

**PLANT-SCALE MANUFACTURING METHOD FOR COVAXIN, A NOVEL
INACTIVATED COVID-19 VACCINE**

QUALITY OVER QUANTITY AND EQUITY OVER EQUALITY

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
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Bachelor of Science in Chemical Engineering

By

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SOCIOTECHNICAL SYNTHESIS

High global vaccine compliance is the key to overcoming the pandemic. The technical project includes an efficient manufacturing process for a COVID-19 vaccine to supplement global supplies. Stockpiles of easily stored vaccines increase accessibility to recipients and decrease the opportunities for viral mutations by expediting distribution plans. Matters of supply and demand are not the sole determinants of vaccine compliance. Analysis of additional factors will utilize frameworks provided by the Science, Technology, and Society (STS) department, emphasizing the social ramifications of technology created by engineers. The tightly coupled technical project and STS research paper present viable solutions to mitigate vaccine non-compliance.

The technical report depicts a chemical plant capable of producing 713 million doses of Bharat Biotech's vaccine, Covaxin, annually. This vaccine does not require special refrigeration, making transportation and storage simple, and the compact plant design allows for easy replication and limited construction time. These characteristics support Covaxin's use to vaccinate a percentage of the world's population once it receives regulatory approval.

The plant will operate for 48 weeks a year and ramp up production to full-scale manufacturing during its first year of operation. Lab-scale experimental data and the manufacturers' claims of efficiency are the basis of the production process, so firsthand experimentation and updating the design are required to ensure the quality of the product and efficiency of the plant. However, the existing calculations project an Internal Rate of Return (IRR) of 377% under the worst conditions, exceeding the industry standard for economic feasibility and allowing room for revising the process.

Racial disparities in vaccine administration and the effects of COVID-19 prompted a deeper understanding of the factors that influence the public's perception of medical innovations. The research focus narrowed to determine the best way to vaccinate African Americans in Atlanta, Georgia. Vast differences in the demographics of medical professionals and public officials in the area compared to national averages lessen confounding variables. The STS framework produced by Pinch and Bijker, Social Construction of Technology (SCOT) theory, was used to establish the social groups that influence vaccine manufacturing and the factors that shape the public's opinions of receiving COVID vaccines. Peer-reviewed journal articles, data from government agencies, and accredited newspaper articles supported this framework.

Limited means of protection from the disease and excessive COVID-19 deaths experienced by the African American community require equity-based vaccination distribution plans. Analysis of national responses to African American hardships revealed that the African American community has a justified suspicion of the medical industry and government. Community-based research in the Atlanta area showcased that churches are capable of increasing community participation and shaping opinion. They are also more widespread than current vaccination sites. Accordingly, incorporating churches in vaccine administration sites offers the best chance to increase vaccination rates among African Americans and promote equity. Conclusively, modifying vaccination plans to compensate for the characteristics of individual communities is the key to overcoming vaccine non-compliance beyond Atlanta, Georgia.

An adequate supply of vaccines and the public's inclination to take them are requirements for overcoming the pandemic or an endemic situation. Vaccines are a technical development created by engineers and a social construction influenced by other entities. Those entities have a

responsibility to portray vaccines in a way that positively resonates with the public and ensures high vaccine compliance.

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PROSPECTUS

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