

**Indian Aircraft Industry: Possible Innovations for Success in the Twenty-First Century**, by Vivek Kapur,  
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Taking off in 1940 with the establishment of Hindustan Aircraft Limited (later named Hindustan Aeronautics Limited or HAL), the Indian aviation industry has grown in spurts over the past seven decades and more. During the initial phase, HAL provided maintenance support to various combat aircraft of the allied forces in World War II and, subsequently, commenced licenced production of combat aircraft. After Independence in 1947 and its nationalisation, HAL grew in strength to design combat aircraft. The Indian Air Force (IAF) inducted HAL designed and built fighter aircraft HF24 Marut and trainer aircraft HT2, HJT16 and HPT32 into its fleet. A number of HAL licence-produced fighters, trainers, transport aircraft, and helicopters were inducted as well.

The Indian aviation industry and HAL remained synonymous for a very long time, with both struggling over the years. The inability to manufacture a suitable engine or generate and develop an indigenous engine technology saw the downfall of HF24 after limited production to equip three IAF squadrons. India's low technological base and isolation meant that the high Air Staff Qualitative Requirements (ASQRs) defined by the IAF for the HF24 could not be met. Therefore, instead of maturing with age to meet the growing national demand for aviation

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assets, HAL gradually lost steam. From being a designer, it slipped back to the lowly status of a licenced production facility to primarily meet IAF requirements. Eco-systems required to design, develop and produce aircraft sprouted many a time at the organisation, only to be quelled. After HF24, practically, the current under-production Advanced Light Helicopter (ALH) and Light Combat Aircraft (LCA) are two stars of HAL, albeit trying to shine. Thus India, with the fourth largest air force in the world, retains the dubious distinction of operating largest fleet of foreign-designed aircraft. The picture is bleaker in the civil aviation domain.

How did the Indian aviation industry grow, or rather, fail to grow? Tracing its history from the day Seth Walchand Hirachand conceptualised the idea of HAL till the current scenario, the author Vivek Kapur, a former IAF fighter pilot, has chronologically marked all milestones in his book *Indian Aircraft Industry*. In the first two chapters, the genesis of, and initial lessons learnt, by the Indian aircraft industry are covered in detail. The third chapter deals with theoretical application of innovation models with practical examples from aviation industry across the globe. The next three chapters cover case studies of development of aviation industries in China, Brazil, the United States (US), and the erstwhile Soviet Union. In the end, four possible models for development of Indian aircraft industry are suggested. Overall, the book has an apt structure for a study of this nature.

Kapur covers in detail HAL's 28 major projects along with their background, technical and operational imperatives. The inability to learn from the past experiences and global trends is evident from the lessons marked after each project. Kapur has included a chapter on innovation as well, giving theoretical aspects and certain practical examples from the aviation world. His discussion prods the reader to wonder: is innovation not a part of everyday life and every industry? There is nothing unique about innovation in aviation. In fact, aviation came into existence, to be precise, as innovation. Every industry needs to innovate to survive and be relevant to the changing operational and technical environment. Those who fail to innovate are destined to stagnate and perish in this competitive world. Unfortunately, it is this inability that shines throughout the narration.

Like any other industry, the Indian aviation industry is based on four pillars—policy, technology, manufacturing, and the end-user. The abysmal state of the Indian aviation industry is a result of incoherence and

disconnect amongst these four verticals. The necessity of developing an indigenous aviation industry was realised as early as 1940, but it was not backed by a realistic long-term policy. Although HAL's nationalisation did give it an initial impetus, the failure to allow competitors in the field, in effect ensuring a monopoly, resulted in a monolith that moved at a glacial pace. Strategic direction and appetite for higher risk and investment in research and development (R&D) were missing after the HF24 experiment. Thus, efficiency and creativity became causalities and what should have been an organic growth of both the organisation and an indigenous aviation industry, stalled. Unaccounted government support, a captive market in terms of the Indian Armed Forces, and reliance on foreign vendors to supply technology reduced HAL to a mere assembly-line functionary.

It is true that India went through phases of technological isolation owing to various political and diplomatic reasons. However, the intervening periods were not utilised efficiently to build a core of technical expertise. Contrast this with the development of India's indigenous space and nuclear programmes. The model followed by the Indian Space Research Organisation (ISRO) focussed on quality expansion rather than quantity expansion. Yet we find that this was not applied to the aviation sector. What eventually followed was the supremacy of mediocracy. Even today, India is far from developing a suitable engine technology for aviation. The LCA project bore the brunt of this shortcoming. All is not bleak, however. The growth of indigenous software industry has ensured that we are self-sufficient in some technological aspects.

The Indian Armed Forces are the prime end-users of aviation assets in India and are looking for over 500 platforms in various categories in the next decade alone! The demand in the civil aviation sector too is rising. This boom in demand could trigger an expansion of the domestic aviation industry and lead it to maturity. For this, the analysis of different models that have been developed and followed across the world and the lessons learnt during their application are relevant. The author looks at four case studies—Brazil, China, Russia and the US—that provide the requisite backdrop.

Kapur objectively analyses the varying conditions and stages of evolution of aviation industry in these four countries. His research underscores the following critical facets: sustained support by the governments; development of the integrator model; interface with the end-user; and logical production scales. Having said that, the industry

too has to be ready to keep pace with the demand in terms of technology and manufacturing. Assured quality control and adherence to delivery timelines are two parameters on which the end-user will judge the industry and decide on backing it further or backing off entirely. Today, private-sector entities such as Tata Aero Space Limited—in a joint venture with Lockheed Martin, and aiming at the manufacture of fuselage section of C130—are appearing on the horizon, albeit at the lower end of the spectrum and limited scales. For the domestic aviation manufacturing industry to grow, these private ventures need to expand manufacturing processes to include high technology aviation equipment. For that, the order book will have to initially depend on the Government of India (GoI). Even GoI needs to move aggressively to form joint ventures with technologically relevant aviation manufacturers. The BrahMos model has yielded results and needs replication. In the aviation space, the Kamov helicopter manufacturing, whenever it commences, may provide the requisite boost to this sector.

While it is natural for the combat forces to seek the best combat equipment, their desires need to be realistic too. The ASQR for HF24 in the 1950s (p. 41) cannot be met by most of the combat aircraft in the IAF inventory even today! Although the end-user cannot be held accountable for the failure of the industry to grow, a pragmatic hand-holding approach is also required. Expansion of scale with greater visibility can assist the industry to cut production costs and lead to economies of scale. The sector has high R&D costs and the risks are extraordinary. As the largest consumer is the government itself, unless a part of the risk is covered by it, private ventures will remain sceptical. At the same time, denying entry to private players with a level playing field would make it difficult to reinvigorate the dormant aviation industry. On the policy front, some movement has been made by the concept of the Strategic Partnership (SP) in Defence Procurement Procedure (DPP). But, if not modulated properly, the model could turn out to be remain in assembly-line mode and unable to scale up beyond it. The assembly-line model has limited implications as has been witnessed in the last six decades. Therefore, disruptive innovation is the answer and should be the approach of the government.

Competing social sector priorities, the lack of industrial development, and short-sighted vision and policies allowed the Indian aviation industry to just about exist. At the end of his exhaustive study, Kapur suggests four different models for the development of aviation industry in India.

These are based on varying degrees of government control, ranging from complete to zero, and on the economics of R&D. A visionary policy and support by the government; efficiency and creativity by the industry; an investment in knowledge and focus on research and development to bridge the technological gap; and a practical and pragmatic end-user will assist in generating the requisite ecosystem. The need of the hour is to strike a balance between these four pillars in terms of the Indian aviation industry. Unless a holistic review is carried out with all stakeholders, and an impetus given on all four fronts simultaneously, it will take a long time before Indian aviation industry can be counted in the sky.

Notwithstanding severe limitations in the suggested options to develop the aviation manufacturing industry in India, *Indian Aircraft Industry* is a very valuable book indeed. Details in the book give a holistic picture of what has occurred over time in this sector in India and in four important aviation hubs across the globe. It is an ideal backgrounder for anyone interested in understanding Indian aviation manufacturing. Hopefully, this book will trigger a debate about steps to be taken to revamp the policies and processes and put India on the aviation map with realistic goals.

