Enrichment: Journal of Management, 14 (3) (2024)

Published by: Instiute of Computer Science (IOCS)

Enrichment: Journal of Management

Journal homepage: www.enrichment.iocspublisher.org

Financial feasibility studies of eVTOL aircraft production project of PT XYZ

Haryo Senggoro A[1], Yudha Oktofa S[3]

[1,2]Masters of Business Administration, School of Business and Management, Institut Teknologi Bandung, Indonesia

ARTICLE INFO

Article history:

Received Jul 19, 2024
Revised Aug 02, 2024
Accepted Aug 16, 2024

Keywords:

Evtol;
Internal Rate Of Return;
Net Present Value;
Monte Carlo Simulation;
Sensitivity Analysis.

ABSTRACT

The growth of Transportation in Indonesia especially in cities led to increased destination time and traffic jams. As one of the solutions air taxis using electric Vertical Take-Off Landing (eVTOL) is advised. As a country capable of producing aircraft, PT XYZ seizes the chance to invest in the production of eVTOL in Indonesia. PT XYZ planned this project from 2024 to 2035 with an initial investment of $327,292,103.88 (USD). From 2024 to 2028 planned to expand its capital and from 2029 to 2035 PT XYZ planned to sell eVTOL aircraft in the domestic markets and international markets. Based on the financial projection of PT XYZ plan, this project is financially feasible because of a positive Net Present Value (NPV) of $209,542,512.94 and an Internal Rate of Return of 26.98%. This project has a payback period of 8 years and a profitability index of 1.49. Using the sensitivity analysis and Monte Carlo Simulation, the costs of goods sold and aircraft prices of this project affect the project's NPV with an 80% chance of positive NPV.

Corresponding Author:

Haryo Senggoro Adikusumo,
Masters of Business Administration,
Institut Teknologi Bandung,
Gelap Nyawang No.1, Lb. Siliwangi, Kec. Coblong, Bandung, West Java, 40132, Indonesia,
Email: haryo_senggoro@sbm-itb.ac.id

INTRODUCTION

Aviation as the art and science of flight, has shown its technological advancement and innovation to push the boundaries of transportation possibilities. Since 1903, aviation has played a major role in the world affecting the economy, health, and, tourism. As an archipelago country, Indonesia adopts aviation as transportation to travel to each region and city. The growth of land transportation in cities creates traffic jams and increases travel time, especially in big cities in Indonesia such as Jakarta. One of the solutions is to use air taxis to travel in the city to reduce travel time and support the country's growing sector in aircraft development. With the

Air taxis represent a transformative shift in the aviation landscape, revolutionizing urban mobility. The industry, defined by the advancement and implementation of vertical takeoff and landing (VTOL) vehicles, offers a promising solution to the challenges of inefficient urban transportation systems. VTOL especially the electric vertical take-ooff landing (eVTOL) is a low-noise and low-emission aircraft capable of being operated over short distances with advanced

propulsion and battery technologies (Husemann et al., 2024). eVTOL as Urban Air Mobility (UAM) is gaining increased prominence however, UAM is still in development and there are challenges of legal, technical, social, and financial aspects (Babetto et al., 2023). In comparison to the ground vehicles, the UAM has aspects to consider such as models to estimate the adoption, vertiport as a landing place, and whether the electrical grid can support the operations (Garrow et al., 2021). In the global market, VTOL is still in development. Countries such as the United States, Germany, China, and Japan have initiated the VTOL aircraft industry by establishing companies dedicated to this emerging sector. As a developing country capable of manufacturing aircraft, Indonesia started to research the VTOL to be implemented in cities.

UAM in full development requires an entire ecosystem integrated with a highly complex multimodal transport environment. Issues for UAM concern the mass production and deployment which expected the benefits and weaknesses to be measured (Duca et al., 2023). For eVTOL to be economically feasible the cost and operation profit should be estimated. Batteries, fare, and driving systems are the main concerns for eVTOL to profit (Liu et al., 2024). With the recent UAM development, the passenger transport concept requires the further maturation of vehicle-related technologies, propulsion systems, electrical power sources, autonomous flying vehicles, noise, and down-wash footprint (Pons-Prats et al., 2022). Other than technological issues, the development of UAM should consider the commercialization and accountability issues, industry coordination, enhancing infrastructure, and social factors (Wang et al., 2023)

PT XYZ is dedicated to developing and researching eVTOL aircraft, symbolizing the advancement of Indonesia's expanding aerospace industry. The development of eVTOL in PT XYZ aligns with Indonesia's aviation capabilities to innovate solutions for urban transportation. With their capabilities and resources, PT XYZ begins to develop and research the eVTOL to be manufactured in Indonesia. The primary activities include designing, selling, maintaining, repairing, and overhauling the eVTOL for domestic and international markets. The eVTOL market in Indonesia has the potential to grow because Indonesia’s new capital, Ibukota Nusantara (IKN), Jakarta, and Bali will plan to use eVTOL as air taxis. For the international market, eVTOL is seen as the need for sustainable transportation to reduce the carbon footprint. Investment in this market is rising although criteria for operations and procedures are still in the making. eVTOL market can be segmented by design, functionality, distance, and component. With a growth rate of 38.2%, the estimated eVTOL market can reach $700 million in 2032 (Sampathkumar, 2022).

As PT XYZ started the development of eVTOL in 2024 to 2028, they planned to start selling the aircraft in 2029 to 2035 (PT XYZ, 2023). PT XYZ collaborating with state-owned aircraft manufacturers plans to have production facilities placed in West Java. PT XYZ needs to determine how feasible this project is. This research conducts the financial feasibility of this project as an insight for PT XYZ. This research estimates the financial projection and condition of the upcoming project based on the scenario PT XYZ development and selling of eVTOL from 2024 until 2035.

RESEARCH METHOD

The possible success or failure of prospective future projects can be measured, examined, and evaluated by a tool called feasibility studies.(Bowen et al., 2009). As this project is the stage to establishing a new business, various aspects such as technical, economic, scheduling operational, legal, and environmental. The project is defined as feasible when the analyst determines the likelihood of satisfying explicit objectives is tested to fit a context of specific constraints and limited resources (Graaskamp, 1972). The financial projection of an investment/project determines the economic feasibility. Financial projections, as a systematic method, predict future financial outcomes by utilizing historical data, market analysis, assumptions, and key drivers(Hoffman, 2002.). Cost estimation can be determined through financial projections to assess the necessary expenditures based on cost drivers and operational efficiencies. (02. Berk, 2017). Financial

projections help determine key aspects such as financing planning, strategies for meeting capital requirements, and optimizing the cost of capital. These projections assist in making financing decisions by providing options between debt and equity financing, optimizing the capital structure, and evaluating various financing alternatives based on risk-return considerations (Hoffman, 2002). Using the capital budgeting technique and scenario analysis, sensitivity analysis, and diversification financial projection can be created and it offers a deep understanding of financial decisions, risk management, and long-term success (Shapiro et al., 2012).

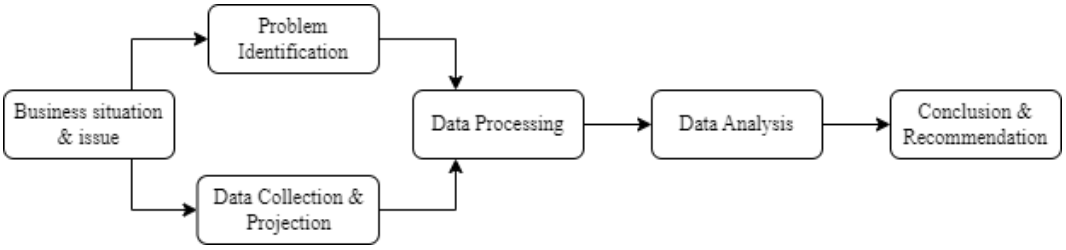

Figure 1. Research framework

To evaluate the possible investment, this research used the capital budgeting technique. Capital budgeting usually involves the planning of long-term investment decisions such as investments in new equipment, replacement of assets, expansions of facilities, investment in employee training programs, or expenditures to improve process efficiency and reduce future costs (Peterson & Fabozzi, 2002). The models used for capital budgeting are discounted cash flows (DCF) that focus on a project's cash inflows and outflows while taking into account the time value of money. DCF models compare today's cash outflows with the predicted future cash inflows and outflows by converting all cash flows into present values based on the theory of compound interest (Horngren et al., 2014). Data collected for this research were obtained from primary data and secondary data. Primary data is sourced from the company's data and interviews, while secondary data is from documents/literature studies related to the eVTOL and financial feasibility study. Primary data consists of financial planning of PT XYZ's eVTOL aircraft production such as primary assets financial plan, production rate plan, and eVTOL research financial plan. The interview was conducted with the business development section to determine variables for sensitivity analysis and scenario for the Monte Carlo simulation.

The financial projections such as Net Present Value (NPV), Internal Rate of return (IRR), Payback Period (PP), and Profitability Index (PI) will later be used for scenario analysis to identify potential risks, evaluate the likelihood and impact, and plan responses to them (Rocha et al., 2020). This research utilizes scenario analyses, including sensitivity analysis and Monte Carlo simulation, to evaluate the project's potential outcomes. The outcome of sensitivity analysis is key variables that significantly affect the project so the decision-makers can prioritize the variable for risk mitigation (Kraus et al., 2021). The outcome of Monte Carlo simulation is probability distributions based on generating thousands of simulations of the project with different key variables (Gitman et al., 2018). Based on the interview, variables that may affect the project's NPV are COGS, the number of aircraft sold, price per unit, and Indonesia's inflation rate. The Monte Carlo simulation was conducted 1000 times with the change of each variable within the range of worst-case and best-case scenarios with the changes of 20% value on base price. The worst-case scenario has a lower COGS, aircraft sold, and price per unit with a higher inflation rate. While the best-case scenario has the vice-versa of the variables. The result of the Monte Carlo simulation determines the statistics of the project by showing the normal distribution curve to validate that the estimation can happen in a real-life scenario.

RESULTS AND DISCUSSIONS

The discounted cash flow model assesses investments and projects using various methods, including the calculation of Net Present Value (NPV), Modified Internal Rate of Return (MIRR), Payback Period (PP), Profitability Index (PI), and Cost of Capital (Samonas, 2015). The first step to evaluate the discounted cash flow from a new project is to determine the general assumptions for the project. Sources of finance for this industry come from internal and external sources. Internal sources such as sales and leaseback. The external sources come from debt financing and equity financing (Munisami, 2010). The general assumptions of the project are shown in Table 1

Table 1. General Assumptions

Description	Value
Fixed assets investment	$327.29 billion
Debt financing	0%
Equity financing	100%
Inflation rate	4.11%
Price increased	Following inflation rate

With these general assumptions, the estimated price and costs of goods sold for the eVTOL can be calculated. As stated before, the selling of the eVTOL aircraft started in 2029. The price and cost of goods sold for 2029 to 2035 is shown in Table 2

Table 2. Aircraft Price and Costs of Goods sold

Year	Price (in billion)	COGS (in billion)
2029	$2.82	$2.47
2030	$2.93	$2.57
2031	$3.06	$2.67
2032	$3.18	$2.78
2033	$3.31	$2.90
2034	$3.45	$3.02
2035	$3.59	$3.14

The investment plan for this project started in 2024 and continued until 2035. The investment plan includes the capital and operational expenditure of the eVTOL project. Several expenditures for this project are research, testing, certification, fixed assets, and others that can't be mentioned. The investment plan of this project is shown in Table 3.

Table 3. Investment Plan

Year	Value (in billion)
2024	$19.20
2025	$18.77
2026	$80.99
2027	$83.12
2028	$37.47
2029	$34,81
2030	$14.29
2031	$7.48
2032	$7.60
2033	$14.79
2034	$7.85
2035	$0.86

The income statement is based on the revenue and costs of goods sold in the project's plan. As mentioned before, the income starts after the production and selling of the aircraft in 2029 until

2035. The net profit of the project is based on the assumption that all aircraft are sold. The net profit of the project is shown in Table 4.

Table 4. Estimated Net Profit (loss)

Year	Value (in billion)
2029	$(7.57)
2030	$40.01
2031	$89.59
2032	$106.67
2033	$118.84
2034	$129.94
2035	$142.09

With the investment plan and the estimated net profit, the weighted average cost of capital can be calculated (Bierman & Smidt, 2007). Using the secondary data, the calculated weighted average cost of capital or the project is 11.95%. The calculated weighted average cost of capital used for accumulated cashflow analysis for the project. The accumulated cashflows determine the net present value (NPV), internal rate of return (IRR), payback period (PP), and profitability index (PI) of the project. NPV measures the fundamental return on the investment, assuming the project is financed using the firm's overall capital resources (Gibson & Morrell, 2004). The accumulated cashflows are shown in Table 5 and the project's NPV, IRR, PP, and PI are shown in Table 6.

Table 5. Accumulated Cashflows (Loss)

Year	Value (in billion)
2024	$(19.20)
2025	$(37.98)
2026	$(118.97)
2027	$(202.98)
2028	$(239.57)
2029	$(264.51)
2030	$(147.20)
2031	$93.60
2032	$263.29
2033	$422.19
2034	$595.28
2035	$790.05

Table 6. NPV, IRR, PP, and PI

Variable	Value
NPV	$209.54 billion
IRR	27%
PP	8 years
PI	1.5

With the financial projections of the eVTOL aircraft project, scenario analysis using sensitivity analysis and Monte Carlo simulation can be conducted. Based on the interview, the 4 key variables affecting this project's NPV are sold aircraft, inflation rate, aircraft price, and COGS. Using 4 key variables, sensitivity is conducted by increasing and decreasing the value of each key variable (Thompson et al., 2022). The change for each key variable is 20%. Changed value causes the NPV to change and based on the changes, the most important key variables of the project can be determined (Thoburn, 2022). The changes in each key variable are shown in the tornado chart in Figure 1.

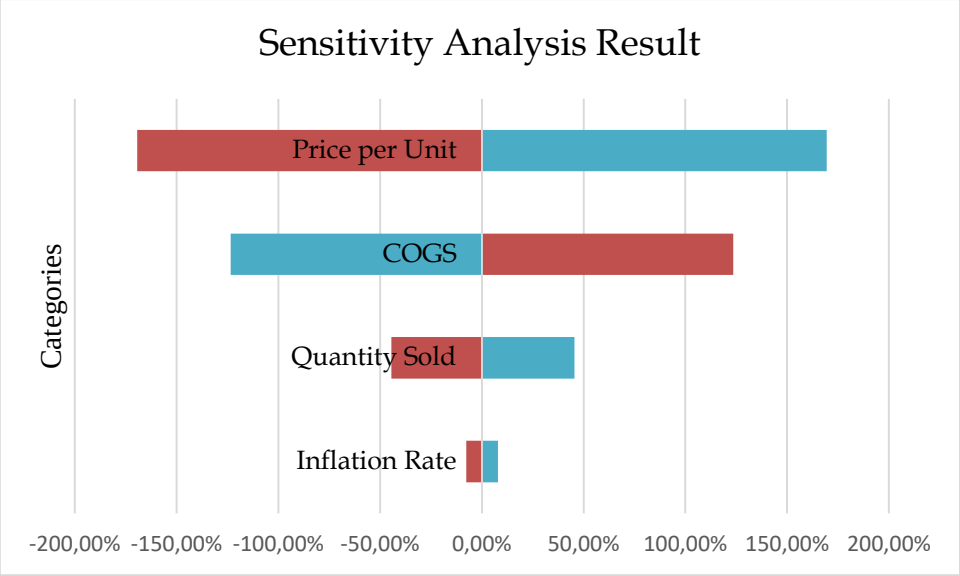

Figure 1. Key Variable Sensitivity

Monte Carlo simulation for this research is generated based on the distribution of each key variable. The distribution ranged from the worst-case and best-case of each key variable (Hendra et al., 2021). The simulation of the project's NPV was generated 1000 times resulting in the distribution of the NPV and statistical characteristics of the project. Based on the Monte Carlo simulation analysis, the statistics of this project show a 20% probability of negative NPV and an 80% probability of positive NPV. The distribution is shown in Figure 2 and the statistical characteristic is shown in Table 7.

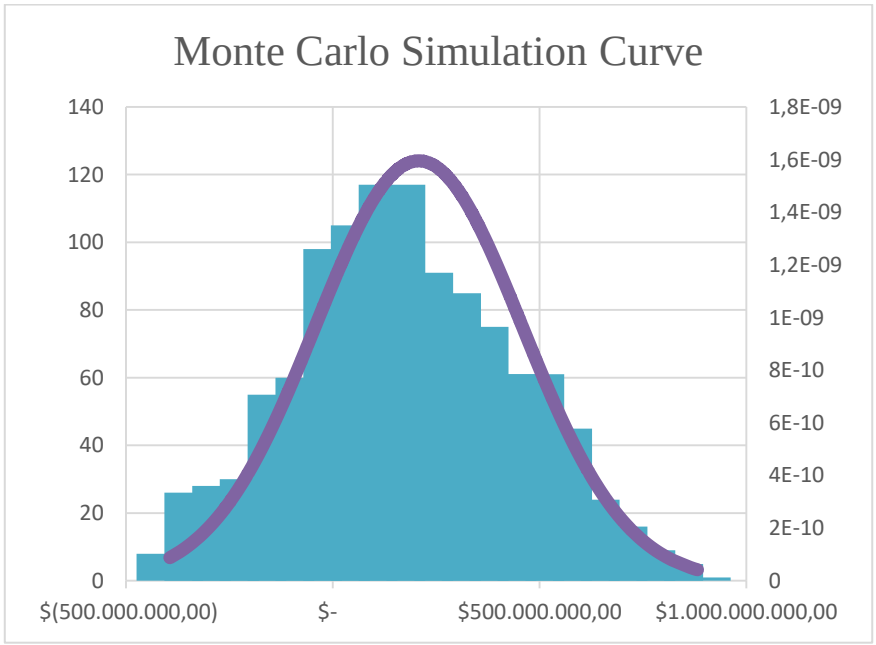

Figure 1. Tornado Chart of Each Key Variable

Table 7. Statistical Characteristics

Variable	Value
Min	$(393.92) billion
Max	$882.10 billion
Mean	$208.07 billion
Standard deviation	$250.07 billion
Median	$195.77 billion
Kurtosis	-0.38
Skewness	0.08
Probability < 0	20%
Probability > 0	80%

CONCLUSION

eVTOL aircraft is a promising investment with a high growth rate despite the regulation and the aircraft itself is still in consideration. Many studies on eVTOL focus on technical aspects such as batteries, propellers, and eVTOL flight systems. Some research also addresses issues related to eVTOL implementation and regulations, while relatively few studies explore the financial feasibility of eVTOL. This research shows that the financial analysis of the eVTOL production project reveals promising indicators, including a net present value (NPV) of $209.54 billion, an internal rate of return (IRR) of 27%, a payback period of 8 years, and a profitability index of 1.5. These metrics suggest the project's financial feasibility, aligning with theoretical expectations and the criteria set by PT XYZ. Sensitivity analysis identifies four key variables that influence the project's NPV: the inflation rate, the quantity sold, the price per unit, and the cost of goods sold (COGS). Among these, the price per unit and COGS are particularly critical, as they have a significant impact on the project's feasibility, with fluctuations exceeding 100%. The Monte Carlo simulation further underscores the project's potential, indicating a high likelihood of success, albeit with some inherent financial risks. The COGS' possible risks are the production cost rise unexpectedly due to supply chain disruption and increased raw material prices. While the price per unit possible risks are the price fluctuations caused by internal and external factors such as market demand, regulatory changes, technological advancement, and investor sentiment. With these possible risks, PT XYZ can mitigate the COGS risk by establishing a contract with the suppliers to negotiate favorable terms and ensure a reliable supply chain. and lean manufacturing to minimize waste and inefficiencies. For the price per unit risk mitigation, PT XYZ can Secure long-term contracts or pre-sale agreements with key customers to lock in prices and ensure a stable revenue stream. Overall, the positive financial outlook supports the viability of eVTOL production in Indonesia, suggesting that the project can proceed and be successfully implemented.

ACKNOWLEDGEMENTS

This journal article was written based on the results of feasibility study research which is used to calculate the investment value for the eVTOL aircraft production project. The contents are the sole responsibility of the author

References

02. Berk, D. 2017 C. F. 4th edition G. edition. (2017). Corporate finance (Global Edition). In *Pearson*.

Babetto, L., Kirste, A., Deng, J., Husemann, M., & Stumpf, E. (2023). Adoption of the Urban Air Mobility System: Analysis of technical, legal and social aspects from a European perspective. *Journal of the Air Transport Research Society*, *1*(1), 152–174. https://doi.org/10.59521/c97be694514dd2fe

Bierman, H., & Smidt, S. (2007). *Advenced Capital Budgeting* (Issue 0).

Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., Bakken, S., Kaplan, C. P., Squiers, L., Fabrizio, C., & Fernandez, M. (2009). How We Design Feasibility Studies. *American Journal of*

Preventive Medicine, *36*(5), 452–457. https://doi.org/10.1016/j.amepre.2009.02.002

Duca, G., Trincone, B., Dziugiel, B., Liberacki, A., Russo, R., Sangermano, V., & Witkowska-Konieczny, A. (2023). Urban Air Mobility in the next future: main findings from a technical survey. *Transportation Research Procedia*, *72*(2022), 965–972. https://doi.org/10.1016/j.trpro.2023.11.524

Garrow, L. A., German, B. J., & Leonard, C. E. (2021). Urban air mobility: A comprehensive review and comparative analysis with autonomous and electric ground transportation for informing future research. *Transportation Research Part C: Emerging Technologies*, *132*(September), 103377. https://doi.org/10.1016/j.trc.2021.103377

Gibson, W., & Morrell, P. (2004). Theory and practice in aircraft financial evaluation. *Journal of Air Transport Management*, *10*(6), 427–433. https://doi.org/10.1016/j.jairtraman.2004.07.002

Gitman, L., Smart, S. B., & Zutter, C. J. (2018). *Principles of Managerial Finance* (18th ed.). Pearson.

Graaskamp, J. A. (1972). A rational approach to feasibility analysis. *Appraisal Journal*, *40*(4), 513–521.

Hendra, F., Supriyono, S., Efendi, R., Rosalinda, R., & Indriyati, R. (2021). a Business Feasibility Analysis of Small and Medium Enterprises for Product Strategy Determination. *SCIENTIFIC JOURNAL OF REFLECTION : Economic, Accounting, Management and Business*, *4*(3), 421–431. https://doi.org/10.37481/sjr.v4i3.320

Hoffman, D. W. (2002). *Capital Budgeting*.

Horngren, C., Sundem, G., Burgstahler, D., & Schatzberg, J. (2014). Management accounting. In *Pearson*. https://doi.org/10.4324/9780203404003-12

Husemann, M., Kirste, A., & Stumpf, E. (2024). Analysis of cost-efficient urban air mobility systems: Optimization of operational and configurational fleet decisions. *European Journal of Operational Research*, *317*(3), 678–695. https://doi.org/10.1016/j.ejor.2023.04.040

Kraus, K., Kraus, N., & Pochenchuk, G. (2021). Principles, assessment and methods of risk management of investment activities of the enterprise. *VUZF Review*, *6*(3), 45–58. https://doi.org/10.38188/2534-9228.21.3.06

Liu, M., Hao, H., Sun, X., Qu, X., Wang, K., Qian, Y., Hao, X., Xun, D., Geng, J., Dou, H., Deng, Y., Du, S., Liu, Z., & Zhao, F. (2024). Exploring the key technologies needed for the commercialization of electric flying cars: A levelized cost and profitability analysis. *Energy*, *303*(March), 131991. https://doi.org/10.1016/j.energy.2024.131991

Munisami, A. (2010). *Aircraft Financing : Perspectives for Small and Emerging Economies*. *June*.

Peterson, P., & Fabozzi, F. (2002). Capital Budgeting Process: Theory and Practice. In *Interfaces* (Issue 2). https://doi.org/10.1287/inte.17.2.78

Pons-Prats, J., Živojinović, T., & Kuljanin, J. (2022). On the understanding of the current status of urban air mobility development and its future prospects: Commuting in a flying vehicle as a new paradigm. *Transportation Research Part E: Logistics and Transportation Review*, *166*(April), 102868. https://doi.org/10.1016/j.tre.2022.102868

PT XYZ. (2023). *InvestDeck*.

Rocha, J., Oliveira, S., & Capinha, C. (2020). Introductory Chapter: Risk Management. *Risk Management and Assessment*, 1–10. https://doi.org/10.5772/intechopen.93553

Samonas, M. (2015). Financial Forecasting. In *Wiley* (Vol. 01).

Sampathkumar, A. (2022). *Electric VTOL (EVTOL) aircraft market - a global and Regional Analysis: Focus on design, range, use case, mode of operation, energy source, component, and country - analysis and forecast, 2023-2032*. bisresearch. https://bisresearch.com/industry-report/global-electric-vtol-aircraft-market.html

Shapiro, E., Davies, K., & Mackmin, D. (2012). Modern methods of valuation, tenth edition. In *Modern Methods of Valuation, Tenth Edition*. https://doi.org/10.4324/9780080937564

Thoburn, N. (2022). Measuring Return on Investments. *Deleuze and Politics*, 98–120. https://doi.org/10.1515/9780748631964-007

Thompson, A. A., Peteraf, M. A., Gamble, J. E., & Strickland III, A. J. (2022). *Crafting & Executing Strategy: The Quest for Competitive Advantage: Concepts and Cases 23Rd Edition (International Edition)*.

Wang, L., Deng, X., Gui, J., Jiang, P., Zeng, F., & Wan, S. (2023). A review of Urban Air Mobility-enabled Intelligent Transportation Systems: Mechanisms, applications and challenges. *Journal of Systems Architecture*, *141*(May), 102902. https://doi.org/10.1016/j.sysarc.2023.102902