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The Journey of Ethiopian Airlines

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AFRICAN DEVELOPMENT BANK GROUP

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Abstract

Despite sceptics who believed Ethiopia lacked the comparative advantage to adopt the latest aviation technologies, Ethiopian Airlines (EAL) has in the past seven decades narrowed the gap between itself and leading global players in the aviation industry by upgrading its technological, organizational, and management capabilities. This paper reviews EAL's journey to build an internationally competitive airline, explores the challenges and complexities of learning for African firms, and examines implications for capability building and catch-up in late-latecomer countries. One key to EAL's success was the partnership with a leading global player, TWA. Another was a strong commitment to "Ethiopianization" from an early stage, which increased learning intensity and highlighted the industry's narrow latitude for poor performance. In the early 21st century, EAL embarked on Vision 2025, at the heart of which are technological capability development, skills formation, aggressive new market development, and commitment to Pan-Africanism. The story shows that African firms can successfully move closer to the productivity frontier in a particularly challenging industry.

Keywords: Learning, capability building, catch-up, Ethiopia, aviation industry, intensity of learning

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1 | Gate open: An introduction to Ethiopian Airlines

This study examines firm-level technological learning and catch-up in Africa, using Ethiopian Airlines (EAL) as a case study.[1] EAL was established in April 1946, barely a year after the end of the Second World War. At the time, sceptics doubted the wisdom of transferring modern technology and management culture into a country that lacked the capabilities to administer them and apply its comparative advantage. In the past seven decades, however, EAL, confounding the sceptics, has evolved from a small domestic airline into a fully integrated, technologically sophisticated, internationally competitive, and highly profitable 21st century aviation company. By 2019, EAL's use of cutting-edge technology and modern organizational and management techniques, has allowed to serve more than 115 international destinations, including more cities in Africa than any other airline (Appendix 1).[2]

A July 2018 cover story in the widely read Airline Weekly remarked, "When Ethiopian Airlines started life in 1946, it did so with the help of America's TWA [Trans World Airlines]. Who back then imagined it would be the African airline, not the American one, still alive and thriving 72 years later?" The article, "Diamond in the Rough," featured EAL's remarkable success despite being rooted in one of the world's poorest countries: "[In 2017] Africa's strongest airline grew at a lightning pace."

The prime drivers of this growth were the support of a disciplined state and an obsessive focus on developing technological capability and the intensity of learning, a strategic approach that enabled the company to align itself with the future of the aviation industry. EAL has acquired the technical and operational capability to repair and overhaul the latest commercial aircraft; to train pilots, aircraft engineers, and technical personnel; and to offer intercontinental cargo services in partnership with leading global service providers. In 2011, EAL became a member of Star Alliance, meaning it had narrowed the gap between itself and leading industry players and achieved international best-practice standards. In the past few years, EAL emerged as a major overseas investor and exporter of technical and management services. By early 2019, EAL will have acquired equity in several other African airlines and secured contracts to provide technical, operational, and management services to other various airlines.[3]

This study analyzes how EAL acquired and developed these technological and organizational capabilities in a low-income agricultural economy with limited skills, few technological capabilities, and a low knowledge base. Conventional wisdom says that successful technological learning and catch-up require prior development of technical, social, and organizational capabilities by learning by doing through assimilation, adaptation, and mastery of international technologies.[4]

Building these capabilities—or "absorptive capacity"—requires considerable investment, intensive learning, specialized skills development, and constant upgrading, especially as economic and technological development progresses.[5] These factors are often cited as distinguishing countries that have caught up (such as Japan, South Korea, and Taiwan) from those that are stuck in the middle-income trap—unable to move beyond a certain level of technological capability—and from those that lag behind, including many low-income African countries that lack even rudimentary technological capabilities.

The EAL experience raises several important research questions. How did EAL acquire the technological and organizational capability to transform itself from a small domestic airline into a global competitor exporting technical, operational, and management services? Why was EAL more successful than other African carriers? Can EAL's learning and catch-up model be emulated by other firms in Ethiopia and other late-latecomer countries in Africa? And what are the implications of EAL's learning and catch-up model for future research in late-latecomer countries?

2 | Learning and catch-up for late-latecomers

The pioneering work of Friedrich List and Alexander Hamilton has shed light on the challenges and pathways of technological capability building, and on catch-up by the latecomers of the 19th century—the United States and such continental European countries such as Germany.[6] In post–World War II economic development discourse, Albert Hirschman and Alexander Gerschenkron advanced the proposition that late starters in industrialization have opportunities to catch up based on "latecomer advantages"—learning from the frontrunners.[7] Extensive research has studied the dynamics of technological learning and capability building by latecomers and the role of industrial policy in fostering learning capability.[8] A series of firm-level empirical studies focused on the successful learning and

1 Since the airline's establishment in 1946, its official name has changed several times from, for example, "Ethiopian Air Lines" before 1965 to "ETHIOPIAN" to, more recently with the expansion of the range of services, to "EAG" (Ethiopian Aviation Group). In this study EAL will be used consistently.
2 EAL 2018a.
3 In 2018, EAL was equity shareholder and managing operator in more than six airways (EAL 2018b; Economist 2018).
4 Cohen and Levinthal 1990. These authors underscore the importance of absorptive capacity for learning and innovation and highlight that "the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities" (p. 128).
5 Cohen and Levinthal 1990.
6 Cohen and DeLong 2016; List 1856.
7 Gerschenkron 1962; Hirschman 1958.
8 Bell 1984; Freeman 1987; Kim 1997; Lall 1992.

catch-up experiences of the newly industrializing East Asian economies.[9] In parallel, other scholars advanced the notion of national innovation systems and viewed technological learning and capability building as an interactive process that goes beyond the firm to the sectoral and national levels.[10]

However, most research on learning and catch-up has focused either on latecomers that have succeeded (the familiar cases in East Asia) and those that gained considerable technological capability but remain far from catch-up, such as Brazil, India, Mexico, and Turkey. Very little research has examined firms and countries in the early stages of technological development and industrialization—which include practically all African countries.[11] The potential for and challenges to their technological learning and catch-up requires further exploration. So does the question whether their being late-latecomers in the 21st century constitutes an advantage or a disadvantage.

3 | Ethiopian Airlines against the odds

In 1946, when most of Africa was still under colonial rule, aviation would have been considered an "alien industry" for Ethiopia, a poor African country totally reliant on subsistence agriculture with an illiteracy rate of more than 96 percent. When EAL was first established, Ethiopia had only two secondary schools and no tertiary institution. Influential mainstream economists of the day would have advised that an aviation industry was out of line with Ethiopia's comparative advantage.

Over the past seven decades, more than 5,000 airlines have secured International Civil Aviation Organization (ICAO) codes, but only a small number have survived beyond 10 years. EAL is one of them. Its journey is thus a rare African catch-up story, teaching the centrality and complexity of technological learning and the role of a disciplined state in building a national champion. It gives hope to African policymakers that, despite the odds and numerous internal and external constraints, catching up is possible even for late-latecomers in the early 21st century.[12]

EAL's story defies the notion of comparative advantage and other conventional nostrums. By 2018, EAL had acquired its 100th airplane—a Dreamliner—and grown its annual passenger count to more than 12 million (Appendix 1). In the same year, it was voted Best African Airline and was ranked 40th in customer service and 24th in size by the World Airline Awards.[13] Its medium-term vision includes doubling the number of aircraft in its fleet to 200 and increasing the number of annual passengers to 25 million by 2025-30. EAL estimates that its total revenue will also double from the target of US$5 billion in 2019 (more than Ethiopia's projected earnings from merchandise exports) to US$10 billion by 2025-30. EAL expects to transport more than 1 million tons of cargo within the next decade, building on a joint venture with DHL Logistics.[14] EAL is also forging partnerships with such leading component and commercial aircraft manufacturers as Boeing, GE, and Airbus and their sub-contractors, ultimately aiming to build a new aerospace manufacturing hub.[15]

EAL developed in three distinct phases. In the first, the airline built absorptive capacity and capability through learning by doing in partnership with TWA, and it pursued a proactive Ethiopianization or localization policy. This phase lasted from EAL's establishment in 1946 until the end of the TWA partnership 1975. In the second phase from 1975 to 2000, by managing a series of externally generated crises, EAL protected and maintained the capability and corporate independence acquired during the first phase and built further capability. In the third phase, which began with the new millennium, EAL has upgraded its capability, improved its processes, diversified its competencies, and caught up.

4 | Take off: The rise of the Ethiopian aviation industry (1946–75)

Partnership with TWA: The genesis

Right after the Second World War, Ethiopia was the only independent African sovereign state, and a founding member of the United Nations.[16] The Ethiopian government, as part of a modernization initiative, committed to establishing a commercial airline to integrate the country politically and economically—the most rational and cost-effective strategy because of the rugged and mountainous terrain and inadequate roads and railways. With the assistance of Swedish Count Eric von Rosen, the Ethiopian government initially approached the Swedish carrier ABA, and an agreement was due to be signed in December 1945.[17] However, in June 1945, the Ethiopian delegation attending the United Nations founding conference in New York met with U.S. state department representatives and requested technical assistance in establishing a commercial airline, primarily for domestic air service. The state department organized an initial meeting with Brigadier-General T. B. Wilson, board chairman of Transcontinental and Western Airlines (TWA, renamed Trans World Airlines in 1950).[18] The Ethiopian government signed an agreement with TWA in September 1945, and the new airline was founded on 21 December 1945, commencing operation on 8 April 1946 with five war surplus aircraft. See Table 1 for a summary of the evolution of this partnership overtime.

[10] Huo 2015; Lundvall 1993; Nelson 1993. See also Fagerberg 2005; Fagerberg and Godinko 2005.
[11] Cramer, Oqubay, and Sender forthcoming.
[12] Cramer, Oqubay, and Sender forthcoming.
[13] Skytrax 2018.
[14] Interview with the CEO of EAL, Tewolde Gebremariam (EAL 2018b).
[15] See Oqubay and Lin forthcoming.
[16] The only other African country joining the United Nations in 1945 was the Union of South Africa, which was not an independent state but an autonomous dominion within the British Commonwealth.
[17] EAL 1988.
[18] John Spencer, foreign affairs adviser to the Ethiopian government, helped facilitate the agreement with TWA.

Table 1 EAL–TWA agreements

Agreement	Year	Key content
First	1945	Established EAL, undertook full operation and the procurement of aircraft
Second	1953	Stated clearly the ultimate objective of Ethiopianization
Third	1959	Reinforced the urgency of the Ethiopianization agenda
Fourth	1966	Transferred management from TWA to EAL and appointed an Ethiopian deputy CEO
Fifth	1970	Shifted TWA's role from management to advisory until 1974

The agreement creating the TWA partnership was the first critical step in establishing a small domestic air service and later transforming it into a successful international airline. It was the first of five critical agreements signed during the 30-year partnership to help EAL develop strategic technological capabilities and business competitiveness.

The first agreement laid the foundations, giving TWA full authority to establish and manage the new airline. In many respects, the agreement was similar to subcontracting relationships that evolve from joint operations between transnational corporations (TNCs) and local manufacturing firms through original equipment manufacturing (OEM) arrangements.[19] Under OEM, the foreign partner initially helps select the technology and equipment needed for production; trains managers, engineers, and technicians; and advises on production, financing, and management.[20] Finished products are initially manufactured according to the specifications of the foreign partner, which markets them under its own brand name. As the local partner learns by doing and imitating, and acquires the capability to manufacture to the TNC's specifications, production is gradually transferred to the local firm. The agreement between TWA and EAL foreshadowed such arrangements. TWA was responsible for selecting and procuring all aircraft and the equipment needed to start an aviation industry. It provided all personnel recruited from abroad, including the CEO, management team, pilots and technicians, finance officers, cabin crew, and staff to perform other functions such as catering. It advised on financial arrangements, including facilitating credit for EAL from American banks. It served as the main interlocutor between EAL and aircraft suppliers. And it provided advisory services for all training and technical facilities established in Ethiopia. For its services, TWA was paid a management fee. It was also offered a minority equity share but never took it up.

From the outset, it was understood that TWA would transfer knowledge and build local capacity so that Ethiopians would gradually take over posts held by foreign (mostly American) staff. The Ethiopianization policy was formalized in the second agreement in 1953, which stated, "The ultimate aim is that EAL shall eventually be operated by Ethiopian personnel." The third agreement in 1959 reinforced the localization of expertise, while the fourth in 1966 marked a major milestone, transferring management and appointing as a deputy CEO Semret Medhane, who would become the first Ethiopian CEO in November 1971 on the occasion of the EAL's silver jubilee. The fifth agreement in 1970 articulated the shift of TWA's role from managing to advising. The partnership ended in 1975 when TWA found the venture less attractive. TWA continued to provide services to EAL on request.

Ethiopianization strategy

The Ethiopianization strategy, which took almost three decades, aimed at the eventual takeover by Ethiopians as pilots, technicians, cabin crew, accountants, and marketing personnel. Execution was challenging, particularly preparing Ethiopians for management roles and, due to safety and operational considerations, replacing pilots and technicians. Constant differences of opinion arose between TWA and the Ethiopian authorities on the pace of Ethiopianization.[21] At a time of widespread racism, Ethiopian trainees had to show exceptional skill and competence before they were allowed to replace American pilots.[22] Developing a pool of Ethiopian recruits was a major challenge due to the lack of higher education. At the time, the only institutions that could provide potential recruits were public colleges, the School of Commerce, and the Technical School, which offered pre-tertiary education. To alleviate the skill constraints, an aviation school was established under the Ethiopian Civil Aviation Authority with assistance from TWA.

[19] It is important to note, however, that the TWA–EAL partnership predates the concept and practice of OEM. In this respect, it was a precursor in services of an arrangement that subsequently emerged in manufacturing.
[20] Hobday 2000. The OEM model was prevalent in East Asia and, as Hobday shows, contributed significantly to technological learning and catching up in electronics.
[21] EAL 1988.
[22] EAL 1988.

The difficulties were eased by recruiting the first Ethiopian pilots and technicians from the Ethiopian Air Force. They had been trained well in Ethiopia and the United States and had built a tradition of excellence. Even the candidates for CEO and other positions came from the air force. Key to the success of Ethiopianization were the young Ethiopian staff's exceptional commitment and sense of mission and the board's strong commitment and close follow-up. TWA was also committed to building competence and achieving Ethiopianization because of the implications for its own reputation and credibility. TWA staff's reluctance to compromise on standards contributed to a tradition of excellence, and fostered the ability to operate in the seemingly impossible situation of practically non-existent infrastructure. Two CEOs in particular, Walden Gene Colien and Vic Harell, played a critical role in instilling a spirit of excellence. Although initially aircraft manufacturers and suppliers played a smaller role, later on Boeing was instrumental in building EAL's technological capability, especially after supplying jets in the early 1960s.

Corporate governance during the TWA partnership included a board with two members from TWA and two members representing the Ethiopian government, while the Ethiopian transport minister served as president and board chair. From the start, the U.S. state department followed EAL's development closely, and this political support no doubt contributed to the project's success.

Capabilities and operational performance

Technology selection

An important element of technology and know-how transfer from TWA to EAL was in the selection of technologies appropriate to the unique local operational requirements and conditions. In 1946, Ethiopia had no runways, and TWA advised the purchase of DC3 (Douglas C-47) war surplus aircraft, which had a proven record of operating in rugged terrain and difficult conditions. The fleet was then expanded with a dozen new aircraft (DC 6B and CV-240), which were capable of regional and international flights and could handle more passengers. In 1962, after completion of the new Bole airport, EAL became the first African airline to incorporate Boeing 720B jets into its fleet. EAL's entering the jet age had considerable implications for its technological advancement. Its ability to select technologies served it well over the years, as evidenced by its continuing strategic and pioneering decisions in acquiring new commercial aircraft technologies.

Capability-building facilities

The new aircraft required improved facilities, new skills, and certification and standards. In the first two decades of EAL's existence, TWA helped it establish a range of capability-building assets to boost its absorptive capacity. The Ethiopian Aviation Academy was founded in 1956, and the Pilot School in 1964. Pilot training commenced in 1970 for both Ethiopians and trainees from other African countries.[23] An aircraft maintenance and technical facility was opened in 1957, and the first overhaul of jet engines was conducted in 1964. From the beginning, the aviation academy and its technical facility provided training and maintenance for carriers from Africa and the Middle East, thereby developing strategic technological capabilities and business opportunities. Accreditation and certification met a high standard.

Operational and marketing capability

The corporate and management qualities and capabilities EAL acquired proved beneficial during the early expansion into regional markets and the later multiple crises following the establishment of a socialist regime in 1975. From the early days, TWA instilled in EAL a culture of corporate independence, a need for intensity of learning, and the importance of a strategic approach to marketing. Consequently, EAL's marketing of both domestic and international destinations was aggressive from the start. For instance, EAL surveyed West Africa as early as 1949.[24] In the early 1960s, EAL found that it needed an expanding regional and international flight network to build economies of scale, improve technology, and remain profitable. Consequently, it extended its routes within Africa and to Europe. Soon EAL's annual passenger numbers exceeded 260,000, while its total revenues reached almost ETB 70 million (about US$125,000) by 1971/72 (Appendix 1). Throughout the 1960s, EAL focused on continuous improvement and took the immense challenges posed by rapid growth as opportunities for accelerated learning, primarily through learning by doing, to ensure survival and sustain the growth momentum it had built up. EAL thus vigorously developed its operations and market capability, with TWA as the main driver and as an effective mentor.

5 | Cruising altitude: Sustaining corporate independence in turbulent times, 1975–2000

Crisis management and survival, 1975–91

The last quarter of the 20th century tested EAL with the crises that engulfed Ethiopia, creating instability and economic uncertainty. The airline achieved only modest growth. But its survival in the face of operational challenges and political crisis is testimony to its remarkable progress during the early stage of learning and building absorptive capacity.

Between 1972 and 1975, EAL had already begun the transition to Ethiopian executives and personnel, and after the partnership with TWA was officially terminated in 1975, EAL was managed and operated by Ethiopians.

[23] EAL 1971.
[24] EAL 1988.

The first challenge of the period was the dramatic political instability created by two regime changes. Following the toppling of the emperor in the February 1974 revolution, the Derg—a totalitarian military regime—came to power in 1975. The Derg's socialist economic doctrine was a major obstacle to EAL. Derg officials intervened in the airline's internal corporate affairs, dismissing Semret Medhane and appointing a military general as CEO solely on political grounds.[25] The government also interfered in labor relations, compromising EAL's performance, staff discipline, and conformity with industry practice, which later led to major financial losses that brought EAL close to bankruptcy.[26] This crisis continued into the early 1980s.

In many respects, EAL responded effectively to the crises of the second half of the 1970s and most of the 1980s, demonstrating the corporate independence, self-reliance, ability to operate in an unconventional setting, and capacity to manage and survive setbacks it had acquired during the long partnership with TWA. Four concrete examples illustrate this. First, under pressure from EAL management, Derg officials eventually agreed to appoint someone who understood the industry as CEO. Captain Mohammed, an aviation veteran, accepted the post in 1980 on condition that state intervention in internal matters would stop and that the airline would operate under international business practices rather than socialist doctrines.[27] The Derg accepted the conditions and the new CEO was able to turn around the nearly bankrupt EAL.

Second, the Derg had instructed EAL to cease purchasing American aircraft and to purchase them only from Russia.[28] This would mean a major policy shift for an airline that had built its capabilities and management style on the basis of partnership with a U.S. airline (TWA) and a U.S. aircraft supplier (Boeing). What happened next was clear testimony to EAL's maturity and emergence as an economically crucial industry. EAL management threatened collective resignation, forcing the government to reverse its decision. Subsequently, EAL introduced Boeing 767s, opening new opportunities for nonstop long-distance flights of up to 13 hours across the Atlantic, and replaced its Boeing B720s with the new Boeing 737s. EAL expanded its technical services and training facilities accordingly.

Third, between 1975 and the fall of the Derg government in 1991, Ethiopia was engulfed in a civil war that drained resources and kept the economy stagnant. The decline in tourism caused shrinkage of domestic networks, currency overvaluation, and anti-export bias, constraining EAL's operations. In response, EAL prioritized its strategic routes and introduced measures to enhance effectiveness. As a result, EAL achieved modest growth in its fleet size and operations. It also made its first attempt to assemble an aircraft—the crop-spraying agro-aircraft, Eshet—under license in 1986.[29] Although this venture proved commercially unviable and was discontinued, it demonstrated EAL's catch-up aspirations. Throughout the 1980s, driven by its motto "Bringing Africa Together," EAL vigorously expanded its routes to all African regions, a move that undoubtedly helped to save aviation industry from the fate met by similar industries elsewhere in Africa.

Fourth, the collapse of the Derg regime in 1991 gave rise to a period of tension and uncertainty. The army of the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) approached the capital Addis Ababa, practically placing it under siege. EAL management decided at this critical juncture to protect and save the assets of the company from damage and destruction, should the conflict spill over into the city itself.[30] The management unilaterally decided to move EAL's aircraft to Nairobi, negotiating with the Kenyan Aviation Authority to operate and service EAL's customers from Nairobi until the political tension in Ethiopia abated. This remarkable corporate independence, commitment, and responsibility was only possible because of the corporate culture developed in EAL and the training and commitment of its management.[31]

Transition, lingering crisis, and modest growth (1991–2000)

For nearly a decade following the fall of the Derg in 1991, Ethiopia was in transition from a closed and socialist-oriented economic system to an open and market-based one. The period was also occupied with recovery from nearly two decades of civil war, economic mismanagement, and neglect of infrastructure and institutions. The reconstruction efforts were both financially and organizationally demanding for the new government, which was simultaneously struggling to re-establish economic relations with traditional trading partners. The impact of these developments on EAL was mixed. To EAL's benefit, the reconstruction program repaired and upgraded domestic airports, enabling the expansion of domestic routes and the recovery of tourism. The new government's devaluation of the local currency was also favorable for EAL. Reconstruction began to turn the economy from negative to positive growth, as evidenced by the modest 5 percent annual growth rate achieved following the economic reforms. Economic recovery during the 1990s thus provided a welcome opportunity for EAL to revitalize itself and reinforce the technical and management capabilities it had built over the previous decades. The strategic importance of

[25] EAL 1988.
[26] EAL 1988.
[27] See Oqubay 2019a; 2019b.
[28] EAL 1988.
[29] EAL 1988.
[30] Interviews with former CEO Girma Wake and Group CEO Tewolde Gebremariam in 2018 (EAL 2018b); minutes of the EAL management team.
[31] An important lesson from EAL's experience is its ability to develop a corporate culture and a high level of commitment among top managers and other employees. Part of the explanation may lie in the management style introduced in EAL from its early days, whereby constant engagement by top management with all employees and careful evaluation of staff welfare was a priority. From the early 1950s, several steps improved the well-being and working conditions of employees, including increased vacation time, recreational facilities for all staff, group accident insurance—the first of its kind in Ethiopia—and a collective bargaining system—also the first of its kind in Ethiopia. These and other measures, such a generous retirement plan introduced in 1969 and suggestion boxes to solicit the views of employees, created a sense of belonging and ownership

EAL was further magnified by the Ethio-Eritrean war of 1998–2000 and Eritrea's prior independence from Ethiopia in 1993, which had left Ethiopia landlocked.

But EAL's efforts to reignite growth and resume its expansion were impeded by the political uncertainties and its own changing management during the transition period. Even after 1991, EAL remained in crisis management mode as a result of government interference and the ambiguities of the political and economic environment, according to company insiders. For example, between 1991 and 2000, the board appointed three successive CEOs from within and outside the airline, creating uncertainty and disrupting EAL's longstanding coherent and stable corporate management structure and culture. It also fired 37 senior staff—practically all the top management team—in disagreements over strategy and the future of the airline. A series of ill-advised reforms and policy experiments by the government damaged EAL's performance and undermined the morale of its management team and staff, leading many executive officers and technical personnel to resign. The 1990s were thus a period of transition, confusion, and policy experimentation, and the government's delay in resolving the situation caused unwarranted setbacks in EAL's recovery, growth, and expansion.

This episode shows that a firm's learning and catch-up can be hampered or accelerated by the type of governance and leadership provided. Internal and external crises can waste capabilities created over decades. But crisis in the political and economic environment can also present opportunities for learning by problem-solving and policy experimentation. At EAL, this happened in the 2000s when two EAL veterans, Girma Wake and Tewolde Gebremariam, returned—Wake from Gulf Air to become CEO and Gebremariam from New York to become deputy CEO.[32] The appointment of highly experienced insiders began to turn the fortunes of EAL from managing crises to pursuing growth and upgrading capabilities. The episode also reveals that managing vulnerability and crisis, given their potential to undermine capabilities and hamper catch-up, is as important managing growth.

6 | Upgrading: High growth and catching up in the 21st century, 2001–18

A new chapter in 21st century African aviation

The 1990s and 2000s brought major changes to the global aviation industry. International competition intensified, spurred by advances in information and communications technology, both in general and in the aviation industry.[33] Mergers and acquisitions and alliances between airlines heightened competition. TWA, with about 200 aircraft and considered one of the big four U.S. airlines (along with American, United, and Eastern), ceased operating after 70 years and was acquired by American. Many flagship African carriers were also grounded. At the same time, globalization and the growing need for air connectivity increased opportunities for growth and expansion, including in developing countries exhibiting high levels of sustained growth and prosperity. These developments allowed EAL to realize its vision of becoming an industry leader in Africa and to strategize for the 21st century.

Economies of scale were essential to EAL's vision. Rapid growth and diversification required not only new aircraft but also technical excellence, new market capacity, organizational capabilities, continuous improvement, and a high level of absorptive capacity. With EAL survival threatened by the increasingly competitive market environment, a new board and management team unanimously decided to develop a fundamental new vision and long-term plan for rapid growth. Vision 2010 (a five-year plan for 2006–10) and Vision 2025 (a 15-year plan for 2011–25) laid out a fundamentally new trajectory for the company.

The new vision and the new management team created dynamism and optimism, and the airline surpassed its Vision 2010 targets with high financial performance and considerable market expansion. Within five years, EAL's fleet had increased by 60 percent to 41 commercial aircraft, its annual passenger capacity had doubled to 3.2 million passengers, and its cargo volume had tripled (EAL, 2004; Appendix 1)). The rapid growth inspired still greater confidence and commitment and more ambitious targets in Vision 2025.[34] Within five years, by 2015, EAL had become the largest African airline. In 2018, it transported more than 12 million passengers (a fourfold increase since 2010) and half a million tons of cargo, and had increased its fleet to more than 100 new-generation aircraft (a threefold increase since 2010). Its network widened to 115 international destinations, including Los Angeles and Tokyo. Its China–Africa routes alone are expected to carry 1 million passengers in 2018, making EAL the major airline linking Africa with China.[35] This rapid overall expansion has made EAL the most profitable aviation company in Africa, while other African airlines (including Egypt Air, Kenyan Airways, and South African Airways) have struggled to survive. Progress has been achieved in the face of intense competitive pressure from Gulf and Middle Eastern carriers, which enjoyed economies of scale and large direct and indirect subsidies. Competition from Middle Eastern state-supported airlines remains EAL's most formidable challenge. The intensity of international competition, with mergers and alliances, environmental protection requirements (for both air and ground pollution), and accelerated technology advances, make airline survival increasingly challenging. The aerospace manufacturing industry has consolidated, making Airbus and Boeing an oligopoly of commercial aircraft manufacturers.

In short, EAL's intensity of learning, and its determination to develop technological absorptive capabilities, enabled it to survive the crisis period, to reorganize itself for renewed

[32] Tewolde Gebremariam became CEO in early 2011.
[33] Belobaba 2016.
[34] EAL 2010.
[35] Oqubay and Lin 2019.
[36] Schumpeter 1942.

growth and expansion, and to formulate an ambitious vision and a strategy for catch-up.

Modernizing the fleet and developing technological capability

The size and type of an airline's fleet shape its value to customers and its operational scope and scale. With advanced avionics and aerospace technology, commercial aircraft have seen rapid technological progress. EAL was committed to expand and modernize its fleet as part of its upgrading and catch-up strategy by introducing the latest aircraft to secure first-comer advantages. EAL was the first airline in Africa to order the most modern aircraft—the Boeing Dreamliner B787—and the longest-range commercial aircraft—the Boeing B777-200 LR. After lengthy internal debate (and intense bidding process) EAL decided to diversify its fleet with the Airbus A350, the latest and most environmentally sound aircraft. The technical and operational capabilities EAL accumulated over the years enabled it to acquire the advanced aircraft, which in turn have kept the airline at the frontier of aviation technology, with implications for forming skills, upgrading technology and infrastructure, and building organizational capability.

Although the A350 provided value for money, its acquisition affected EAL's inventory, maintenance facilities, and absorption capacity (in training pilots and technical personnel). All EAL's procurement arrangements include technical specifications and technological capacity development packages (such as training facilities and skill upgrading). EAL originally envisaged acquiring an additional 100 aircraft over 15 years (to 2030), giving it the advantage of a bulk purchase. The initial aspiration of Vision 2025 was to increase the number of aircraft in the fleet to 120 by 2025 (a 20 percent increase), subsequently to be revised to 200 (a 100 percent increase) by 2025-30. Since EAL's annual absorption capacity reached 12 aircraft in 2018, doubling the fleet within a decade seems entirely feasible (Appendix 1).

However, executing the high growth and expansion strategy was by no means smooth due to delays in new aircraft delivery (especially the Dreamliner) and common technical problems in their introduction. The greatest challenges to rapid technological upgrading are preparing sufficient pilots and technicians and managing rapid growth to avoid reducing service quality. Managing growth became a major pressure point, intensifying the need for learning by all staff from cabin crew, pilots, and technicians to the executive leadership. Another major challenge was inadequate physical infrastructure that required a new passenger terminal and cargo terminals. Such tensions are inevitable in a growing and upgrading firm that must improve continuously or risk being paralyzed by crises. EAL's prior learning and capability building were key to resolving each problem and engaging in intense learning.

Improving organizational capability and process

Building technological capability is often narrowly associated with acquiring hardware (machinery and equipment), and fostering innovation with dramatic new inventions. But an alternative view sees building technological capability as acquiring a range of abilities, including organizational capabilities and continuous process improvement. Schumpeter, for example, distinguishes categories of innovation, including new products, new production methods, new inputs, new markets, and new methods of business organization.[36] He distinguishes innovation as continuous improvement and incremental change from radical innovation and technological revolution.[37] Organizational capability and continuous process improvement have arguably been central to EAL's Vision 2025 because of the challenges arising from increasing size to seek economies of scale.

New structure and capability

A new organizational structure became necessary as EAL underwent a strategic shift from airline to a fully diversified aviation group (Ethiopian Aviation Group). Initially, the various services and operations were structured in seven autonomous strategic business units, each operating as an independent profit center: international passenger service, domestic express service, cargo service, technical services (MRO—maintenance, repair, and overhaul), the aviation academy, ground services, and catering and hotel services.[38] With growing, upgrading capabilities, and diversifying into strategic services, EAL needed a more integrated structure that allowed strategic planning, coherence, performance monitoring, and accountability.

The new structure required a fundamental shift affecting all functions, including EAL's strategy for equity shareholding and in providing operational and management services to other African carriers. EAL acquired a 40 percent equity share in ASKY (AfricaSKY Airline),[39] including management services, which allowed it to build a West African hub. Similarly, acquisition of a 49 percent equity share in Air Malawi has enabled EAL to strengthen its Southern African hub. Furthermore, in 2018, EAL's overseas operations expanded with the acquisition of equity shareholding in Guinea Airlines (49 percent), Chad Airlines (49 percent), Zambia Airways (45 percent), and management contracts with CEIBA Intercontinental in Equatorial Guinea and Ethiopian–Mozambique Airlines, a new domestic carrier in Mozambique. EAL has also partnered with DHL Logistics (owning 51

[37] Fagerberg 2005; Fagerberg and Godinko 2005.

[38] EAL's MRO services were established in 1957 to provide MRO for aircraft, engines, and components of Ethiopian and third-party customers. At present, the MRO division employs over 1,800 qualified technical staff, and its facility is certified by international regulatory bodies. In addition to the maintenance base in Addis Ababa, the MRO division has some 60 senior and highly qualified maintenance personnel located at 40 destinations in Africa, Europe, North America, South America, the Middle East, and the Far East. These technical staff provide line maintenance services to both Ethiopian and other carriers.

[39] ASKY is a private passenger airline, founded by West African governments to operate across several West and Central African countries, and based in Lomé, Togo. EAL is a major shareholder in ASKY and provides training, operational, marketing, and maintenance services under management contracts.

percent of the joint company), aiming to move beyond conventional passenger air services to become a leading logistics provider in Africa. EAL has initiated a new program to develop and manage African airports, including air traffic control. The development of a more sophisticated organizational capability, building on knowledge acquired through learning by doing, has thus enabled EAL to spearhead a new strategic initiative, expand revenue streams, and reinforce its presence and competitive position in Africa.[40]

Continuous process improvement and performance

Since mid-2000, EAL has developed several internal process improvement schemes, to which it has adhered consistently. Three are worth highlighting.

First, to achieve competitive excellence and enhance and maintain the airline's credibility and safety records, increase proficiency in engine maintenance, aircraft engineering, and planning capability; increase component maintenance, quality assurance, and environmental management system capability; implement the International Air Transport Association Operational Safety Audit program; and adopt the International Civil Aviation Organization's Safety Management System. EAL also digitized its operations and became a paperless organization.

Second, to ensure continuous improvement, adopt a benchmarking approach that robustly links capability with performance. Although EAL had previously compared its performance with leading African airlines, its board and management decided to upgrade its benchmarking standards to compare its performance with leading global airlines—Singapore Airlines, United, Lufthansa, and Emirates. This has pushed performance closer to the industry's productivity frontier and has had a major impact on EAL's continuous performance improvement.

Third, to develop new market capabilities, build on EAL's core Vision 2025 motto, "The New Spirit of Africa," as its prime marketing strategy.[41] In 2011, following almost two years of mentoring by Lufthansa that triggered improvements in service, processes, and safety standards, EAL became a member of Star Alliance, one of the largest and oldest global alliances. This consolidated EAL's access to wider global markets. New initiatives to upgrade its services such as Cloud 9 business class and Sheba Miles were introduced in the late 2000s.

Building technical capability and skill formation

With EAL's Vision 2025 goals, its focus on skill development, and its traditional technical excellence and self-sufficiency, EAL has developed new capabilities and reinforced its absorptive capacity. For example, the aviation academy has invested in state-of-the-art facilities, including simulators that accommodate the latest aircraft, thus expanding its capacity and upgrading to the level of other leading global aviation academies. Similarly, the pilot school has opened centers in five cities and improved its intake and quality of pilot training. Both the EAL technical school and the cabin crew school have also expanded and upgraded. The technical school can now train more people than EAL can absorb, producing a surplus for the market.

But executive leadership development at different levels is a major limitation. With continued growth of the EAL Group, upgraded human resource management will be essential to motivate and retain the company's 15,000-strong workforce. Priorities include an employee housing project, performance-based payments, staff appraisal, and building a productive relationship between management and unions. Retention of core technical staff is critical to technological capability and organizational memory. To date, the turnover of pilots and technicians has been limited to 1 percent a year, much lower than the industry norm.

Preparations for an aerospace manufacturing facility—part of the government's vision of Ethiopia as Africa's leading manufacturing hub—are complete. With system integrators such as Boeing and Airbus dominating aerospace manufacturing, the success of Ethiopia's initiative depends on EAL's ability to work closely with commercial aircraft manufacturers, component suppliers, and subcontractors. EAL signed a tripartite agreement with sub-manufacturers along with Boeing, Airbus, and other manufacturers in 2018 and has studied existing aerospace manufacturing hubs, such as those in Morocco and Singapore, to extract lessons and ensure the success of its new venture. This new frontier has great potential for technological spillovers and linkages to domestic manufacturing capability. A unique characteristic of EAL and a potential lesson for other late-latecomer firms has been its investment in institutions that enabled it to develop its absorptive capacity. It has invested US$500 million in upgrading its aviation academy and technical services infrastructure and another US$500 million in hubs infrastructure.

6 | Air miles: Implications for policy and technological capability and lessons for late-latecomers

The government and EAL's catch-up

Technological learning and catch-up in Ethiopia's aviation industry would have been impossible without the government's strong commitment and support. EAL was established by the state at a time when no domestic private company had the required capacity, and it was nurtured by the state as a major industrial policy instrument for several decades. From the beginning, EAL was built into a national champion by the government, which maintained self-

[40] See Arrow 1962; Cohen and Levinthal 1989.
[41] Over the years, EAL has adjusted its motto to align with its prevailing strategy. It started with "To go to great length to please," then "Bringing Africa together and closer to the world" to reflect its dominance in the African market.

discipline in its relationship with the airline while playing a developmental role. Even during the 1975–2000 phase, when government interference posed major operational challenges, it was clear that ultimately the government of the day had no interest in jeopardizing the survival of EAL, which has always been regarded as a flagship state enterprise with unofficial corporate independence.

During the 2001–18 phase of EAL's development, the government used the airline as an instrument of industrial policy and offered it new growth opportunities by pushing it to serve the export sector.[42] The Ethiopian floriculture industry, whose development began in the early 2000s, would not have expanded without EAL investment and services. EAL also promotes tourism in all its destinations.

EAL itself has become the largest single generator of export earnings for Ethiopia, accounts for 4 percent of GDP, and has directly or indirectly created employment for 50,000 people. It has achieved a high level of domestic technological capability in a technology-intensive industry, and it serves as a role model for both state-owned and private African firms. Government ownership has provided stability, growth opportunities, and the ability to pursue a long-term strategy rather than short-term profitability. The corporate culture and management capability developed during EAL's early evolution were clearly instrumental in generating a sense of independence and self-reliance. Equally important is the operational autonomy provided by EAL's corporate governance structure, notwithstanding isolated but damaging instances of interference. For example, it has been customary under successive regimes for the ministry of finance to pay for EAL services for the head of state or prime minister, and even in times of conflict, the government must compensate the airline for cargo transport services. The government's inability to subsidize EAL has clearly provided the discipline to EAL to ensure fiscal responsibility.

The case of EAL contradicts the myth that industrial policy should be limited to latent comparative advantage and new comparative advantage cannot be created in highly competitive industries. It also defies the notions that ownership determines performance and that public ownership is inferior to private, EAL having performed considerably better than many privately-owned airlines. EAL has demonstrated the advantages of long-term strategic orientation rather than the short-term profit orientation dominant in the Anglo-Saxon corporate world. And it has shown that industrial policies are not limited to the manufacturing sector, but can encompass high-productivity service sectors.

The dynamics of technological learning

EAL's story also demonstrates that technological learning does not occur in a vacuum, but is organically intertwined with a firm's struggle to survive and grow. Despite the inherent tensions, EAL had to develop its own absorptive capacity, which thrived with the company's growth and was shaped by its strategic vision and choices. This experience challenges the idea that prior knowledge and absorptive capacity are prerequisites for learning and technological capability-building, especially for technological learning and catch-up by late-latecomers with underdeveloped domestic absorptive capacity. Rapid expansion and the gap in coping with growth pressured EAL's management and staff to focus on rapid development of technological capability. Reciprocally, however, EAL's accumulation of technological capabilities and growing confidence about its future, especially after 2000, shaped its vision and strategy. EAL's ability to exceed the goals of Vision 2010 encouraged it to adopt a new and more ambitious trajectory in Vision 2025, which in turn added impetus to revise the company's targets. While long-term strategy and vision were essential, building technological capability also required continuous assessment of the external and internal environment and the capacity to gauge and align the strategic drive. Vision and strategies are not static, and their interactions with technological capability go in both directions.

EAL's experience shows that technological capability is built at the firm level and that sectoral capability is expanded by the presence of competitive firms. So, firm dynamics are the most decisive factor. Technological capability development and intensity of learning become yet more critical due to the growth of the firm and, in the case of EAL, due to intensified international competition in the aviation industry in the early 21st century. Not only has learning become more intense, but its complexity has increased as new organizational capabilities are required to develop new markets, achieve continuous process improvements, develop sophisticated skills and facilities, establish a new structure and business model, and achieve new performance milestones. The EAL experience also shows that learning by doing is not limited to imitation, but also involves building capability through continuous process improvements. For EAL, learning by doing involved incremental innovations—suggesting the possibility of creating paths to developing entirely new industries.

Vital to EAL's catch-up was the passionate and concerted development of technological capability and dynamic learning by doing that blended incremental innovations in response to the challenges and opportunities the firm faced. Learning and catch-up are facilitated by the very newness of an industry such as aviation and thus critically benefit from an eye to the future and a long-term approach. The intensity of learning is promoted by aviation's very narrow latitude for poor performance, since high safety standards leave no room for failure.[43] The capital intensity of the industry makes operating at full capacity critical and sustaining creditworthiness a precondition for survival and growth. Intense international competition, which leaves no room for inefficiency, further increases pressure for learning.

[42] Oqubay 2019b. See also Cheru, Cramer, and Oqubay 2019.
[43] Hirschman 1967.

A safe flight: Conclusions from the journey of Ethiopian Airlines

The EAL experience presents a unique example of firm-level learning and catching up in an industry considered alien to a late-latecomer country struggling to reach middle-income level. The relevance of the Ethiopian experience to other 21st-century late-latecomers is less clear, depending on country specificity, government commitment, institutional development, and the internal and external policy environments.

Broadly, however, a review of the ups and downs in the transformation of EAL from a simple domestic airline into an internationally competitive aviation industry reveals five critical factors: First, the more backward and late-starting a country is, the more intensive and assertive the state response needed for technological learning to influence capability building and catch-up. This is confirmed both by EAL's experience and by empirical research on the catch-up of East Asian economies.

Second, twentieth-century economic history clearly links learning to the rare instances of catching up. As Amsden highlighted, "Diversity notwithstanding, all late industrializers have in common industrialization on the basis of learning, which has conditioned how they behaved."[44] Learning by doing and emulation aimed at equalling or surpassing others is critical for late industrialization, especially in the early stages.[45] In EAL's experience, intensity, pace, and direction of learning are key determinants of technological learning, especially learning by doing.

Third, path following and, ultimately, path creation are required for catching up to leading firms or countries.[46] In this complex process, learning by doing and emulation must eventually combine with innovating.

Fourth, firms are the key drivers and the foundation of technological learning, although sectoral-level learning creates catch-up of the overall economy through the cumulative development of sectoral and national systems.[47] As EAL's experience shows, firm-level technological catch-up can be achieved while economic catch-up lags behind.

Fifth, for late-latecomers, imported technologies and know-how are important sources of technological learning and capability building.[48] They may come through trade, turnkey projects, management contracts, technical cooperation, partnerships with leading global firms, and other ways. Just as technology transfer was an important source of learning and catch-up for 19th-century latecomers industrializing in continental Europe, so as it is now for 21st-century late-latecomers. The main difference is that 21st century latecomers have a wide choice of sources of new technologies—many emerging economies are in a position to supply them. However, the jury is still out on whether the diversity of sources has a qualitatively different impact on the pace and direction of late-latecomers learning and catching up.

In general, technological development paths are unique and country specific. Latecomers cannot simply copy or emulate them. Although the experiences of other firms or countries can provide valuable lessons, the most successful learning is based on adapting to local peculiarities and context: "Catch up does not mean just cloning. What is actually achieved by successful catching up invariably diverges in certain ways from practices in the countries serving as bench-mark models. In fact, this divergence reflects the fact that exact copying is almost impossible," according to Lee and Malerba.[49]

This study has reviewed the path followed by EAL in transforming itself from a simple domestic airline into an internationally competitive and dynamic aviation industry. Three key points may serve as lessons for other late-latecomers:

First, TWA served as a role model and a source of inspiration and experience. The selection by the government of a reliable technological partner and teacher was a critical strategic choice that affected the intensity of learning and transfer of knowledge and know-how, as well as the pace and direction of catch-up.[50] Learning by doing played a dominant role in EAL's technological learning and catch-up. The investment in capability-enhancing facilities and infrastructure accentuated EAL's learning intensity and broadened its capacity to "identify, assimilate, and exploit" knowledge from the environment.[51]

Second, the government's strong commitment to Ethiopianization—to building a national carrier entirely run by Ethiopians—shaped the learning process. From day one, the Ethiopian government was keen to make this strategy work. The supportive U.S. political environment and the commitment to excellence of the foreign partner were also helpful. Ultimately, the commitment and readiness to learn and the process fostering this outcome primarily determined the intensity of learning. Finally, crisis management was critical to increasing the intensity of learning. EAL had to survive and expand in difficult situations, and the intensity of airline industry competition with a narrow latitude for poor performance offered critical pull.

[44] Amsden 1989, p. viii.
[45] While "true innovation and learning by doing" are critical for overall productivity catch-up, learning by doing "is arguably the most important source" in mature industries (Solow 1997, p. 33).
[46] Lee 2013; Lee and Malerba 2018.
[47] Lee and Malerba 2018; Oqubay 2015.
[48] See Oqubay and Ohno 2019.
[49] Lee and Malerba 2018, p. 3.
[50] TWA's motivation was not simply money but also pride in helping establish a new and high-quality airline service in Africa that reflected the global standing of TWA itself.
[51] See Cohen and Levinthal 1989, p. 569.

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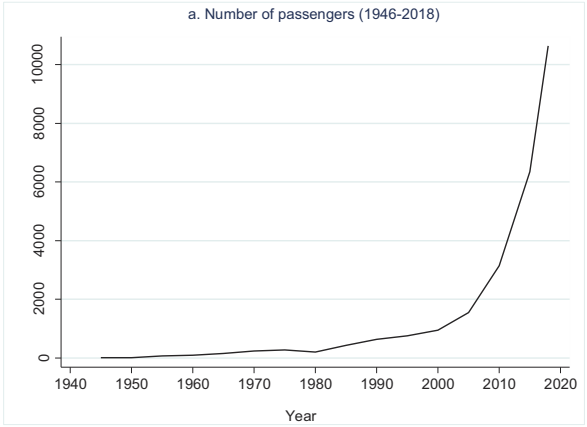
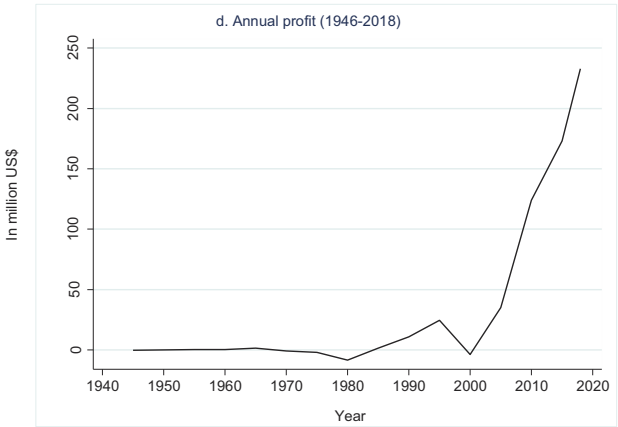
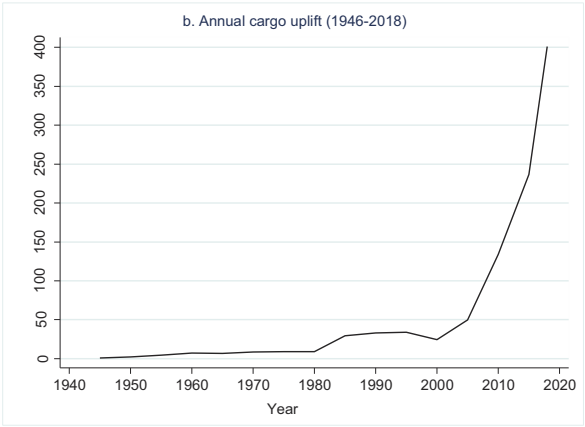
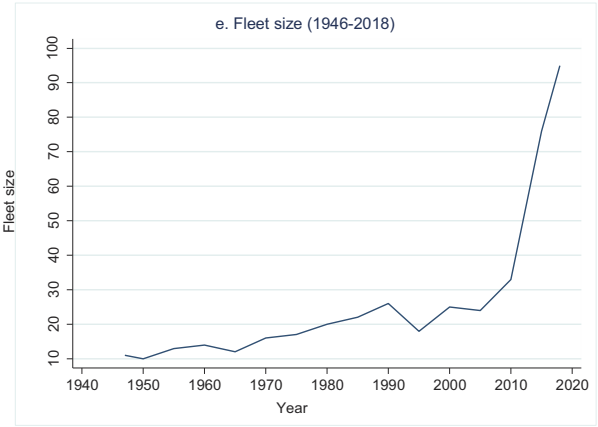
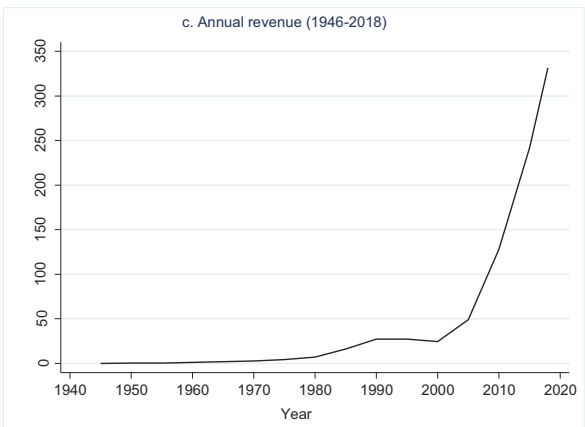
Appendix 1 Growth and performance trends (1946-2018)

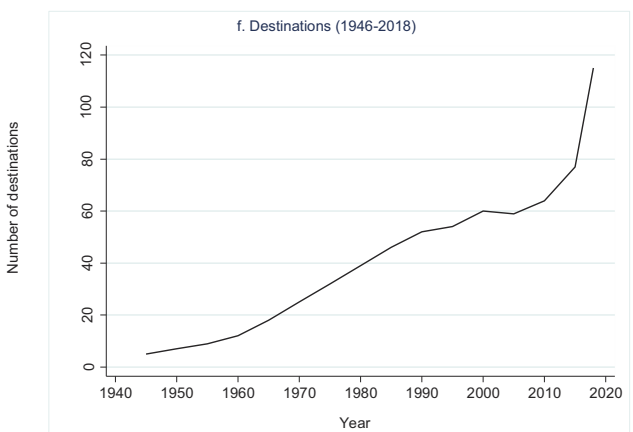












Source: Ethiopian Airlines Annual Reports (1946-2018)

Bibliography

Airline Weekly. 2018. “Independent Worldwide Coverage.” No. 678, 2 July.

Amsden, Alice. 1989. Asia’s Next Giant: South Korea and Late Industrialization. Oxford: Oxford University Press.

Amsden, Alice. 2001. The “Rise of the Rest”: Challenges to the West from the Late Industrializing Economies. Oxford: Oxford University Press.

Arrow, Kenneth. 1962. “The Economic Implications of Learning by Doing.” Review of Economic Studies 28: 155–73.

Bell, Martin. 1984. ‘Learning’ and the Accumulation of Industrial Technological Capacity in Developing Countries. In: Fransman M., King K. (eds) Technological Capability in the Third World. Palgrave Macmillan, London

Belobaba, Peter. 2016. “Introduction and Overview.” In A Global Airline Industry, ed.. Peter Belobaba, Amedeo Odoni, and Cynthia Barnhart, 2nd ed. West Sussex, UK: Wiley.

Christian Science Monitor, 1988. “West Africa Tries to Make Its State-owned Airlines Fly Right: Managing a Capitalist Success in Marxist Ethiopia.” 22 November. http://www.csmonitor.com/1988/1122/ffair.html, accessed on 10 October 2018.

Cohen, Wesley, and Daniel Levinthal. 1989. “Innovation and Learning: The Two Faces of R&D.” Economic Journal 99 (September): 569–96.

Cohen, Wesley, and Daniel Levinthal. 1990. “Absorptive Capacity: A New Perspective on Learning and Innovation.” Administrative Science Quarterly 35 (1), Special Issue: Technology, Organizations, and Innovation: 128–52.

Cohen, Stephen S., and J Bradford DeLong. 2016. Concrete Economics: The Hamilton Approach to Economic Growth and Policy. Boston, MA: Harvard Business Review Press.

Cramer, Christopher, Arkebe Oqubay, and John Sender. Forthcoming. African Economic Development: Evidence, Theory, and Policy. Oxford: Oxford University Press.

EAL. 1950–2018. Minutes of EAL Board of Directors. Addis Ababa, unpublished.

EAL. 1958, 1959, 1964, 1967. Annual Report. Addis Ababa.

EAL. 1971. Annual Report. Addis Ababa

EAL. 1988. Bringing Africa Together: The History of an Airline. Addis Ababa.

EAL. 2000–18. Annual performance reviews of EAL. Addis Ababa, unpublished.

EAL. 2000–18. Minutes of EAL management team. Unpublished.

EAL. 2004. Vision 2010: ET’s Growth Strategy. Addis Ababa.

EAL. 2010. Vision 2025 and Strategic Roadmap (Scaling up of ET’s Growth Strategy). Addis Ababa.

EAL. 2016. Sixty years fleet data. Addis Ababa, Ethiopia, unpublished.

EAL. 2018a. Factsheet. March, unpublished.

EAL. 2018b. Interview with Ethiopian Aviation Group CEO Tewolde Gebremariam.

EAL. 2018c. TWA–EAL agreements, unpublished.

Economist, The. 1987. “In Search of Excellence, the Hard Way.” 31 December.

Economist, The. 2018. “Ethiopian Airlines Is Founding New African Flag Carriers.” https://amp.economist.com/gulliver/2018/09/11/ethiopian-airlines-is-founding-new-african-flag-carriers. Accessed on 10 October 2018.

Fagerberg, Jan. 2005. “Innovation: A Guide to the Literature.” In The Oxford Handbook of Innovation, by Jan Fagerberg, David Mowery, and Richard Nelson. Oxford: Oxford University Press, 1–26.

Fagerberg, Jan, and Mauel Godinho. 2005. “Innovation and Catching-up.” in The Oxford Handbook of Innovation, by Jan Fagerberg, David Mowery, and Richard Nelson. Oxford: Oxford University Press, 514–42.

Freeman, Christopher. 1987. Technology Policy, and Economic Performance: Lessons from Japan. London: Pinter Publishers.
Gerschenkron, Alexander. 1962. Economic Backwardness in Historical Perspective. Cambridge MA: Harvard University Press.
Hirschman, Albert. 1958. Strategy of Economic Development. New Haven: Yale University Press.

Hirschman, Albert. 1967. Development Projects Observed. Washington, DC: Brookings Institution.

Hobday, M. 2000. “East versus Southeast Asian Innovation Systems: Comparing OEM and TNC-led Growth in Electronics.” In Technology, Learning and Innovation. Linsu Kim and Richard Nelson. Cambridge: Cambridge University Press, pp. 129–69.

Huo, Jingjing. 2015. How Nations Innovate: The Political Economy of Technological Innovation in Affluent Capitalist Economies. Oxford: Oxford University Press.

Kim, Linsu. 1997. Imitation to Innovation: The Dynamics of Korea’s Technological Learning. Brighton, MA: Harvard Business School Press.

Lee, Keun. 2013. Schumpeterian Analysis of Economic Catch-up: Knowledge, Path-Creation and the Middle Income. Cambridge: Cambridge University Press.

Lee, Keun, and Franco Malerba. 2018. “Economic Catch-Up by Latecomers as an Evolutionary Process.” In Modern Evolutionary Economics: An Overview, ed. Richard Nelson. Cambridge: Cambridge University Press.

List, Friedrich. 1856. National System of Political Economy. 4 vols. Memphis, TN: Lippincott.

Lundvall, Bengt-Åke. 1992. National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Pinter.

Nelson, Richard, ed.. 1993. National Innovation System: A Comparative Analysis. Oxford: Oxford University Press.

Oqubay, Arkebe, and Kenichi Ohno. 2019. “How Nations Learn: Technological Learning, Industrial Policy, and Catch-up.” In Oxford Handbook of the Ethiopian Economy, by Arkebe Oqubay. Oxford: Oxford University Press.

Oqubay, Arkebe. 2015. Made in Africa: Industrial Policy in Ethiopia. Oxford: Oxford University Press.

Oqubay, Arkebe. 2019a. “Ethiopia: Learning from an Experiment.”, In Oxford Handbook of Structural Transformation, ed. Célestin Monga, and Justin Lin. Oxford: Oxford University Press.

Oqubay, Arkebe. 2019b. “Industrial Policy and Late Industrialization in Ethiopia.” In Oxford Handbook of the Ethiopian Economy, ed. Fantu Cheru, Christopher Cramer, and Arkebe Oqubay. Oxford: Oxford University Press.

Oqubay, Arkebe, and Justin Lin. 2019. China–Africa and an Economic Transformation. Oxford: Oxford University Press.

Oqubay, Arkebe, and Justin Lin. Forthcoming. The Oxford Handbook of Industrial Hubs and Economic Development. Oxford: Oxford University Press.

Schumpeter, Joseph. 1942. Capitalism, Socialism and Democracy. New York: Harper.

Skytrax. 2018. The Best Airlines in Africa 2018. https://www.worldairlineawards.com/best-airlines-2018-by-region/. Accessed on 23 December 2018.

Spencer, John. 2006. Ethiopia at Bay: A Personal Account of the Haile Selassie Years. Hollywood, CA: Tsehai.
Solow, Robert. 1997. Learning from “learning by doing”: Lessons for economic growth. Stanford: Stanford University Press.

Wade, Robert. 1990. Governing the Market: Economic Theory and the Role of the Government in East Asian Industrialization. Princeton: Princeton University Press.

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