Frontiers in Business, Economics and Management
ISSN: 2766-824X | Vol. 23, No. 1, 2026

Business Model Innovation and Industrial Chain Construction Empowered by AI For Low Altitude Economy

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Abstract: In recent years, a large number of low altitude aircraft, represented by drones and electric vertical takeoff and landing vehicles, have accelerated their entry into various fields such as logistics and distribution, urban management, agricultural crop protection, emergency rescue, etc., playing an increasingly important role in promoting production and improving people's livelihoods. Meanwhile, with the diversification of application scenarios and the increasing frequency of flight activities, traditional production and operation methods face problems of low efficiency, low energy, and lack of intelligence. The application and development of artificial intelligence technology has pushed the low altitude economy to enter the era of AI + .bringing disruptive effects on the low altitude economy from the perspective of big data analysis, intelligent judgment, and automated operations. Based on the development of low altitude economy empowered by AI, this paper explores the driving role of AI in the development of low altitudeeconomy and proposes four types of innovative modes generated under AI driving. On this basis, this article also analyzes the formation and development of the low altitude economy industry chain by artificial intelligence, and elaborates from four aspects: upstream, midstream, downstream, and supporting platforms. Given the technical constraints, airspace governance frictions, and shortage of viable commercial patterns in combining artificial intelligence with low altitude economic development, targeted strategies and suggestions are put forward to guide how to grasp the opportunity of low altitude economy and the formation of a new ecosystem for intelligent industry development.

Keywords: Artificial intelligence; Low altitude economy; Business model; Industrial chain; Smart City.

1. Introduction

With the gradual deepening of the development concept of low altitude economy in recent years and its rise as a part of strategic emerging industries, the vision of unmanned aerial vehicle logistics tu rban air traffic is increasingly recognized for its commercial and social value in the low altitude field, governments all over the world have successively put forward policies to develop the development of urban air traffic .
opment order of low altitude economy and listed it as a new economic growth point supported by the state. It is worth noting that artificial intelligence will fully empower the development of the lowaltitude economy, from intelligent drone flight movements to analyzing large amounts of flight data, to overall planning of hundreds or thousands of flight missions, all of which require AI support. Traditionally, low altitude flight is mostly carried out in a single aircraft operation mode, under the real-time control of the pilot, and its operational efficiency and operational area are limited; The application of AI endows aircraft with certain environmental perception, path planning, and autonomous decision-making capabilities, making low altitude flight possible from single point operations to networked and large-scale operations [1]. At the same time, artificial intelligence can turn photos and sensor information obtained from flight into tradable products and services, further expandingthe scope of application of low altitude economy and bringing a new round of industrial revolution and market opportunities. Looking at AI+low altitude economy at the industrial level is not simply about technological empowerment, but will trigger a series of systematic reconstructions, including the need to think from a higher dimension about the underlying logic, value chain, and industrial ecology model of low altitude economy. Therefore, this article attempts to systematically discuss this topic, hoping to provide some inspiration for related research and exploration.

2. AI technology as the Core Driving Force for Improving Low Altitude Economic Efficiency and Expanding Scenarios

To understand the role of AI in the development of low altitude economy, the first step is to understand what low altitude flight activities are? The low altitude flight scenario is complex, and aircraft flying in this environment may face threats from buildings, terrain, weather conditions, and even other sudden obstacles. The pre-set program for fixed flight routes cannot adapt well to such environments, and AI technology can solve this problem. With the help of computer vision, deep learning and other related technologies, airplanes can perform real-time detection of their surroundings and automatically avoid obstacles when encountered, which is a prerequisite for the large-scale use of low altitude economy development [2].

At the operational level, the value of AI lies in intelligent task planning. For example, in logistics distribution, how to plan the optimal flight route due to the diversity of distribution scenarios and the complexity of cities? How to schedule multiple aircraft to complete tasks? What should I do when encountering temporary new orders? All of this is inseparable from the support of powerful algorithms. And AI's decision optimization technology can solve many complex scheduling problems in milliseconds. Significantly improve work efficiency and save operating costs.

In terms of safety, AI is changing the way low altitude flight

risk management is carried out. AI can determine the health status of aircraft based on past flight conditions and real-time flight status, predict possible faults, and take corresponding measures to transition from passive repair to preventive maintenance; In terms of regulation, AI can assist management departments in completing dynamic supervision of numerous air traffic and making reasonable arrangements. Effectively reduce the probability of flight conflicts and improve the efficiency of airspace utilization [3].

From the perspective of application scenarios, AI has made it possible for applications that were previously impossible to implement, such as flight operations at night or in complex weather environments. In traditional modes, there are significant safety hazards. By utilizing AI's perception and decision-making functions, it is possible to execute predetermined tasks in low visibility environments; For example, high-frequency and refined inspections for urban governance rely on high labor costs and low efficiency. AI+automatic inspections can operate 24/7 and real-time analyze and process the collected data into valuable information for decision-making reference.

It can be said that AI technology is reshaping the operational foundation of the low altitude economy from three dimensions: efficiency, safety, and scenarios, becoming the core driving force for the development of this emerging industry. Understanding this is the logical starting point for exploring future business model innovation and industrial chain construction.

3. Innovation of Main Business Models for Low Altitude Economy Empowered by AI

The development of technology ultimately needs to serve the creation of commercial value. With the help of AI, the business model of low altitude economy will also be reshaped, shifting from simply selling equipment to providing services and building platforms. New profit models and value added space will gradually emerge.

The AI+precision operation+data service model is also a relatively mature business model innovation at present. For example, in the field of agricultural crop protection, there are problems such as excessive, out of range use, and repeated coverage in the traditional pesticide spraying process [4]. Drones equipped with AI visual recognition technology can monitor the growth of crops in real time, spray targeted areas of pests and diseases, and improve control effectiveness while reducing pesticide use. More importantly, the multispectral images and crop growth information collected during the flight can be processed by AI to form a digital file of the field, providing planting suggestions to farmers. This extension from homework execution to data value-added has transformed the role of service providers from mere operators to data service providers in agricultural production, significantly expanding their profit margins.

The new model of low altitude intelligent logistics and instant delivery in cities under artificial intelligence technology is also changing the logistics pattern of cities. For urban areas, there is a high demand for short distance delivery with high timeliness requirements, and traditional land transportation is greatly affected by traffic [5]. Drone delivery is not affected by ground traffic conditions and can be quickly delivered to customers from the starting point to the destination. AI plays the role of the brain in it. From order acquisition to route planning, from multi aircraft scheduling to real-time avoidance, to final landing location determination, all require real-time analysis and decision-making assistance from AI. Some companies have tried to use drones to cooperate with operations, where drones are responsible for end of line delivery, while unmanned vehicles undertake post landing delivery work, and AI technology is used for deployment and management. The integrated delivery system of heaven and earth is gradually being established.

Both air taxis and autonomous driving in smart cities are more cutting-edge business model innovation attempts. After the maturity of eVTOL technology, the future of short to medium distance air transportation in cities will no longer be a conceptual idea. In addition to the successful development of the eVTOL aircraft itself, a more advanced system platform is also needed to support its operation. Artificial intelligence will play an important role in areas such as aircraft autopilot management, airspace flow management, airport ground resource management, passenger authentication, and security control. The value of this model is not only in terms of ticket prices, but also in providing more services in the future [6]. The demand for viewing scenery and picking up and dropping off passengers on the plane may also be future consumption points.

AI+inspection, surveying, and urban management as a service will become an important part of future smart cities. Traditional power inspection, pipeline inspection, and bridge inspection often require human inspection from above, which carries great risks and is inefficient. The drones empowered by AI recognition technology can automatically cruise along the set route, making judgments on equipment defects and security vulnerabilities while cruising, and generating inspection reports. In terms of urban management, drones can conduct regular inspections of illegal construction, urban environment, and traffic conditions. AI automatically compares historical information, identifies problems, and alerts in a timely manner.

This service model transforms the management needs of governments or enterprises into standardized data products, where service providers provide data results on demand rather than selling hardware equipment, achieving light asset operation and sustainable profitability.

The commonality of the above modes is that AI not only exists as a means, but also becomes a key factor in realizing value. It transforms low altitude flight behavior from simply completing tasks to intelligent services, from one-time business to long-term data streams, and thus brings infinite possibilities for business models.

4. Construction and Reshaping of AI Driven Low Altitude Economic Industry Chain

Business model innovation is grounded in the industrial chain, and with AI enablement, the low-altitude economy industrial chain is being progressively built and continually reconfigured, with shifts in value allocation and in the entities at each link.

Looking upwards, AI chips+sensors and key components are AI based as the underlying foundation. The components of traditional aircraft are designed to accomplish the simple task of flight, and in the era of AI, computing power has become a key indicato [7]. Low power AI chips deployed for edge applications can execute visual recognition algorithms

and compute neural network models locally on the aircraft as the basic hardware platform for autonomous flight.

At the same time, the capabilities of various sensors are also improving. For example, the cost of perception devices such as high-resolution cameras, LiDAR, and millimeter wave radar is gradually decreasing. More and more aircraft can carry various types of perception devices to provide data input to AI algorithms. The core point of competition in this stage will no longer be simply hardware performance, but the design ability and algorithm matching ability of software and hardware combination.

In terms of midstream, AI aircraft research and development, manufacturing, and AI software system integration belong to the core part of the industry chain. In the design of aircraft platforms, the focus used to be on payload capacity and endurance, but now more and more attention is being paid to issues such as computing power support, data interfaces, and algorithm adaptation [8]. Some new aircraft manufacturers even set AI computing platforms as standard, with sufficient computing resource reserves and data interface expansion capabilities to meet the future development needs of application systems. At the same time, companies specializing in AI software system integration have emerged, focusing on integrating universal AI algorithms into specific applications to create a specialized intelligent system for logistics, inspection, surveying and other specific application scenarios. This division of labor can further refine the industry, improve the overall level of specialization and efficiency.

From a downstream perspective, AI platform operation, data processing, and value-added application development are the high points of value in the industry chain. With the normalization of low altitude flight activities, massive amounts of flight data, image data, and various sensor data are generated every day. How to store, process, and analyze these data, and form valuable information from them to guide business decisions, is a new industry opportunity. This gave rise to a group of data companies specializing in data management, which do not manufacture airplanes or directly implement flights, but have established data platforms to conduct data-driven analysis and provide consulting advice to users in various industries. This platform based operation model has the characteristics of low marginal costs and strong economies of scale, and is expected to become the most profitable link in the industry chain.

From the perspective of support, the construction of low altitude intelligent networking, AI supervision, and service guarantee systems is an essential part of the healthy development of the industrial chain. The large-scale operation of low altitude economy requires supporting facilities and equipment for low altitude communication, navigation, and surveillance. The low altitude intelligent networking built on 5G and future 6G networks can provide data synchronization capabilities between aircraft and ground terminals, providing a channel for AI cloud edge collaboration.

At the same time, artificial intelligence assisted systems for regulatory agencies are also under development, which can achieve intelligent approval of massive flight plans, real-time monitoring of flight activities, automatic identification and warning of violations, thereby greatly improving the intelligence level of airspace management; Meteorological services, insurance services, maintenance services, etc. are all part of the service guarantee system. Artificial intelligence makes them accurate and efficient.

From the perspective of the development trend of the entire industry chain, the previously relatively linear industrial form is gradually evolving into a network and platform type form, where each link intersects and permeates with each other, and even the boundaries become blurred [9]. Hardware companies begin to provide software services, software companies begin to intervene in hardware design, and platform based enterprises engage in customized development of components upstream. The competitive landscape of the industry presents a cross-border trend.

5. Challenges and Development Strategies for Promoting AI+Low Altitude Economy

Although AI has a wide range of applications for empowering the low altitude economy, we believe that there are still many problems in practical application which need to be solved through cooperation among various parties. The problems such as algorithm security, marginalization of computing power; data security. Low altitude flight involves public safety issues and has very high requirements for the reliability of AI algorithm. How to avoid misjudgment and failure in complicated environment is also a technical problem need to be constantly broken through; Edge computing power deployment also has the problem of power consumption and heat dissipation, and the loading capacity of aircraft is not strong enough to support a large amount of high-performance computers. and light-weight algorithms and high performance chips should be developed [10]. Also, huge amounts of image data collection in-flight involve personal privacy and geo-informations security issues. How to strike a balance on data development and utilization with security protection needs double guarantees of technology and system.

The dynamic airspace management and compliance assisted by artificial intelligence in air traffic management are also major challenges that constrain development. At present, China mainly adopts a static airspace management and approval system, which is not suitable for low altitude flights with large scale and strong maneuverability. How to achieve dynamic airspace management based on situational awareness? How to improve airspace utilization while ensuring safety? How to incorporate artificial intelligence into decision-making into the current regulatory system involves exploration and innovation in policies and regulations.

From the perspective of commercial formats, cost reduction and efficiency improvement, economies of scale, and social recognition are objective reasons that hinder the landing of industries. At present, low altitude flight services assisted by AI are still in the market cultivation stage, with large initial investment and high unit costs. How to reduce costs and obtain profits through economies of scale is one of the main difficulties that enterprises need to overcome. At the same time, people have different levels of acceptance towards low altitude flight. If issues such as noise disturbance, privacy infringement, and safety concerns are not handled properly, it will affect the healthy development of the industry.

In this context, the author maintains that the aforementioned difficulties can be addressed through the following measures: first, at the level of high-level planning, the country should provide clear guidance for industrial development, affirm the strategic importance of cultivating the low altitude economy, and introduce policies that support

the research and development, piloting, and broader adoption of related technologies.; Secondly, in terms of industry management, it is urgent to introduce a series of aircraft related product standards, data exchange standards, flight management standards, and air traffic control standards. The second is to provide a basis for the standardized development of industries. In terms of infrastructure construction, it is necessary to coordinate and promote the construction of low altitude intelligent networking, takeoff and landing site networks, monitoring service platforms and other infrastructure to provide support for the landing of AI applications.

In terms of ecological co construction, we encourage collaboration between upstream and downstream enterprises, research institutes, and regulatory units to form an open and win-win industrial ecosystem, overcome difficulties together, and explore feasible models.

6. Conclusion

Low altitude economy development has entered an era driven by AI. Be it technology innovation or business model innovation, intelligent logistics, city air traffic, and management services continue to arise and emit new vitality. Meanwhile, the upstream and downstream of industrial chain are being revolutionized by AI ,with the confluence of hard ware ,software, platform, and service boundaries that tend toward disappearance.

To tackle the aforementioned technological, managerial, and market challenges, public authorities, firms, and research institutions should collaborate to expedite the adoption of AI in the low altitude economy via policy backing, rulemaking, and ecosystem development. I believe that in the near future, the low altitude economy empowered by AI will play a more important role due to technological development and innovative business application models, creating more convenience and value for people's lives and production.

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