Management strategies in the aerospace industry. Particular case: The Boeing Company

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Abstract: *The present paper aims to provide an overview of the aviation industry in the United States (US). The study focuses on Boeing Company analyzing the organizational architecture and management strategies applied throughout its evolution. The paper is structured in three parts: the first part presents the scientific references; part two focuses on the structure, management strategies and performances of the company; the last part is devoted to conclusions.*

Key words: *aeronautic industry, organizational architecture, management strategies, Boeing*

1. INTRODUCTION

The United States is one of the main developers of the aerospace industry and a leader in the global aerospace industry. Changes that have occurred in the last half century in the US market aerospace affected the industry both at structurally and organizational level. This was mainly due to economic and political environment, and the needs of customers. Also according to the forecasting reports [1, 2, 3] we can state that US has the largest aerospace market in the world, a skilled workforce, products, and diverse and extensive distribution systems. United States began to lose its competitive edge, since the early 1970s, when several countries in Europe have created Airbus.

Also other countries like China, India, Brazil, and Russia invest significantly in aerospace industry taking into account the strategic importance of this area and the role of catalyst for other industries.

Since the beginning of its development US aviation industry included manufacturers such as Boeing Airplane Co., Douglas Aircraft Co., McDonnell Aircraft Corp., North American Aviation and Hughes Aircraft. According to historical documents [4] this companies collaborated and merged over time and their technological innovations that they have bequeathed contributed to the US industry consolidation. Most of the activities and services of these companies were integrated in Boeing.

With 168,400 employees in 2014 Boeing is the largest aerospace company in the world and a leading US exporter, as mentioned in 2013 Boeing Annual Report [5]. Being a traditional manufacturer, Boeing continues to introduce products and services on aerospace market from almost a century, to meet the emerging needs of customers.

The present paper aims to provide an overview of the aviation industry from the United States (US). The study focuses on Boeing Company analyzing the organizational architecture

and management strategies applied throughout its evolution. The paper is structured in three parts: the first part presents the scientific references; part two focuses on the structure, management strategies and performances of the company; the last part is devoted to conclusions.

2. THEORETICAL REFERENCES

A company strategy is based on setting goals and determining how they will be achieved. Porter (2002), in his "What is strategy?" [6] describes the strategy as "the creation of a unique and valuable position, involving a different set of activities". At the same time it also mentions that "A good competitive strategy" is one that creates unique value for a particular set of Customers". Focusing the study on Boeing was due to the fact that it is one of the most important leaders both in the US aerospace industry and worldwide.

The company's strategy is to provide aircrafts and innovative technologies to meet the increasing competition and manufacturers who entered later on the market.
U.S. International Trade Commission (1998) [7] highlights the fact that a corporate structure that is flexible, responsible, with a good repute in terms of financial which holds the ability to adapt quickly to dynamic markets is essential in setting transactions (sales) worldwide, marketing and support network.

Also the repercussions of political, economic and global recession led to a decrease in the availability of capital for funding new purchases of aircraft, leading to reduce the total demand for commercial and military aircraft, also affecting the production and employment. Moreover, the transformation of the industry so amenable to (in a way that could be on) the interests of the parties involved depends on establishing an interdependent mix of social skills, techniques and procedures of companies. In response to these fluctuations in the aerospace industry, a number of companies from aerospace have taken into consideration several aspects such as: merging with other companies from this field, acquiring and creating alliances to maintain or increase the market share; cost reduction; and risk sharing of development programs to strengthen their position in this sector and improve the financial perspective.

Cutcher-Gershenfeld J. (2002) [8] states that the aerospace industry is an important source of export for the United States and continues to be a dynamic context in the organization and transformation of systems. Becu et al. (2014) [9] quoting Porter (1980) suggests that the industry from which the company is part is the main factor that determines the performance, which can be favorable or unfavorable attributing the development of a competitive advantage.

This paper provides a synthetic snapshot over the company structure and its strategies that were classified in technological innovation, organizational innovation, environmental strategies and involvement in research programs.

3. STRUCTURE OF THE BOEING COMPANY

According to Boeing historical documents [10] the company was founded in 1916 by William Boeing, who bought almost three quarters of the shares of Pacific Aero Products and has integrated his manufacturing therein. The following year, Pacific Aero Products has been renamed as Boeing Airplane Co. In 1927, was created a new division Boeing Air Transport (BAT), their own airline transport, as a result of winning the contract with American Post Office to deliver mail [11].

Together with the engine manufacturer Pratt & Whitney, Boeing established in 1929

United Aircraft and Transport Corp (UATC) in which have been integrated the two divisions of the company: Boeing Airplane Co. and Boeing Air Transport.

This new structure of the company included engines manufacturers, aircraft components manufacturers and airlines (airlines business), in order to enter on all aviation market, both civil and military aviation.

The new structure has operated until 1934 when the antitrust legislation was introduced, and did not allowed aircraft manufacturers to hold airlines.

Therefore UATC has been divided in three entities: United Air Lines (responsible for air transport), United Aircraft (responsible for production operations in the eastern United States, renamed United Technologies) and Boeing Airplane Co. (responsible for production operations in the West, including Stearman Aircraft and Boeing Aircraft of Canada, as mentioned in Boeing History [12].

The company created in 1958 Boeing Scientific Research Laboratory (Boeing Scientific Research Laboratories) and in 1959 Aerospace Division (Aerospace Division) [13].

To face to the recession of the 1970s, the company has oriented to new areas and has established new divisions like Boeing Computer Services and Boeing Engineering and Construction. Between 1986-1988 space and defense units merged and formed Boeing Defense & Space Group, along with the other two major divisions of the company: Boeing Commercial Airplane Group and Boeing Computer Services. In 2001 the company integrated the Boeing Defense & Space Group and Boeing Computer Services in a single division called Boeing Integrated Defense Systems, Boeing History [14].

In 1996, The Boeing Company merged with the defense and space divisions of Rockwell International Company. The two units were combined into a single subsidiary, Boeing North American, Inc. [15] A year later the new component of the North American Boeing merged with McDonnell Douglas Inc. Corp. Boeing purchased in 2000, three units of the company Hughes Electronics Corp.: Hughes Space and Communications Co., Hughes Electron Dynamics, and SPECTROLAB Inc. that were integrated into Boeing Satellite Systems, a subsidiary of the company that later became part of Boeing Integrated Defense Systems formed in 2001 by merging several units of the company.

In 2011, Boeing Satellite System changed its name into Boeing Defense, Space & Security. The two major divisions of the company are currently: Boeing Commercial Airplanes Group and Boeing Defense, Space & Security. A synthesis of US aviation industry evolution is shown in Table 1.

Table. 1

<table>
<tr><th colspan="4">The Boeing Company</th></tr>
<tr><td>1916</td><td colspan="3">Pacific Aero Products Co.</td></tr>
<tr><td>1917</td><td colspan="3">Boeing Airplane Co</td></tr>
<tr><td>1927</td><td colspan="2">Boeing Airplane Co</td><td>Boeing Air Transport</td></tr>
<tr><td rowspan="2">1929-1934</td><td colspan="3">United Aircraft and Transportation Corp</td></tr>
<tr><td>United Airlines</td><td>United Aircraft</td><td>Boeing Airplane Co</td></tr>
<tr><td>1934</td><td colspan="3">Boeing Airplane Co</td></tr>
<tr><td>1986-1988</td><td>Boeing Commercial Airplanes Group</td><td>Boeing Defense & Space Group</td><td>Boeing Computer Services</td></tr>
<tr><td>2001</td><td>Boeing Commercial Airplanes Group</td><td colspan="2">Boeing Integrated Defense Systems</td></tr>
<tr><td>2011-prezent</td><td>Boeing Commercial Airplanes Group</td><td colspan="2">Boieng Defence, Space & Security</td></tr>
</table>

Source: Boeing, Historical documents, retrieved at:
http://www.boeing.com/boeing/history/narrative/n001intro.page

The main Boeing's competitor is the European company Airbus founded in 1969 as a Pan-European consortium. The consortium has become an integrated company in 2001 involving partners from France, Germany, Spain and Great Britain.

4. MANAGEMENT STRATEGIES

Boeing has always followed (adapted) the market requirements using a range of strategies classified in:

►Technological innovations had a significant impact on every aspect of business and manufacturing. During World War I the company was one of the leading manufacturer's trainer aircraft. Boeing produced "the country's most important heavy bombers" (Boeing History) [16], which were used in World War II and the first pilotless aircraft. In order to coordinate the new technologies developed as pilotless aircraft, missiles and launch systems, Boeing has developed a massive analog system, called BEMAC which has become a catalyst for today's computers. As surveillance technologies have evolved, the company developed an airport surveillance system (AWACS) and designed, installed and operated nationwide telecommunications network for NASA. Focusing on the market space Boeing has been involved in major programs as Apollo project, Dyna-Soar Boeing, International Space Station, developing innovative technologies that have a significant impact in the field. On the civil market, Boeing introduced in 1930 the first aircraft models with one row of wings (monoplane aircraft) which, even if they were too advanced for that time, paved the way for the development of large civil aircrafts of the company. He also developed the first aircraft that could cross the Atlantic and the first pressurized passenger aircraft. The two planes have attracted worldwide passengers during 1940, more than 2.2 million people have traveled over 150 million kilometers (Boeing, History) [17]. The company launched on the market aircrafts that involved fuel efficiency in a period when its prices increased, and which were aim at reducing noise and increasing flight performance. Boeing also launched its first 3 engines aircraft design for small airports with short runways and the first aircraft with a large capacity called "Jumbo Jet" 747 that was built in the period in which air traffic has increased and airports became congested. After the events of 2001, the company introduced video monitoring equipment on the market which increased security by allowing pilots to observe the passengers cabin and the whole flight process. Technologies and innovative concepts continue to keep Boeing Commercial Airplanes in the industrial standards for passenger comfort and fuel efficiency. Current products of the two main units are summarized in the table below:

Tabel 2. Boeing CA Product Families & BDS Sub-Units Products

Commercial Airplanes (CA)	**Boeing Defense, Space & Security (BDS)**
737: ►100/200/300/400/500/600/700/800/900	**Boeing Military Aircraft** ►tactical, tanker and airlift aircraft, weapons, surveillance and engagement programs, and unmanned airborne systems programs.
747: ►100/200/SP/300/400/8F/8	**Global Services & Support** ►aircraft and systems with a range of products and services through integrated logistics, including supply chain management and engineering support; maintenance, modification and upgrades for aircraft, and training systems and government services, including pilot and maintenance training.
767: ►300Freighter/ 300ER/KC-200ER	**Network and Space Systems** ►electronic and information solutions; strategic missile and defense systems; satellites and other space and intelligence systems; space exploration activities

777: ►200/300/Freighter	**Boeing Phantom Works** ► addresses emerging market opportunities to capture vital new business that will enhance Boeing Defense, Space & Security's core and extend the company's presence in new and untraditional frontiers
787 Dreamliner: ►8/9/10	**Joint Ventures** **United Launch Alliance (ULA)** **United Space Alliance (USA)**
BBJ/VIP: ►BBJ, 747-VIP, 777VIP, 787VIP	

Source: The Boeing Company website, Orbis Database

►Organizational innovations. The company has diversified his products and services, starting from the development of aircraft and their components up to mail delivery and maintenance services of the airports. Also the company established the School of Aeronautics Boeing for training pilots and mechanics. Boeing has set up new divisions, such as Boeing Scientific Research Laboratories, Division Aerospace, Boeing Computer Services, to develop new products that are intended to market space and strategic missiles. In order to support his customers, Boeing established a leasing and a lending unit to provide credit facilities that help airlines to purchase its products. Also Boeing signed an agreement with the Dutch company Fokker, to establish an European Support Centre near Amsterdam, Netherlands – "part of a larger global support network offering comprehensive life-cycle maintenance and service for military aircraft around the world" (Boeing, History) [18].

►Involvement in research programs launched by public institutions like NASA (National Aeronautics and Space Administration) and FAA (Federal Aviation Administration). In the Apollo project, Boeing has provided a comprehensive and integrated system for the entire project. Over time, Boeing has cooperated with its rivals, General Electric and Hughes Aircraft Co., to design and build the Viking Mars probe. Its role was to collect scientific data on surface features on Mars and to discover whether there is life on Mars. Moreover other programs that certify the company's involvement in top research activity were: the Atlas-Centaur construction vehicle a project on which Boeing has worked with General Dynamics and the North American Rocketdyne and was responsible for tracking, communications and mission operations; design, development, construction and integration of the International Space Station, program launched by NASA; development and integration of software components for International Space Station; updates of communication, navigation and electrical systems S-3B Viking of anti-submarine warfare, involvement in the Minuteman Force Development Evaluation flight-test program. The Minuteman ICBM is a three-stage, solid-fueled strategic missile first deployed in the 1960s (Boeing, History) [19]. Boeing was also involved in the research program Next-Generation Air Transportation System, which aims to develop methods for managing the air traffic growth expected by 2020 and increase safety, security and environmental performance, in which FAA has also a key role. According to Ecorys report (2009) [20] The European Corresponding program is the SESAR project. To ensure coordination of the two programs and in particular the use of compatible technology, the European Commission and the FAA have signed a cooperation agreement in July 2006.

►Environmental Strategy: Since the early 70s Boeing researched the opportunity to explore energy in a more environmentally friendly. Boeing built photovoltaic cells, in one of the subsidiaries held SPECTROLAB Inc. Sylmar, California. Also the company built wind turbines and designed solar energy system satellite. Boeing renewed its commitment with

Energy Star, a joint program of the US Department of Energy and US Environmental Protection Agency who works with industry to reduce energy consumption and greenhouse gas emissions. Boeing also managed to reduce energy and water consumption, carbon dioxide emissions and hazardous waste at its facilities and obtained ISO 14001 environmental certification at the end of 2008. Certification at the globally recognized standard is the benchmark for commitment of an organization to understand and continue to improve the environmental performance.

Boeing has experimented demonstration flights with sustainable biofuels in collaboration with airlines companies Virgin Atlantic, Air New Zealand, Continental and JAL. By participating in research programs the company studied different air traffic management concepts such as "tailored arrivals", which significantly reduce fuel consumption, emissions and noise by improving the efficiency of air traffic. In 2008, Boeing, Virgin Atlantic and GE aviation conducted the first commercial flight using sustainable fuel and the first manned flight of an aircraft powered by hydrogen fuel cells. In 2008, Boeing has signed an agreement with Airbus to work together in order to reduce the effects of aviation on the environment, (Boeing, History) [21].

5. COMPANY PERFORMANCE

In the last ten years, the performance was reflected both in turnover and in the number of customers as shown in Table 3.

Tabel 3.

Item	Year	Employees (number)	Orders - Civil aircraft (number)	Turnover ($ mil.)	Labor productivity (%)
1	2004	159000	271	51400	0.32
2	2005	153000	959	53621	0.35
3	2006	154000	916	61530	0.40
4	2007	159300	1153	66387	0.42
5	2008	162200	573	60909	0.38
6	2009	157100	244	68281	0.43
7	2010	160500	550	64306	0.40
8	2011	171700	864	68735	0.40
9	2012	174400	1316	81698	0.47
10	2013	168400	1531	86623	0.51

Source: Boeing annual reports & Orbis Database

The table shows that the number of orders has increased almost six times, between 2004 – 2013, while the turnover increased 1.6 times and the number of employees increased by approx. 1.01 times.

The slower rise in the number of employees in relation to turnover indicates labor productivity growth, with positive effects on competitiveness.

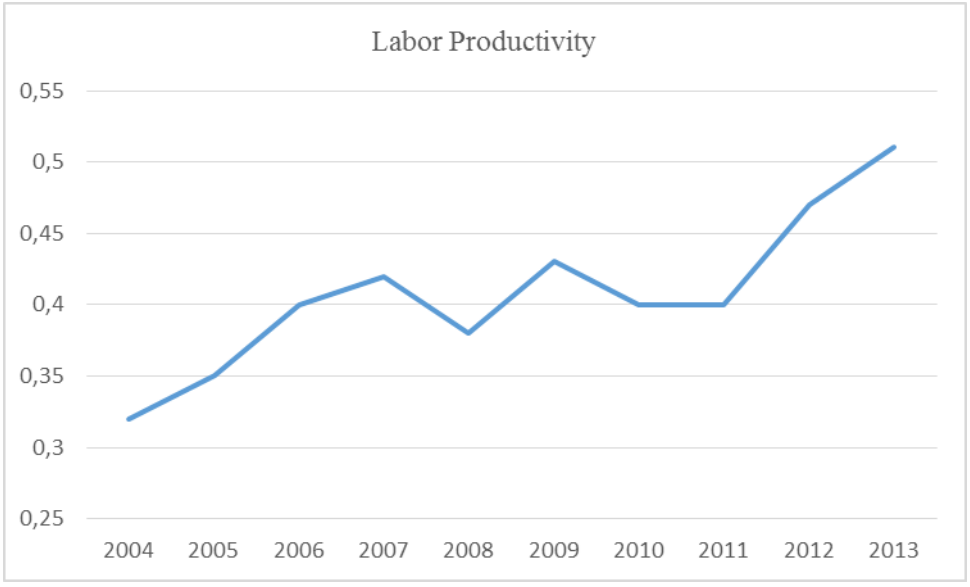

Figure 1

Figure 1 shows that the general trend in productivity is increasing and that this increase was accentuated after 2011.

6. CONCLUSIONS

US companies have explored and launched on the market new technologies that have led civilized world to a modern era since the beginning of the 20th century, having a significant impact on transportation and communications.

The changes that have occurred in the last half century in the US aerospace market affected the industry both at structural and organizational level. The political, economic repercussions and global recessions have determined the companies from US aeronautical industry to adopt a complex of strategies such as: merging with other companies in the field, acquiring and creating alliances to maintain or increase market share; costs reduction; extending the scope of products; and risk sharing programs development to strengthen their position in this sector and improve financial perspective.

The mergers and transformations that have occurred over time have strengthened the US aerospace industry, creating major producers not only at the level of the main suppliers, but also in the second and third levels.

Such companies hold the potential to allocate financial and human resources to take over the role of system integrators and become risk-sharing partner. Currently, the US aerospace industry is dominated by large firms that provide highly integrated products, as mentioned in Ecorys Report (2009) [22]. Aerospace, is a symbol of technological progress for many nations and also an important source of export to the United States.

The strong technological position of the US comes largely from the defense industry and research and from the development programs which have had an impact on the civil aviation industry. Also, the leading position of large companies in the US is based on long experience to deal with complex tasks. Since the beginning of its development the US aeronautics industry included manufacturers such as Boeing Airplane Co., Douglas Aircraft Co., McDonnell

Aircraft Corp., North American Aviation and Hughes Aircraft.

The Collaborations and mergers between them that took place over time and technological innovations which were left as legacy, contributed to the US industry consolidation, implicitly to Boeing Company strengthening.

The technological innovations have had a significant impact on every aspect of business and manufacturing of the company. The company diversified its products and services, starting from the development of aircrafts and their components to mail delivery and maintenance services to airports.

Boeing also explored and developed green technologies supporting government institutions in achieving the objectives regarding the energy independence and efficiency. The company performance was reflected both in the turnover and in the number of customers. With 168,400 employees in 2014 Boeing is the largest aerospace company in the world and a leading US exporter.

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