



A partner selection approach for strategic alliance in the global aerospace and defense industry

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ABSTRACT

Finding a mutually beneficial alliance partner is a critical success factor for various companies. This paper aims to propose an effective method based on grey theory and data envelopment analysis (DEA), which efficiently predicts future business and measures operational performance by using critical input and output variables. Decision-making units (DMUs) can find the most appropriate candidates. This research was implemented with public data from four consecutive financial years (2012–2015) of the world's 35 largest aerospace and defense companies. The study forms a total of 69 virtual alliances for target Airbus Group SE (DMU2) and 627 virtual alliances for all inefficient DMUs. The empirical results showed that the alliances between DMU2 + DMU1 and DMU27 + DMU6 are the two most feasible partnerships. DMU3, DMU6, and DMU13 are considered to be the best partners for inefficient DMUs. DMU6 was recommended 12 times (63%), DMU3 was recommended four times (21%), and DMU13 was recommended three times (16%). The study will be a key recommendation for strategic planners of the aerospace and defense industry as well as other manufacturing industries.

1. Introduction

Aerospace and defense (A&D) is a high-tech industry that comprises the manufacturing of civil, military, aerospace, and defense equipment. A&D has become a critical part of the global infrastructure, economic growth, international trade, and globalization. The demand for aircraft is related to air transport, travel, and cargo and is linked with changing global domestic product (GDP) (Airbus's GMF, 2016). This industry provides highly skilled jobs and reduces the unemployed rate. A&D also plays an important role in protecting citizens, ensuring domestic security, and exploring space. According to Deloitte (2014)'s report, the global A&D industry recorded total revenues of US\$684.9 billion in 2012. This was a growth of 5.9% from 2011's US\$654 billion revenue but declined to 3.1% in 2013. PricewaterhouseCoopers (PWC, 2015) reported that global A&D revenues reached US\$729 billion in 2014, an increase of 3% compared with 2013.

Different from general industry, the A&D plays a vital role in national security. It is directly affected by the nation security policy and indirectly affected by the invisible pressure in social-economic policies and the development of information technology. After World War II, countries maintain a defense industrial base (DIB), but they changed to off-the shelf (OTS) policy after the Cold War (PWC's The Defence Industry in the 21st Century). This meant changing from manufacturing A

&D product to buying manufactured A&D product. This happens because different countries were affected by different policies and pressures. The trading way allowed nations to have a new equipment and technology faster and more economical. Terrorism and instability in the Mideast and East Asia recently are leading to an increase in defense sectors revenue, while commercial aerospace growth is slowing down. The report of Deloitte in 2017 indicated that, global A&D sector revenue grew by 2.4% in 2016, slightly higher than global domestic product (GDP) growth 2.3%. The top 100 A&D companies' revenue was added US\$ 13.7 billion. This was driven by the EU commercial A&D and especially the US defense subsector. In which, the original equipment manufacturing (OEM) and electronic segment are top contributors at US\$3.4 billion and US\$3.7 billion respectively. This report also showed that the alliance or acquisition are one of the five key elements that the A&D companies are focusing to enhance innovation capabilities (Deloitte, 2017). Today, the A&D industry is developing based on basic industry (e.g. metallurgical industry, machinery industry, mechanical industry etc.) combining with the information technology industry. The best digital technologies support A&D industry and do more than just send, receive, store or manipulate communications; they also maintain security, safety and reliability of data (AIA).

Due to rapid advancements in technology, the trend of economic globalization, and the integrations of countries around the world, the

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competition among A&D manufacturers is running high, and prices are coming under increasing pressure. Hence, manufacturers are looking for various strategies to adjust production, recover growth, and create value to customers.

The study began with the largest 100 A&D companies, which are drawn from the financial reports of fiscal 2015 results by revenue, PWCs' report 2014, and Deloitte 2016. However, this research focused specifically on only 35 companies, due to a lack of complete public data. These companies played major roles and can fully reflect the prospect of the A&D industry. In the midst of them, Airbus Group SE is ranked second by revenue. Formed in France in 1970, it is the largest Aerospace and Defense Company in Europe. Airbus now operates in more than 180 locations worldwide. It also provides more than 136,574 jobs today (Airbus, 2016). The company combines the capabilities of three market leaders: Airbus, Airbus Defense & Space, and Airbus Helicopters. They contribute to the economies of France, Germany, Spain and the United Kingdom as well as their 35,500 suppliers.

The performance of Airbus in 2014 was not good, due to the delay in commercial aircraft deliveries and big order backlog (Airbus' orders and deliveries, 2014). This links with the unstable increases in revenues, which can be seen in Fig. 1. From 2011 to 2012, the group revenue increased 14.96%, but from 2013 to 2014 the increase was just 2.46%. The main problem comes from Airbus Division's revenue change, which is a main aircraft manufacturing subsidiary of the Airbus Group (decrease 31.42% in 2014). Fig. 1 shows the Airbus group's global revenues in comparison with Airbus Division revenues from 2008 to 2016 and the percent change in each year (Airbus, 2017).

Airbus and its primary competitor Boeing control most of the commercial airplane industry. The worldwide Airbus commercial results in 2014 are shown in Table 1. The backlog of aircraft from Airbus is the worst in its history, with a total of 6400 jetliners (41% of its total order).

Important questions arise for the future of the A&D industry. How will it maintain sustainable operations, competitiveness in fierce markets, expand scale, and create value to customers and itself? Strategic alliance could be a solution. "Alliances are fueling the success of a wide range of companies, including Starbucks, IBM, Eli Lilly, General Electric, Corning Glass, Federal Express, Cisco Systems, British Petroleum, Millennium Pharmaceuticals, and Siebel Systems" (Bamford et al., 2003). Nevertheless, many companies have failed with alliances or have not met the conditions of their partners. The purpose of this study is to provide an assessment model based on grey theory GM (1,1) and data envelopment analysis (DEA). The model will predict future business and measures operational efficiency by using critical input and

Table 1

Airbus commercial results in 2014.

Source: Airbus' orders and deliveries in 2014

Items	A300/310	Single aisle	A330/A340/A350	A380	Total
Total orders	816	11829	2676	317	15638
Total deliveries	816	6668	1587	167	9238
Backlog	0	5161	1089	150	6400
Aircraft in operation	356	6394	1517	167	8434

output variables. From that, the companies can find their suitable candidates when setting global business alliance strategies decisions. The study's results can be a reference for worldwide aerospace and defense manufacturers.

The rest of this paper is organized as follows. Methods and related works are provided in Section 2. Section 3 presents the research approach, an integrated grey GM (1,1) and DEA model for decision-making. The empirical results will be shown and discussed in Section 4. Conclusions are given in Section 5.

2. Methods and related works

In this section, the study provides the literature review about strategic alliance, grey theory, Data envelopment analysis (DEA), and its related works.

"Strategic alliances are agreements between companies (partners) to reach objectives of common interest" (Mockler, 1997). International strategic alliances (ISAs) are voluntary, long-term, contractual, cross-border relationships between two firms, designed to achieve specific goals through collaboration (Brouthers and Bamossy, 2006). These definitions emphasize the importance of common business objectives with the involved firms. Carpenter and Sanders (2007) defined that strategic alliance is a partnership in which two or more firms combine resources and capabilities, with the goal of creating mutual competition. Bamford, Gomes-Casseres, and Robinson (2003) stated an alliance strategy represents much more than a deal—it is intent, dynamic process, and logic that guides alliance decisions. The types of alliances range from simple agreements, with no equity ties, to more formal arrangements involving equity ownership and shared managerial control over joint activities (Chan et al., 1997). The alliance activities can be supplier – buyer partnerships, technical collaborations, outsourcing agreements, shared product development, shared manufacturing arrangements, joint research projects, common distribution agreements,

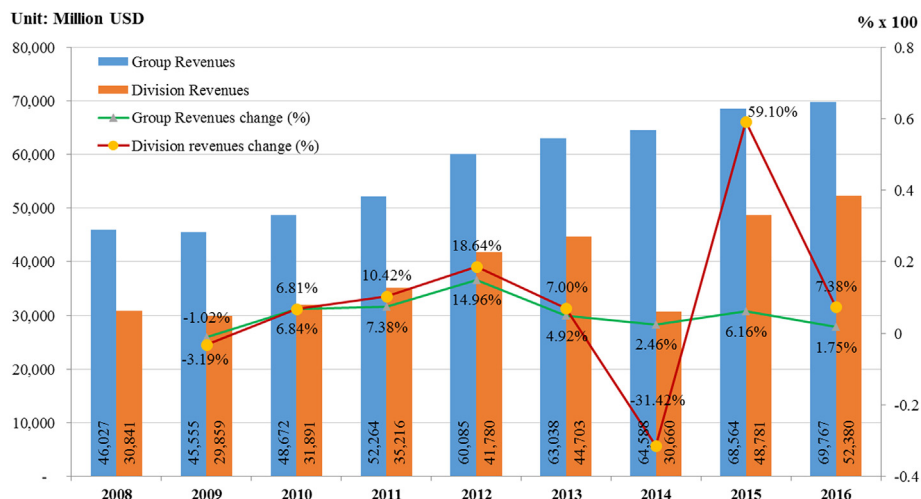


Fig. 1. Airbus group's global revenues, Airbus division's revenues 2008–2016. Source: Original data from Airbus annual report and Registration Documents (2017), calculated by researcher.

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