THE RIGHT PRODUCT AT THE WRONG TIME: THE DOWNFALL OF EUROPEAN REGIONAL AIRCRAFT MANUFACTURERS

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ABSTRACT

We investigate whether there are common causes for the withdrawal from the regional aircraft market of three established manufacturers (BAE Systems, Fokker and Saab), while competitors thrived. We focus on the markets for 50- and 100-seat aircraft. One cause concerning the 50-seat market was the introduction of a new class of aircraft, the regional jet, which pushed the less successful turboprop aircraft from the market. Turboprop aircraft that had been relatively successful before the introduction of regional jets survived. A probable reason for the withdrawal of BAE Systems and Fokker from the 100-seat market (on which Saab was not present) was that their products were 'standalone' aircraft, while those of their successful competitors were members of aircraft families, the larger members being far more successful. Not the availability of technology determined the success of regional aircraft manufacturers, but the application of (suppliers') technology in new products.

Keywords: Aerospace industry, regional jet market, withdrawal strategy

INTRODUCTION

For students of corporate strategy, there is an abundance of literature on factors that influence the success or failure of individual companies or products (see, for example, Johnson & Scholes, 1999; Kerzner, 2003). On the level of markets and industries, much research has also been done (for the airline industry, see, for example, Doganis, 2002; Doganis, 2003; Hanlon, 1996). In this contribution, we focus on the intermediate situation: not one but a number of companies share the same fate, but the industry as a whole does not share that fate. In the past decade, three established European producers of so-called regional aircraft (defined in the next paragraph) closed their production lines for this type of aircraft. Fokker in the Netherlands went bankrupt in 1996 and ceased aircraft production altogether. It now is part of the Dutch Stork engineering group and makes parts and subsystems for aerospace companies such as Airbus and Boeing. Saab and BAE Systems (formerly British Aerospace) stopped producing regional aircraft and concentrated on military planes and subsystems. Other companies, however, continued to prosper. While there were undoubtedly many unique factors influencing the destiny of BAE Systems, Fokker and Saab, there similar fate in such a short time span raises the question whether common factors played a role. If these can be identified, important lessons for other companies and industries may be learned. So, our problem statement is: what were the common (as opposed to company-specific) factors that contributed to BAE Systems, Fokker and Saab leaving the regional aircraft market in the 1990's?

Regional aircraft are planes with a capacity of up to about 100 passengers, mainly used for short routes of up to 1000 km. The upper limit is to some extent arbitrary, but is generally accepted in the industry. We confine ourselves to aircraft with 45 to 100 seats. Reasons for this are that these aircraft

were the main products of BAE, Fokker and Saab, and that lowering the lower limit would have forced us to incorporate manufacturers like Beechcraft that did not compete with the above-mentioned companies.

In this contribution, we examine the regional aircraft market in the period 1990-2005 from the perspective of the competitive forces at work in the industry, using Porter's (1980) five forces model as a means of defining groups of actors and their influence on BAE Systems, Saab and Fokker. The components of this model are summarized in Section 3, after addressing the scientific and practical relevance of our study in Section 2. Our method of research is addressed in Section 4. In Section 5, the results are presented. Section 6 contains the conclusions, practical implications and recommendations for further research.

SCIENTIFIC AND PRACTICAL RELEVANCE

The scientific relevance of our work is that it shows that looking at a group of companies can reveal causal relationships that remain hidden if one looks just at individual organizations. Furthermore, this article brings together a number of possible causes of one of the most dramatic shake-ups in the aerospace industry in the past forty years, one that has nit been analyzed in its totality before. Also, it was already known that management decisions can shape a company's future, and that the aerospace industry depends heavily, perhaps more than others, on advanced technology. But how these two factors contributed to the fate of aerospace companies was not clear. We show that availability of technology needs not be the bottleneck, regardless of its importance in isolation, but the strategic vision on how to use technological resources that are basically available to all players is at least as important.

The last point also touches the practical relevance of our study. Operations management has to do with, amongst other things, the identification, mobilization and allocation of resources. Few would argue that technology is an important resource. Operations management is not about the generation of technology, but about its application. The development of complex capital goods like aircraft involves continuous choices which technology to apply. For executives seeking to position themselves within an industry by choosing the appropriate technologies as instruments of competition, out work may be of interest.

THEORETICAL MODEL

Porter's (1980) five forces model describes the competitive forces at work in an industry. As the model is well known, we will describe the forces only briefly, together with the operationalization for our study.

First of all, it should be said that we use Porter's (1980) model only as a means of distinguishing the various groups of actors that generated the factors influencing the fate of BAE, Fokker and Saab. This article is not meant as a theoretical contribution to the development of Porter's model, or as an evaluation of its merits. We probably could have used another means of structuring the players in the regional jet market, but Porter's model is well established and fitted our purpose, so we used it.

In Porter's model, the competitive forces that the players in an industry are confronted with are generated by five groups of actors in the industry itself, plus forces in the wider environment. The groups of actors in the regional aircraft industry are described below. The forces are industry-wide, but the effects they have may differ per player, depending on the unique characteristics of each player. We will show that the effects of, for example, the introduction of new aircraft by a competitor (a factor that potentially has an industry-wide impact) had other effects for BAE, Fokker and Saab than on some of the other regional aircraft manufacturers (who managed to stay in the market).

Porter's five forces are the following:

1. Suppliers. These provide resources like raw materials and semi-finished goods. Main suppliers in the aerospace industry are airframe (fuselage, wings), engine, and avionics manufacturers. While there are worldwide only a few handfuls of 'primes', like Boeing and Airbus, there are hundreds of large and small suppliers. Yearly overviews can be found in the trade journals Aviation Week & Space Technology and Flight International. Primes are almost inevitably also suppliers. For example: Boeing builds its own series of jetliners but supplies one third of the F-22 fighter for the U.S. Air Force. Suppliers often deliver to competing companies. For example: customers for the Boeing 747-400 airliner can close between engines from each of the three main Western engine makers: General Electric, Pratt & Whitney and Rolls-Royce. Also: competitors in one market can be partners in another. General Electric and Pratt & Whitney together build one of the two competing engines form the Airbus

A380 super jumbo. Boeing and Lockheed Martin competed to build the F-35 combat aircraft but build the F-22 fighter together.

This open market means that we expect technology to be available to all players that can afford it and have the means to utilize it. Since we confine ourselves to the civil market this expectation is reasonable. In the military market the situation is different, as the problems with technology transfer of the F-35 fighter program illustrates (Fulghum *et al.*, 2006; Sweetman, 2001). In effect, we will only look at suppliers when there are indications that products or technologies that turned out to be relevant for the fate of the companies we studied were only selectively available.

2. Buyers. Buyers of the regional aircraft produced by the companies under study are mainly airlines. Some aircraft were sold to the military, but that number is limited. We will therefore confine ourselves to the civil market and assess how demand for the aircraft built by Fokker, BAE Systems and Saab developed.
3. Competitors. At the time, the competitors were, for all practical intents and purposes, a limited number of Western aircraft builders: Avions de Transport Regional (ATR, an alliance of Aerospatiale from France and Italian Alenia), Bombardier (Canada), Boeing and McDonnell Douglas (the latter now part of Boeing) from the USA. Other Western manufacturers built smaller aircraft not relevant for our study (for example: CASA from Spain) and Beechcraft from the United States). Non-Western manufacturers like Yakovlev and Ilyushin from the former USSR had not penetrated the Western market to any meaningful extent. We will look at the aircraft introduced by competitors and their influence on the viability of the products of BAE, Fokker and Saab.
4. New entrants. In 1996, Embraer from Brazil entered the regional jet market. Although the company had previously built turboprop aircraft with up to 30 seats, and military planes, the 50-seat market was new to it. So we consider Embraer a new entrant, in fact the only successful one. Germany's Dornier (later Fairchild Dornier and later still Avcraft) introduced a 30-seat regional aircraft and set out to extend its product line to 50- and 70-seaters, but after continued financial difficulties and several new owners the company finally ceased production of regional aircraft in 2004 after having produced only 30-seat aircraft (Steenhuis *et al.*, 2005). We therefore devote no further attention to it.
5. Substitute products. For regional aircraft, flying distances between 200 and 1000 km, the primary substitute good is the train, especially the high-speed train (Heerkens, 1996). This is also shown by the notion of regional airline representatives that rail transport is subsidized and regional air transport is not, creating a non-level playing field (Doke & Moxon, 2000; Wastnage, 2002). Rail transport is also the mode of transport that has probably affected air transport the most in the period under study, compared to road transport (Doke & Moxon, 2000; Heerkens, 1996).

The above players all execute competitive forces on the three companies under study. But the regional aircraft industry operates in a wider environment, important elements of which are the clients of the airlines that operate regional aircraft, and the various governments. Airlines will be partly guided by the perceived preferences of their clients when acquiring aircraft, but clients have no direct contact with aircraft manufacturers. We will not consider them in our study. Governments are important since most, if not all, aircraft manufacturers receive government support in one form or another, in the form of development grants, direct investment (shares), tax breaks, export help and so on, as the continuing dispute about aircraft subsidies between Europe and the USA indicates (Aboulafia, 2005; Butterworth-Hayes, 2002; Butterworth-Hayes, 2004). It is, however, extremely difficult, if not impossible, to assess the amount of support given. Not only are the support instruments many and varied, but governments and receiving companies alike often have an interest in denying that support is given. Furthermore it is difficult to distinguish cause from effect. Did the Dutch government stop supporting Fokker in 1996 because its planes did not sell well enough or was production stopped because government support was no longer forthcoming (Heerkens & Ulijn, 2000)? For these reasons, and because all companies in the regional aircraft industry receive support and it is hence not an a priori discriminating factor, we exclude government support from our analysis.

Two issues should be kept in mind when looking for common causes of the demise of Fokker, Saab and BAE Systems regional aircraft production:

1) There are several individual factors that played a role. For example, Fokker had a burden of debt after years of losses in the 1990's, partly due to the fact that it had extensively upgraded two aircraft in a very short time. We do not go into individual factors, or their relative importance, due to space constraints.

2) The companies concerned differed in several important ways. Saab built only turboprop aircraft, Fokker and BE Systems built both turboprop and jet aircraft. Fokker built no self-designed military aircraft, the other two did. Both Saab and Fokker were based in small countries with limited financial resources, home market and worldwide political influence, BAE Systems was based in one of the world's leading aviation nations. Yet their fates as far as regional aircraft production is concerned were the same.

RESEARCH METHOD

We used literature study to identify possible factors that led to the discontinuation of the production of regional aircraft at Fokker, BAE Systems and Saab. We also searched for those factors during interviews, at the time and afterwards, with representatives of the companies. We talked to several marketing managers, strategists and airline analysts from these companies, and also to a few representatives from Embraer and Bombardier, and to some experts in marketing and strategy outside the aerospace sector. The interviews were unstructured and often were devoted to several topics besides the one addressed in this study. Amongst the topics discussed were the merits of various (classes of) regional aircraft, technological and market developments, and the strategy of the companies. Also, strengths and weaknesses of the companies and their products were addressed.

This information resulted in a list of possible factors causing the withdrawal of the companies from the regional aircraft market. The next step was to assess for each of these factors whether it was company-specific or not. If it was, it could not be a common factor for all three companies.

The next step was to asses whether possible common factors were not, in fact, industry-wide problems.

Finally, the factors labeled as 'common causes' were, as far as possible, quantified and the exact causal chain that defined the influence of each variable was established through literature study. Factual data and opinions of relevant actors primarily came from trade journals.

This study has the following limitations:

1) Many of the interviews with aerospace executives were informal and took place after the events studied in this paper had taken place. So, the actual cause of events was constructed rather than measured.
2) The aerospace industry consists of a limited number of players, no two of them being really comparable. This makes it possible to amend the conclusions by pointing at distorting idiosyncrasies of the various players. Future research should cover other industries with a larger number of players, such as the consumer electronics industry.

RESULTS

We will use Porter's (1980) five forces model as a structure for presenting the results.

Suppliers

The question is: were actions of suppliers a common cause of the withdrawal of Fokker, Saab and BAE Systems from the regional aircraft market? BAE Systems, Fokker and Saab shared common suppliers, but for major subsystems the suppliers varied. For example, Table 1 shows the suppliers for the engines for each of their regional aircraft (Taylor, 1989; Gould, 2005). In the table we also include some of the main characteristics of the aircraft, for a better understanding of the remainder of this article. Of course, many other suppliers play a role, but the engine is often the most costly subsystem, and the most difficult to change, so the engine supplier potentially has a profound effect on the success of an aircraft program.

From Table 1, it appears unlikely that actions by a single supplier could bring down all products of a single company, let alone the products of the three companies together. All programs, with the possible exception of the Saab 2000, were mature at the time they were stopped. So there is no reason to believe that the quality or cost of suppliers as such was a common cause. In terms of both engine and avionics (aviation electronics) technology, there is no reason to suppose that these technologies were selectively available to some manufacturers and not to others. So we conclude that the competitive forces executed by suppliers had equal effects for all regional aircraft manufacturers and do not explain why BAE, Fokker and Saab left the market while others survived.

Table 1 - Main characteristics of regional aircraft built by BAE Systems, Fokker and Saab, plus engine suppliers

Aircraft type	Type (number) of engines *	Number of seats	Year of first flight	Developed from (year of first flight)	Supplier of engine
BAE Systems ATP	Turboprop (2)	64	1986	Avro 748 (1960)	Pratt & Whitney Canada
BAE Systems BAe 146/RJ/RJX	Jet (4)	73-100	1983	---	Honeywell
Fokker 50	Turboprop (2)	50	1985	F27 (1955)	Pratt & Whitney Canada
Fokker 70/100	Jet (2)	79-107	1986	F28 (1967)	Rolls-Royce
Saab 340	Turboprop (2)	37	1983	---	General Electric
Saab 2000	Turboprop (2)	50	1992	Saab 340 (1983)	Alison (now Rolls-Royce)

- A turboprop engine is a jet engine driving a propeller

Buyers

The question is here: was the demand for the aircraft produced by BAE Systems, Fokker and Saab too low to sustain production, and if so, was there a common cause for this? A good indicator of the role of buyers is the number of regional aircraft delivered (see Table 2). A measure of success for individual aircraft programs is the number of aircraft sold relative to the break-even point: the point at which the revenues of sold aircraft equal the total development and production cost. An aircraft program only generates profit after the break-even point is passed. The problem is that the break-even point is a closely guarded secret. In the literature and in conversations with aerospace executives we came across figures from 60 for a new version of an aircraft to 500 for a completely new aircraft, but no definitive figures are available.. For the new Airbus A380, one of the most expensive airliners ever designed, the accepted break-even point is 250 examples plus or minus 10% (Pilling, 2005).

Table 2 lists actual deliveries and not orders, because the latter are rather volatile (are cancelled frequently) and deliveries follow orders by only 1-2 years, so for the period studied (BAE systems was the last to leave the regional aircraft market in 2001) deliveries give a good indication of the success of the various aircraft programmers in the relevant timeframe.

Table 2 - Numbers of regional aircraft delivered until 2005 by BAE Systems, Fokker and Saab

Aircraft type *	Number delivered
BAE Systems ATP	62
BAE Systems BAe-146 and RJ	390
Fokker 50	212
Fokker 70 and 100	324
Saab 340	456
Saab 2000	60

* Versions of the same aircraft but with different designations are taken together

Sources: Kingsley-Jones (2005b); Gould (2005)

We have three seemingly reasonably successful aircraft (Saab 340, BAe-146/RJ and Fokker 100), plus two failures (ATP and Saab 2000), with the rest in the balance, indicating that the companies producing these aircraft had different levels of success in adapting to the competitive forces that the buyers generated. Before we can judge the success of these aircraft, let us first look at the competitors and new entrants.

Competitors

When analyzing competition between regional aircraft manufacturers, it should be borne in mind that not every plane competes with every other plane. Generally, the regional aircraft market can be segmented on two criteria: number of seats and type of propulsion. An airline wanting to acquire a new aircraft will first look at how many passengers, on average, need to be transported. As there are only a limited number of sizes available, generally an airline has to choose between a 50-seater, a 70-seater, a 85-90-seater and a 100-110-seater. The choice of powerplant determines, amongst other things, productivity and operating cost. The segmentation of regional aircraft according to size and powerplant is depicted in Table 3.

Table 3 - Market segmentation of main types of regional aircraft

	50 seats	**70 seats**	**85 seats**	**100 seats or more**
Turboprop	Fokker 50, ATR42 Dash 8-300	ATR72, ATP, Dash 8-Q400	None	None
Jet	CRJ100/200/440, ERJ140/145	BAe-146-100, CRJ700 series, ERJ170 (since 2004), Fokker 70	BAe 146-200/RJ70, CRJ900 series, ERJ175 (since 2004)	BAe RJ85/RJ100, Fokker 100, MD-87/Boeing 717, Boeing 737-500/600, ERJ190/195 (since 2005)

Let us first look at how well the competitors did compared to BAE Systems, Fokker and Saab. In Table 4, total numbers of aircraft delivered are shown until 2005.

Table 4: Numbers of regional aircraft delivered until 2005 by the competition

Aircraft type *	**Number delivered**
Airbus A318	25 (779 if 124-seat A319 is included)
ATR42 and 72	680
Boeing MD87 and 717	MD87 not available, 717: 146
Boeing 737-500 and -600	Approx. 443
Bombardier Dash 8	716
Bombardier CRJ100, 200 and 440	1013
Bombardier CRJ 700 and 900	253
Embraer EMB140 and 145	843
Embraer ERJ170, 175, 190 and 195	92

* Versions of the same aircraft but with different designations are taken together

Sources: Kingsley-Jones (2005b); Gould (2005)

In this table, as far as jets are concerned, 50-seat and 70-100-seat aircraft are depicted separately. The jets in Table 2 all fall in the 70-100-seat category. For turboprops, this distinction is less relevant, as will become clear.

From Tables 2 and 4 combined, we see that Bowing, and to a certain extent Airbus, are more successful, by a considerable margin, in the 100-seat market than both BAE Systems and Fokker. ATR and Bombardier are much more successful in the 50-seat turboprop market than BAE Systems, Saab and Fokker. We shall see that the relative lack of success may indeed point at two common causes; one highly likely and one probably. Fir the first common cause we return to the market segmentation depicted in Table 3: turboprop and jet aircraft. In Table 5, the numbers of turboprop and jet aircraft (all types combined) delivered in the period 1991-2004 (no definitive figures for 2005 were available).

Table 5 - Numbers of regional turboprop and jet aircraft (all types) delivered in 1990-2004

Year	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Number of turboprops	398	341	251	216	206	244	238	184	154	105	91	78	65	27	36
Number of jets	1	1	5	24	30	61	72	88	131	191	283	328	318	304	294

Source: Kingsley-Jones, 2005a

Tables 5 shows an interesting trend: production of turboprop aircraft diminished dramatically in the late 1990's. In the 1980's the turboprop market was very healthy, 410 examples of the ATR42 and 72, the most successful turboprop family, being delivered in the period 1985-1994, the first 10 years of production (Kingsley-Jones, 2005). It was suspected for some time, and is now generally accepted in the industry, that the introduction of 50-seat regional jets from 1992 onwards, caused what some saw as the definitive demise of the turboprop passenger aircraft (Aboulafia, 2006; Kingsley-Jones, 2005; Kingsley-Jones, 2005a, Kingsley-Jones, 2006). It was not so that there had been no 40-60-seat jet aircraft before 1992, but these were not nearly as suitable for regional operations as the latter regional jets. The main reasons why regional jets were so in demand in the 1990's are (Kingsley-Jones, 2005; Kingsley-Jones, 2005a; Aboulafia, 2006; Heerkens, 2006, in press): their higher cruise speed (shortening traveling time and increasing the number of destinations that could be reached within a given flight time), their greater productivity; and the perceived greater comfort and safety compared to turboprop aircraft.

The rise of the regional jets was, of course, an industry-wide phenomenon. It does not explain why production of the Fokker 100, the Saab 340, Saab 2000 and ATP was stopped, while the Dash 8, ATR42 and ATR72 continued to be built. The Saab 340 was too small (34 seats) to be directly affected by the coming of the regional jets, but the number of deliveries of all sizes of turboprops went down (Kingsley-Jones, 2005a) and Saab concentrated on the Saab 2000. The ATP had so few orders that it is hard to see how it could have become a success even without the threat of the regional jets. As far as the Fokker 50 is concerned; it remained in production until Fokker went bankrupt in 1996. The question is then: did Fokker go under (partly) because of lack of success of the Fokker 50? This seems to be the case (Heerkens & Ulijn, 2000). The Fokker 50 certainly was much less successful than the ATR-series, as can be seen from Table 4. The reasons are likely to be aircraft characteristics like price/quality ratio (Heerkens & Ulijn, 2000), so, individual and not common factors.

Contrary to the Fokker 50, Saab was not forced to stop production of the Saab 340 and 2000 because of calamities like bankruptcy. It took the decision because 'the production has not been profitable and the demand for turboprops has not been satisfactory' (Saab Group annual report 1997, p. 7). This is not surprising given the plane's lack of sales up till then. Like was the case with the Fokker 50, this seems to be due to aircraft-specific factors that we will not go into. We see that a common cause (lack of sales success) may be due to individual factors (aircraft characteristics).

The above may explain why Fokker and Saab stopped production of their turboprop aircraft, but does not make clear why ATR and Bombardier continued. In the case of ATR, the installed base was such that the break-even point should have been passed (although this cannot be said with certainty), so that it was possible to continue low-rate production as long as orders kept coming in, in the hope of a reversal of fortunes (which did indeed occur in 2005). Furthermore, ATR harbored the long-time ambition to develop a jet aircraft of its own (Kingsley-Jones, 2005). Since the ATR42 and -72 were the company's only products, stopping production would have deprived Aerospatiale and Alenia of the logical vehicle for developing their jet transport. There are no indications that the two companies even seriously considered abandoning ATR.

As for Bombardier, it could afford to continue production the Dash 8 since its financial health was assured by the success of its regional jets. Here, too, the company seems to have wanted to have several 'irons in the fire' in the market for regional aircraft. Anyway, even if Bombardier had abandoned the Dash 8, she would not have left the regional aircraft market like Fokker, Saab and BAE Systems did.

After this discussion of the 50-70-seat market, let us now look at the 80-100-seat market. Saab was not active here, but Fokker built the Fokker 100 and the smaller Fokker 70, and BAE Systems produced the BAe-146 (later called RJ). These aircraft did not face competition from regional jets, although this has since changed with the introduction of the CRJ700, CRJ900, EMB170/175 and EMB 190/195.

Of the competitors of Fokker and BAE Systems on the 100-seat market, Boeing and Airbus are still active. McDonnell Douglas was taken over by Boeing in 1996. By that time the MD-87 had given way to

the improved MD95, fitted with new engines. In January 2005, Boeing announced that production of this aircraft, now renamed Boeing 717, would be stopped, citing a lack of order potential as the main reason (Norris, 2005). 155 were ordered (Gould, 2005), The other McDonnell aircraft were already out of production, making the 717 a standalone aircraft. The other two 100-seaters, the Boeing 737-500 (now superseded by the improved 737-600) and Airbus A318, are still in production. Both planes were developed as smaller derivatives of, respectively, the 737-300 and A320 150-seaters. They make it possible for airlines to have one 'family' of planes, consisting of members with different numbers of seats. Having one family of planes reduces maintenance and training costs. The numbers of planes in service in 2005, respectively 443 (737-500 and-600) and 25, do not indicate a huge dominance versus the Fokker 100 and BAe 146/ RJ, all versions (373 and 313.in service) (Gould, 2005; Kingsley-Jones, 2005b). The market success of the A318 and 737-500 seems to have been no valid reason for Fokker and BAE Systems to leave the market, especially not since the 737-500/600 have been around as long as the BAe-146 and Fokker 100 (the A318 is much newer which partially explains the small numbers in service, but if we include the 124-seat A319 Airbus is also very successful). Fokker, going bankrupt, obviously failed to make money on aircraft production, regardless of the market success of the Fokker 100, and BAE Systems stopped production of the BAe 146/RJ (only shortly after having upgraded it as the Avro RJX-series) in 2001. The reason given in the annual report of BAE Systems in 2001 (p. 11) was that after the attacks on 11 September of that year 'in this deteriorating market environment, regional aircraft production is no longer viable'. It would be extraordinary for an aircraft producer to stop production of an aircraft on the ground of one event, however calamitous, and we may safely assume that the real reason was a lack or order potential. So, at first sight, there seems to be no direct common cause for the suspension of Fokker 100 and BAe 146 production. But it is striking that all stand-alone aircraft (Fokker 100, BAe 146 and Boeing 717, were abandoned while the 'family' aircraft (737-500/600 and A318) are still in production. Several new 100-seat projects were conceived in the last 15 years and all came to grief, the latest being the Bombardier CSeries (Warwick, 2006; Warwick, 2006a). What the figures also make clear is that the number of 100-seat aircraft in service is relatively small compared to number of aircraft in the next-bigger market segment: the 150-seat aircraft. This segment is dominated by the 737-300/400 and Airbus A320, with, respectively, 1776 and 1430 delivered (Kingsley-Jones, 2005b). This shows that, although Fokker and BAE Systems may, ideally, have been able to sell enough 100-seaters to break even, Boeing and Airbus can afford to sell their 100-seaters at far more favorable terms, amortizing development cost over a much larger number of aircraft and exploiting the sales potential of the 'family' benefit. This puts a big question mark on Fokkers and BAE Systems' ability to generate enough funds to eventually develop successors to their aircraft. Even if Fokker had not gone bankrupt, it seems possible that the company would have had to leave toe 100-seat market just as BAE Systems did.

We conclude that the introduction of the regional jets, in combination with the relatively modest sales success of the Fokker 50 and Saab 2000 plus the absence of other 50-seat products to ride out the onslaught of the regional jets was an important cause for the lack of success of Fokker and Saab on the 50-seat regional aircraft market. The lack of success in the 100-seat market that contributed to the bankruptcy of Fokker and to the abandoning of the BAe 146 may have been partly due to the fact that both were standalone products and that the market for 100-seat aircraft was relatively small compared to that of, for example, 150-seat aircraft. All in all, we see that the forces generated by competitors had different effects on Fokker, BAE and Saab, who withdraw from the regional aircraft market, than on the successful players (ATR, Bombardier and Embraer and, for the 100-seat market, Boeing and Airbus).

New entrants

As stated above, with the exception of Dornier (not to be discussed further), Embraer was the only new entrant in the market for regional aircraft with 50 or more seats. It entered the market in 1996 with its growing regional jet family. So, the first critical years in which the foundation for the success of the regional jets was laid and the fate of Fokker was sealed, Embraer was only present with 'paper' aircraft (aircraft still in development). With the Saab 2000 the situation was different. If Embraer had not decided to build regional jets, Bombardier would have had the market alone for some more time (later perhaps more successfully joined by Dornier), but lack of production capacity may have forced some airlines to settle for the Saab 2000. Bur this is, of course, highly speculative, and it is unlikely, with the obvious success of the regional jets, that Bombardier would have maintained a monopoly or would not greatly have expanded production capacity. It is unlikely the Saab 2000 would have been able to cope in the long run. As for the Fokker 100 and BAe 146, only after production of those aircraft had ceased did Embraer

enter the market for 70-90-seats regional jets. The influence of Embraer on the fate of BAE Systems, Fokker and Saab in the regional aircraft market is thus small and in any way indirect.

Substitute products

In the USA, the substitute product we identified, rail transport, plays only a limited role. In Europe the situation is different, and furthermore, great changes took place in the 1990's in the form of the establishment of a high-speed train network (Heerkens, 1996). But since high-speed trains run only between major cities, high-density routes flown with much bigger aircraft (150-seats or more) would be much more affected. They were, but only temporarily, and now low-cost carriers operating 150-seat aircraft thank their successes to exactly this type of routes (Heerkens, 1996; Campbell & Kingsley-Jones, 2002). The increased competition from high-speed trains may have induced some airlines to buy regional jets instead of turboprops, but the Saab 2000 should also have benefited and it does not explain why ATR remained in business. All in all, substitute products do not appear to have had a major influence on the fate of Saab, BAE Systems and Fokker.

CONCLUSION AND DISCUSSION

We have identified one common cause for the withdrawal of BAE Systems, Fokker and Saab from the regional aircraft market: the emergence of the regional jets. A possible common cause relating to Fokker and BAE Systems may be the fact that their 100-seat aircraft were standalone products. While we did not go into factors pertaining to each individual company, we identified one clear boundary between common and individual factors. The (lack of) success of certain aircraft was a common factor, the reasons for differences in aircraft characteristics likely follow from factors unique for each individual company.

Apart from the fact that the relevance of the common cause is difficult to establish (after all, there also were a number of factors pertaining to individual companies, see, for example, Heerkens & Ulijn, 2000), a logical question is why regional jets were only developed by Bombardier and new entrant Embraer. Bombardier had an ideal platform to start from (the Challenger business jet), and Embraer made the risky but potentially lucrative choice to enter the market with a product that the traditional players, with the exception of Bombardier, could not match, but why did BAE Systems, Fokker or Saab not develop a regional jet of their own? This question lies outside the scope of this article, for us it is enough that they didn't. But it certainly is an interesting subject for further research. Technology utilization seems to have been much more relevant here than technology acquisition. This notion should be borne in mind by managers deciding on the development of new products.

Is the exercise of trying to find common, but not industry-wide, causes for the fate of a limited number of companies scientifically useful? It definitely is. It lets us understand the workings of an industry better. This class of factors misses the appeal of the blanket explanation of the fate of either an entire industry or of one company, and will thus never prevail as a single explanation. Always, additional explanations at the individual company level remain necessary, for the simple reason that companies are never alike and thus never react alike to common factors. But common factors draw our attention to aspects in which companies are not unique, and hence encourage the generalization that is necessary for theory-building. For practitioners, the concept of common factors is valuable, since they may be outside the normally perceived scope of direct influence, but their consequences may be controlled to a certain extent so as to differentiate the company from its competitors. If BAE Systems, for example, had embarked on the development of a regional jet before Embraer did, the company might still be a player in the regional aircraft market. It was already known that management decisions can shape a company's future, and that the aerospace industry depends, perhaps more than others, on advanced technology. But we have shown that availability of technology need not be the bottleneck, but the strategic vision on how to use technological resources that are basically available to all players. We recommend that in future research emphasis is placed on the different uses of available technology by successful and failed companies; and not merely to the technological resources available within enterprises.

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