Investigation into Prosthetics, with the Development of 3D Printing and Artificial Intelligence.

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PROBLEM STATEMENT

"What are the Recent Developments in the Prosthetic Industry regarding 3D Printing and Artificial Intelligence?"
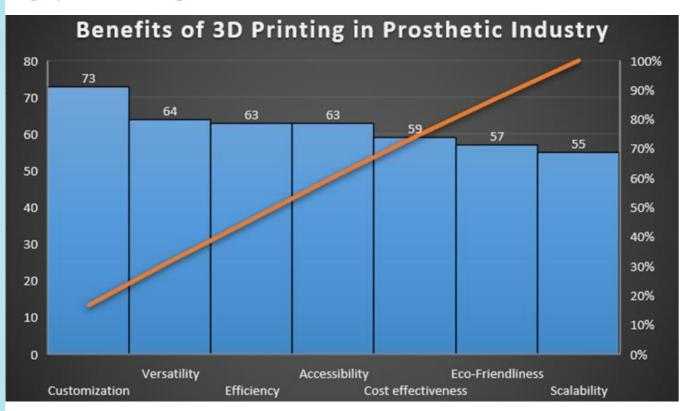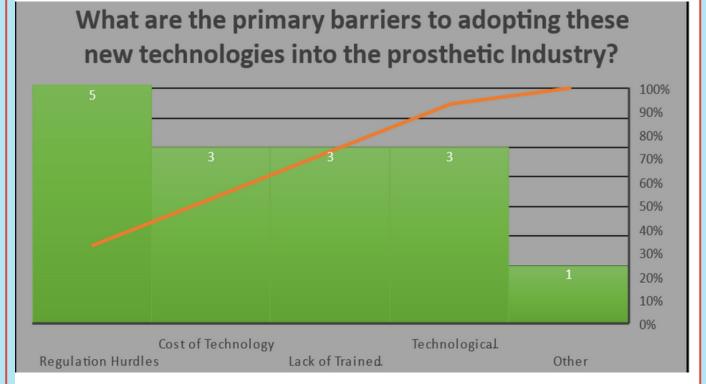
OBJECTIVE

- Carry out a critical literature review on advancement of Prosthetics, 3D Printing and Artificial Intelligence.
- Conduct a series of Interviews and Surveys with Industry Professionals on the possible implementation of proposed subject topics.
- Carry out case studies to investigate and identify the development of Prosthetics using Additive Manufacturing and AI.
- Develop a Process Design Analysis for implementing 3D printing process with integrated AI into a manufacturing prosthetic facility.
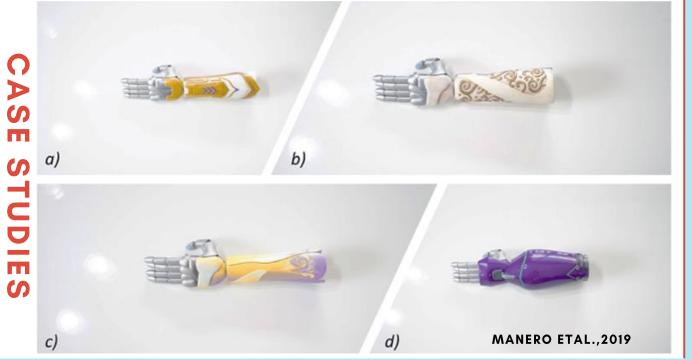
BACKGROUND

The integration of 3D printing and artificial intelligence (AI) is revolutionizing the field of prosthetics, offering customized, cost-effective, and highly functional solutions. Traditional prosthetic manufacturing is often time-consuming and expensive, limiting accessibility for many patients. However, advances in 3D printing allow for rapid prototyping and personalized prosthetic designs, while AI enhances precision, adaptability, and in both design and functionality. Recent developments include machine learning models that analyze patient biomechanics, enabling AI-driven design adjustments for better comfort and efficiency. Additionally, smart prosthetics embedded with AI can learn from user movements, improving adaptability over time. As these technologies continue to evolve, they promise to enhance affordability, accessibility, and functionality, addressing critical gaps in current prosthetic solutions.
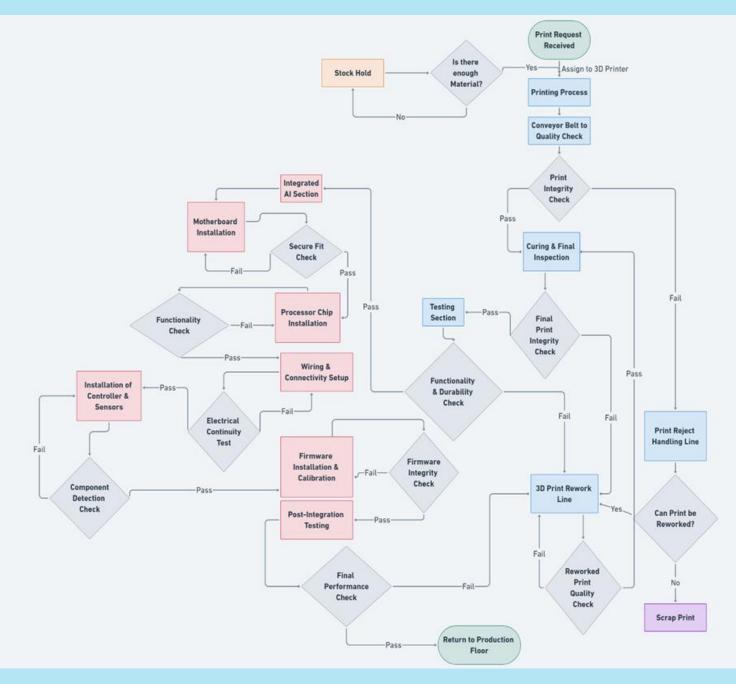
SURVEYS

Benefits of 3D Printing in Prosthetic Industry

What are the primary barriers to adopting these new technologies into the prosthetic Industry?

CASE STUDIES

MANERO ETAL.,2019

PROCESS PLAN MAP

RESEARCH FINDINGS

3D Printing Advantages:

1. Cost-effective and patient-specific designs.
2. 97.33% of survey respondents cite customization as the greatest benefit.
3. Material durability and scalability remain challenges.

AI-Driven Prosthetics Challenges:

1. Skepticism due to high costs, regulatory barriers, and software reliability concerns.
2. Industry experts divided—some highlight AI potential, others warn of software malfunctions, over-dependency, and cybersecurity threats.
3. Case studies show AI improves movement control but faces data privacy and long-term adaptability issues.

RELATED LITERATURE

Keywords: 3D Printing, Artificial Intelligence, Prosthetics, Biomedical Engineering, Customization, Myoelectric Control, Machine Learning, Regulatory Compliance.