



Ph.D. DISSERTATION DEFENSE

Candidate: Ibrahim Aldulijan
Degree: Doctor of Philosophy
School/Department: School of Systems and Enterprises
Date: Wednesday, April 24
Time/Location: 2 pm <https://stevens.zoom.us/j/4984066297?omn=91411789391>
Title: A Distributed Systems Framework for Improving Citizen Science: The Case of Community Bio Labs and Open-Source Insulin Development

Chairperson: Dr. Mo Mansouri, School of Systems and Enterprises

Committee Members: Dr. Onur Asan, School of Systems and Enterprises
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ABSTRACT

This dissertation seeks to clarify how community biology labs as social enterprises can play a role in optimizing higher-order systems in line with their social goals. Utilizing these labs to reroute the exogenous insulin ecosystem in the US seems a promising application of citizen science. However, there are a number of barriers to their participation in healthcare and life science research. With their inherently individualized organizational structure, community labs face a range of common and unique obstacles. In this dissertation, I use an approach grounded in systems science to study social distributed systems and propose solutions to these challenges.

The first part of my dissertation investigates community biology labs, which are locally organized spaces for research, tinkering, and innovation. These labs are important arenas for improving the accessibility of biological research and the transferability of scientific knowledge. First, using a paradigm developed by David Stokes, I argue that the role of community labs falls most frequently into the category of use-inspired basic research (Pasteur's quadrant). As such, their ability to integrate diverse expertise, pivot between basic and applied work quickly, support collaboration, and focus on local priorities makes them valuable additions to this quadrant and to the scientific research community. Next, using design thinking and Enterprise Systems Thinking (EST) approaches, I apply a set of first design principles to develop potential solutions for improving the sustainability of these laboratories so that they may provide consistent accessibility, innovation, and education to local communities.

The second part of my dissertation investigates challenges and opportunities related to the development of open source drugs, with a particular focus on open source insulin. The adoption of open source insulin through the open-source innovation value model would offer an alternative to the current healthcare system, potentially decreasing costs for stakeholders and increasing accessibility and affordability for patients. I propose a value model that proponents of open source insulin can use both to evaluate its adoption within the constraints of the US healthcare regulatory landscape. I also provide a case study of the Open Insulin Project, which presents a novel business model applying the concept of open innovation to the production of open source insulin.

I look forward to sharing the results of my research and engaging in a thoughtful discussion. Your attendance and participation are highly appreciated.