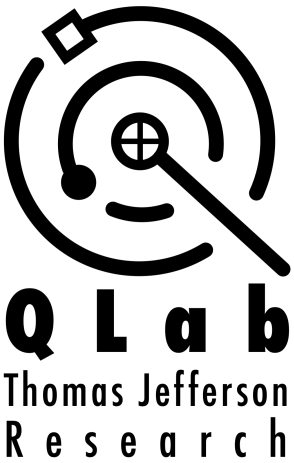

Research Proposal

Quantum-Enhanced Agent Based Modeling of the Senior-Care Technology Market

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Contents

1 Introduction **3**

2 Research Goals **3**
1 Develop Baseline Agent-Based Model of the Senior-Care Technology Market 3
2 Integrate Quantum Decision Theory in ABM 3

3 Potential Pitfalls and Alternative Strategies **4**

4 Research Timeline **5**

5 Group Responsibilities **7**

References **7**

1 Introduction

The proposed research aims to create a more accurate representation of the Senior-Care Technology Market in the US through quantum decision theory. In this research, we will analyze interactions between actors such as families of elders, government, NGOs, and senior-care technological service companies to build a more accurate model.

Intellectual Merit

The intellectual merit of this experiment is rooted in the quantum decision theory, which involves superposition for multiple simultaneous choices and could be used to analyze the entanglement of interconnected actors in this case [1]. The hypothesis is that the quantum-enhanced ABM is more accurate than classical models.

Broader Impact

The broader impacts of this research are noteworthy. As the current aging population increases, there is a rising demand for elder care solutions, and an accurate model of the appropriate market could have a significant impact on society. For example, an accurate model of the senior-care technology market could support policy design for the government by showing which interventions (subsidies, training, regulations) maximize adoption and thus the benefit. Additionally, the model could help NGOs identify underserved needs. Also, the model could provide companies providing services in the market with insights into adoption barriers, interoperability, and trust issues between different parties[2]. Overall, creating a more accurate model could promote efficiency in the adoption of senior-care technologies, thus contributing to digital inclusion for seniors and improving senior-care quality[3].

2 Research Goals

1: Develop Baseline Agent-Based Model of the Senior-Care Technology Market

The primary goal is to create a basic agent-based model of the referred market through programming behaviors observed about the different actors inside the market[4][5]. The agents are as follows: the US government, the National Council on Aging, Habitat for Humanity, CarePredict, Asha AI, Home Instead, Sensi AI, Sentrics, Hometeam, Inspiren, Cariloop, and Remo Health. By researching on their behaviors through their websites and any other useful social media platforms, I can program the behaviors of the agents for my model. The measurement of this goal is to track metrics such as adoption rates, cost efficiency, and consumer satisfaction of the agents.

2: Integrate Quantum Decision Theory in ABM

As stated in the introduction, I will use quantum decision theory to give superposition and interconnectedness to the decisions agents make to make the model more realistic than classical models. The measurement of this goal is to compare classical and quantum-enhanced ABM predictions in scenario tests.

3 Potential Pitfalls and Alternative Strategies

Develop Baseline Agent-Based Model of the Senior-Care Technology Market

Challenge 1

One potential challenge when striving for this goal is that I might experience data scarcity when trying to create the agent-based model according to the patterns of decision-making of each agent.

Solution: One solution to this issue look at case studies of certain agents instead of datasets in general. And when analyzing across case studies, try to gather up information about adoption figures, pricing, and performance. This way, I can gather up some scattered data when not being able to find a very concentrated one.

Challenge 2

Another challenge could be the accuracy of the data due to constant changes in the market. Thus, this could cause the basic ABM to be less accurate than later-generated ABMs in this research.

Solution: A solution to this issue is to code a more dynamic model. This means the model cannot be hard-coded, but rather needs coding methods such that it is simple to change the values later on if necessary.

Challenge 3

One potential challenge when trying to enhance the model with quantum concepts is that, since quantum agent-based models are relatively recent, I may experience inefficient integration of quantum decision theory due to a lack of knowledge and information online.

Solution: One way to minimize this is to research and understand how each agent is interconnected and what decisions can be simultaneously at the same time. There is no easy way to achieve this goal, yet I am confident that with sufficient research and the proper application of quantum concepts, this potential challenge can be mitigated.

Challenge 4

Another potential pitfall is the difficulty that I might not fully understand the quantum concepts, as I am currently not taking Electro at TJ.

Solution: A solution to this is that I will consult Mr. Hannum or the internet whenever I come across a problem or have a question related to concepts that are necessary to know.

By anticipating these potential hurdles and implementing these solutions, the experiment can be conducted with a higher degree of precision and confidence, increasing the likelihood of successfully proving the quantization of spin angular momentum and extending quantum principles to atomic structure.

4 Research Timeline

The following section outlines the proposed timeline for this research project, structured to distinguish clearly between different types of milestones. To improve clarity and organization, we categorize each entry into one of three levels—Tasks, Objectives, and Goals—defined as follows:

- **Tasks** - A task is a specific action or set of actions that need to be completed as part of the overall project. It involves concrete steps that contribute to the progress of the experiment or the writing process. Tasks are often short-term and focused on accomplishing a specific aspect of the project.
- **Objectives** - An objective refers to a measurable outcome or milestone that indicates progress toward completing a major phase of the project. Objectives are tied to a task's broader purposes and often focus on verifying or ensuring the quality, accuracy, or functionality of the work.
- **Goals** - A goal is the broader, long-term achievement or outcome of the project or a specific phase of it. It represents the final result you aim to achieve through completing the tasks and objectives. Goals are usually tied to the successful completion of a major project phase or the entire project.

Mid-September: Formal Project Proposal

Task: Develop and submit a detailed proposal outlining the experimental objectives, hypotheses, and methodology. This proposal will include a literature review, a plan for building the experimental apparatus, and safety considerations.

Objective:

Goal: Ensure approval and receive feedback from the supervising teacher or research mentor

Mid-December: Experimental Setup and Initial Testing

Task: Collect data on how each agent of the model behaves. This includes adoption figures, pricing, and performance. Create an ABM based on the data collected.

Objective: Make sure the collected data is as accurate and realistic as possible. Make sure the ABM embodies all the collected characteristics of the market.

Goal: Collect data and make sure it is realistic, then analyze it and put it into code form.

Mid-March: Data Collection and Analysis

Task: Create a quantum-enhanced ABM based on further data collected. Then compare to the basic model.

Objective: Then compare the quantum-enhanced model to the basic ABM to see which one is more accurate in predicting events in the market.

Goal: Make sure the ABM embodies all the collected characteristics of the market. After finishing the two models, compare them.

End of May: Complete Experiment and Prepare for Presentation

Task: Finalize data collection, ensuring accuracy and reliability of results. Confirm the observation of discrete deflection patterns and complete any necessary recalibration or adjustments.

Objective: Conclude the analysis phase, and present the results and conclusions in a formal presentation to peers, teachers, or a research committee.

Goal: Provide backup or counterproof for my hypothesis based on results.

5 Group Responsibilities

To ensure the success of this research project, each team member has been assigned specific roles that align with their expertise and interests while also contributing to the broader goals of the investigation. This structured division of responsibilities promotes accountability, encourages individual ownership, and ensures efficient collaboration across all phases of the project—from theoretical development and experimental design to data collection, analysis, and interpretation. The following section provides a detailed overview of each member's contributions, highlighting how their efforts collectively support the advancement of the research objectives.

Group Member	**Roles**
Chenxi Xu	• Will do anything necessary for the success of this project as she is working alone.

References

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