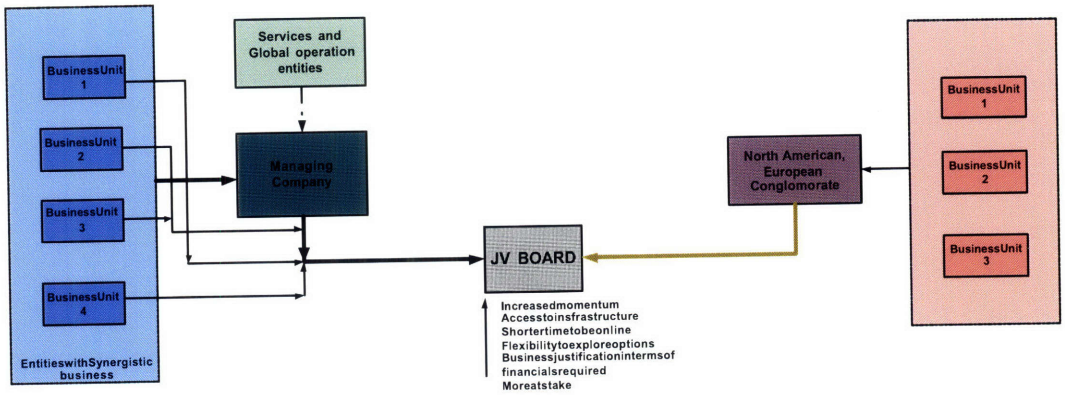


Figure 30: Possible Structure of the Alliance

Policy/External View

Example of affect: In order to benefit from the stronger political power of Emerging market Company (which were not included within the boundary definition but are stakeholders in the combined enterprise), should be strongly integrated.

Strategy

Example of affect: The new organization would compete based on perceived quality with channels to market designed according to regional management's discretion.

Process

Example of affect: The existing Aerospace Company can provide its mature processes to the relationship. Additionally emerging market company can provide the logistic and other processes custom to the local market to the relationship

Organization

Example of affect: A new organization with equal representation from both the companies should be created.

Knowledge Management

Example of affect: Significant knowledge sharing in the combined organization. The existing aerospace organization will provide technical know how, product understanding as a knowledge while the emerging market enterprise could provide the knowledge base on how to operate in that market. Either firm can act as a mentor in this case

Information Technology

Example of affect: Either company will develop applications making sure that common communication pattern is established. Best practices in IT will be chosen from either organization.

Products and Services

Example of affect: _ Products and services view will be to expand the capability of the new enterprise to develop products for Aerospace market

5 Conclusion

Emerging markets present a unique profile of risks—geopolitical, regulatory, financial, currency, and governance risks among others. Aerospace further increases this risk because of the regulation and the currently where it is concentrated .Among the greatest concerns facing manufacturers generally in emerging markets is potential threats to intellectual property rights, either through outright theft of proprietary know-how or counterfeit products.

Companies must not only protect themselves from these "unrewarded" risks, they also need to guard against the risk of failing to capture the upside potential of these markets. The goal is to achieve *risk intelligence* by systematically identifying, evaluating, and managing all the risks faced by a company across all the markets in which it operates. To manage the new markets organizations need to modify the business models to match each market, while retaining their core business propositions. A key aspect of this comprehensive approach is to manage explicitly the interdependencies that inevitably exist among the different types of risk that a company faces. The ability to take a holistic approach to risk management will continue to grow in importance as companies develop increasingly complex global value chains to support their worldwide operations. While companies cannot use the same strategies in all developing countries, they can generate synergies by treating different markets as a system.

In the end Emerging Markets are here and every industry including Aerospace should be well positioned to use them to their advantage. Moreover as customers are shifting more and more in these markets one ought to have a value chain local to support them. This study just suggests a framework and it is authors understanding that it will assist the internal stakeholders in improving the quality of decision making.

5.1 Future Research

The study definitely opens up opportunities for future work. Though the thesis support the hypothesis with examples, there is also an opportunity to do a case –study for an

entire value chain in an organization with the suggested framework. Then each element will be co-related with an Emerging market and strategies can be put in place on how to execute. Another aspect that can be improved is quantitative analysis as the current framework is more focused on the qualitative assessment.

To wards the details of the framework there is definitely a needs for refinement of system dynamics model and a more thorough application of EA to business development in Emerging Markets. A system dynamics models needs to be expanded to have more tunables pertaining to institutional contexts. Finally a system dynamics models tuned to each of the BRIC countries should be created.

6 Appendix A

The following section suggests Keys Questions relative to each aspect of Emerging Markets. This will help prepare a quantitative assessment of each market.

Cost and capital advantages of Emerging markets
• How large is the net cost advantage today of manufacturing major products in and shipping them from an Emerging Market including the hidden costs? How large will it be in three to five years?
• How much reduction in capital expenses can be achieved by resourcing key operations?
• How would an operation in Emerging Market affect long-term operating economics, including competitive cost position, working capital productivity & return on capital?
• How is the competition exploiting the opportunity?

Rapid growth of talent and capabilities in Emerging Markets
• What advantage could be gained by having higher numbers of skilled engineers available for operations and R&D?
• What amount of the world's emerging technical talent pool is already captured by the organization? If so, how far ahead is the organization from its competitors?
• How could Emerging Markets be used to boost the effectiveness and efficiency of business processes?
• How these capability advantages can be integrated with the cost and capital advantages and the possible growth opportunities to outperform competitors?

Migration of customers to Emerging markets:
• Where will the major customers be producing and sourcing next year? In three or five years? How is the downstream supply chain
• Understanding of how customers intend to go global with their supply chains?
• What range of business models and offerings can be employed?
• What is the opportunity to be a viable local player of sufficient size and profitability in an Emerging markets where there are offset requirements or where the customers are?

Threats and opportunities posed by new global competitors.
• Which competitors are growing fastest?
• Comparison of the product offerings and perception by the customers.
• Timeline for the development of their offerings & an insight into their product road map?
• What business model are they using and what advantages do they employ?
• What are the likely M&A targets that maybe appealing?
• Does the operation strategy need to be changed?

Organizational solutions for the global initiatives:
• Various roles of the business unit leaders, regional managers, and corporate staff in gathering market intelligence, developing strategies, making investment decisions, and executing all plans? Who owns Ultimate accountability for results?
• Is their a need for dedicated Emerging Markets organizational entities or use cross-functional and cross-business-unit teams or other ad hoc coordinating mechanisms?
• How to address the organizational barriers—including lack of incentives, actual disincentives, real and perceived risks, complexity, and misaligned accountability
• How should the company address HR-related issues— recruiting, global assignments, career development, and compensation?

Strategic Prioritization of an Emerging Market with respect to Value Chains
• Ability to rebalance the manufacturing and sourcing network to take advantage of emerging market positions.
• Ability to target a higher penetration within the reduced purchasing volume of the account, an approach that is possible if a player is significantly superior to its offshore competitors or willing to make major price concessions.
• Ability to pursue adjacent opportunities with higher value and more technical content. These are more likely to remain in the home-country purchasing pool for the time being. Moving up the product value pyramid, however, means being exposed to smaller segments—and meeting stringent requirements, which can consume considerable time and resources.
• Ability to move into new lines of business where the home country advantage will count in the long run and where it is possible to transfer capabilities from the declining core business

Table 7: Emerging Market Prioritization

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