**Research design**

1. **Research Objectives**
   1. **Research Questions**
      1. **Qualitative Research question**  
         1. What is the perceived sustainability and cost-effectiveness of AI in facility management at BUas (Breda University of Applied Sciences)?

**2.** How can the implementation of AI-driven tools optimize the study environment at BUas (Breda University of Applied Sciences)?

* + 1. **Quantitative Research Questions:**  
       1. To what extent does the use of AI in facility management result in measurable reductions in energy consumption and carbon emissions?

2. What percentage of water conservation can be achieved with AI-driven smart irrigation systems in large-scale agricultural operations compared to traditional irrigation methods?

3. What is the correlation between AI implementation in facility management and both environmental sustainability (as assessed by metrics such as consumption of energy and emissions) and cost savings (as measured by metrics such as operational expenses)?

4. How do perceptions of AI in facility management vary among students and staff across different demographic groups?

5. What is the extent of students' and lecturers' experiences and satisfaction in using AI-driven tools in their daily lives?

6. What is the acceptance attitude towards AI-driven tools being integrated in facility management study curriculum?

7. Are AI-driven tools influencing the educational outcomes of facility management students at BUas (Breda University of Applied Sciences)?

* 1. **Research Statement**

The main challenge for modern facility management is to handle sustainability issues in the face of rising operational expenses and environmental challenges. Artificial Intelligence (AI) integration into facility management procedures has come to light as a potential remedy. However, an in-depth understanding of its possible environmental benefits and cost-saving implications is necessary in order to fully understand the advantages of AI in this context. By assessing its potential to lower environmental impact and improve cost-efficiency, this study aims to evaluate the sustainability impact of AI integration on facility management. By assessing its potential to lower environmental impact and improve cost-efficiency, this study aims to evaluate the sustainability impact of AI integration on facility management. By identifying and quantifying these benefits, this research aims to provide valuable insights and strategies for organizations aiming to enhance both their environmental stewardship and financial sustainability within the realm of facility management.

1. **Literature Review**
   1. **Perceived Sustainability Impact of AI in Facility Management**

AI-driven predictive maintenance systems, as well as energy management systems, have been recognized as tools that enable facility managers to reduce resource consumption and minimize environmental impact (R. Panchal, 2021) (J. Aguilar, 2021). There is no doubt that AI has the potential to enhance sustainability, but there are a number of challenges as well as barriers to overcome. It is important to understand that these challenges include initial implementation costs, the need for specialized expertise, as well as concerns about data privacy and security. A common challenge for facility managers is to integrate AI technologies into existing systems and workflows of the organization without disrupting the existing processes (Reza Toorajipour, 2021). In facility management, user perception is crucial for AI integration. Users who perceive AI to be effective at achieving sustainability goals and who have positive user experiences are more likely to adopt the technology (Tao Chen, 2021). The environmental and financial impacts of AI in facility management have been examined quantitatively. Results show that implementing AI can result in significant savings in energy use, operating expenses, and carbon emissions (Praveen Ranjan Srivastava, 2023). Particularly cost reductions are an important reason for businesses to participate in AI-driven sustainability projects (My, 2021).

* 1. **Cost-Effectiveness of AI Implementation in Facility Management**

Analyzing the cost-effectiveness of AI in facility management relies largely on the Return on Investment (ROI) concept (Dr.Farzad Karimi, 2013). To determine the return on investment from implementing AI, researchers have created models and approaches. The models consider factors such as initial investment, maintenance costs, and the expected savings and efficiencies achieved by AI-driven solutions (Brynjolfsson, 2018). The cost-effectiveness of AI in facility management is often examined based on industry-specific nuances. Healthcare, commercial real estate, and manufacturing sectors, for example, investigate the financial implications of AI adoption. (Qian Chai, 2020) (OECD, 2021) rely on these insights to tailor their AI strategies to their specific needs and objectives. The cost-effectiveness of implementing AI depends on various aspects. In order to optimize cost-effectiveness, AI strategies must be in line with corporate objectives (OECD, 2021).

* 1. **Conclusion**

In conclusion, artificial intelligence (AI) is a potential tool for increasing sustainability and cost-effectiveness in facility management, but its adoption is dependent on resolving difficulties, user perceptions, and ROI concerns while aligning strategies with larger corporate goals. Furthermore, various obstacles must be overcome in order to completely incorporate AI into facility management, including initial expenses, specific knowledge, and data security issues.

1. **Methodology**
2. **For this study quantitative and qu**
3. **PHASE 1: Subject selection**
4. **PHASE 2: Choosing source of papers to review and analyze**
5. **PHASE 3: How to review and analyze**
6. **Data Collection Design**
7. **Ethical Consideration**
8. **Data Analysis**
9. **Conclusion**
10. **References**

*Wang, Y., Kung, L., & Byrd, T. A. (2018). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. Technological Forecasting and Social Change, 126, 3–13.* [*https://doi.org/10.1016/j.techfore.2015.12.019*](https://doi.org/10.1016/j.techfore.2015.12.019)

*Aguilar, J., Garces-Jimenez, A., R-Moreno, M. D., & García, R. H. (2021). A systematic literature review on the use of artificial intelligence in energy self-management in smart buildings. Renewable & Sustainable Energy Reviews, 151, 111530.* [*https://doi.org/10.1016/j.rser.2021.111530*](https://doi.org/10.1016/j.rser.2021.111530)

*Panchal, R., Singh, A., & Diwan, H. (2021). Does circular economy performance lead to sustainable development? – A systematic literature review. Journal of Environmental Management, 293, 112811.* [*https://doi.org/10.1016/j.jenvman.2021.112811*](https://doi.org/10.1016/j.jenvman.2021.112811)

*Chen, T., Guo, W., Gao, X., & Liang, Z. (2021). AI-based self-service technology in public service delivery: User experience and influencing factors. Government Information Quarterly, 38(4), 101520.* [*https://doi.org/10.1016/j.giq.2020.101520*](https://doi.org/10.1016/j.giq.2020.101520)

*Srivastava, P. R., Mangla, S. K., Eachempati, P., & Tiwari, A. K. (2023). An explainable artificial intelligence approach to understanding drivers of economic energy consumption and sustainability. Energy Economics, 125, 106868.* [*https://doi.org/10.1016/j.eneco.2023.106868*](https://doi.org/10.1016/j.eneco.2023.106868)

*Karimi, D., Zare’ie, D., & Najafabadi, M. S. (2013). Estimating the return on investment opportunities in financial markets and establishing optimized portfolio by artificial intelligence. International Journal of Academic Research in Business & Social Sciences, 3(7).* [*https://doi.org/10.6007/ijarbss/v3-i7/45*](https://doi.org/10.6007/ijarbss/v3-i7/45)

*Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2021). Artificial intelligence in supply chain management: A systematic literature review. Journal of Business Research, 122, 502–517.* [*https://doi.org/10.1016/j.jbusres.2020.09.009*](https://doi.org/10.1016/j.jbusres.2020.09.009)

*My, C. A. (2021). The role of big data analytics and AI in Smart Manufacturing: An Overview. In Springer eBooks (pp. 911–921).* [*https://doi.org/10.1007/978-981-15-7527-3\_87*](https://doi.org/10.1007/978-981-15-7527-3_87)

*Chai, Q., Wang, H., Zhai, Y., & Yang, L. (2020). Using machine learning algorithms to predict occupants’ thermal comfort in naturally ventilated residential buildings. Energy and Buildings, 217, 109937.* [*https://doi.org/10.1016/j.enbuild.2020.109937*](https://doi.org/10.1016/j.enbuild.2020.109937)

*OECD (2021), Artificial Intelligence, Machine Learning and Big Data in Finance: Opportunities, Challenges, and Implications for Policy Makers,* [*https://www.oecd.org/finance/artificial-intelligence-machine-learningbig-data-in-finance.htm*](https://www.oecd.org/finance/artificial-intelligence-machine-learningbig-data-in-finance.htm)*.*

*Brynjolfsson, E., Hui, W. T., & Yang, S. (2018). "The Impact of Artificial Intelligence on Productivity: Evidence from a New Firm-Level Database." NBER Working Paper No. 24239. National Bureau of Economic Research.*