PennExchange

A web-based mock stock exchange

Team 60

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Executive Summary

The PennExchange project aims to develop a mock trading exchange that is designed specifically for educational purposes. The motivation for this project stems from the lack of access to platforms for people new to the finance industry to learn about trading. Currently, many firms in the quantitative finance industry train interns and new hires through various trading games through mock exchanges or open outcry, but systems are often outdated and not up to industry standard. Furthermore, for people not in the industry, there isn't easy access to these platforms and there is a steep learning curve, so it is hard for people to prepare for industry. We want to provide a more standard way for people to engage with mock trading games through hands-on experience. This platform can be used in collegiate trading competitions, clubs dedicated to teaching and learning different trading strategies, and firms training junior traders. By building this platform, we hope to expose more people to the trading industry that is generally more secretive and harder to get into than other industries.

The mock trading exchange will include a variety of features to facilitate manual and algorithmic trading. The key components of our system will be a backend order matching engine, endpoints for algorithmic trading supported by a python library, web-based user interface for manual trading, and general mock exchange tools. There will also be a news feed and users will be able to customize what they are trading to simulate a real trading environment.

Value Proposition

Our platform seeks to fill a niche within the trading industry that hasn't been developed in a long time. The PennExchange team found many software programs currently in use to be outdated or limited in features, and believed that there is space for a new provider of technology for trading education for both firms within the industry and individuals and academic organizations.

In particular, we seek to make our platform more performant, more visually appealing, and as easy as possible for new users to use and old users to excel upon. This is done through innovations in three areas: a modern user interface with internal keybinds and hotkeys, a high-performance backend engine with the latest industry-level tech stack, and an intuitive set of functions in a python library that allows users to interact with the exchange algorithmically. We seek to combine the best aspects of the various different exchanges and mock trading platforms our team members have encountered into one singular product that is accessible to all.

Stakeholders

There are several stakeholders who are relevant to our project.

1. Financial Institutions and Professionals (Proprietary Trading Firms, Hedge Funds, Asset Managers, Bank Sales and Trading Divisions). These organizations typically have their own internal training programs, and the product that we are building can integrate seamlessly into many currently outstanding programs, replacing open outcry type trading with a more modern electronic version. They can also configure mock trading simulations to simulate real scenarios, preparing trainees for actual trading events.
2. Educational Institutions. These organizations generally seek to create a community within an academic setting to learn more about extracurricular pursuits such as quantitative trading, which may not be formally offered at many places as an actual class that one may be able to take. With a product like ours, professors may be able to bring more interesting

examples into class, and clubs and other student organizations can do smaller training lessons to spread the knowledge they've gained during internships or other work experience to underclassmen and less involved students.

3. Career Development organizations. Another group that may be interested in our product are third-party career development organizations. These groups, typically (but not always) formed by ex-professionals, seek to prepare others for success in the industry, often for a fee. By outsourcing the development of an electronic exchange (PennExchange) to another party, these career development organizations can focus on building out the educational program and teaching the valuable lessons that potential employees need to hear rather than spending time building infrastructure that is not up to industry standards.
4. Gamification platforms/trading communities. A big part of the trading community is a culture of gaming and puzzle hunting. With this, our team believes that the general community of traders may be interested in holding open competitions or tournaments with their own designed scenarios, and our platform could very well become a central hub for the trading community at large.

Targeted Customer Segment

The key customer segments that we are targeting are academic organizations (such as clubs) and trading firms without sophisticated internal training systems. The end goal of our project is to build something for people to be able to learn trading concepts from; in particular, those who are most in need of training are students who are preparing for jobs, and young professionals in those jobs who are seeking to improve their market understanding, quick thinking, and general financial intuition.

We will explore the more direct cost and revenue models in a later section.

Competition

There are two types of competitors with our product. The first type is external tools built for general use, the main one of which is the RIT market simulator, originating from UToronto, which is to our knowledge the only external tool that is used as part of training at a proprietary firm (Citadel Securities). The second type of competitor is the exchanges that organizations and firms build on their own. Examples of this include Jane Street's internal trading platform that is similar to the actual platform that their traders trade on, or the algorithmic trading platform that the UChicago Trading Competition Team built for the competition.

Our team has used user feedback and surveying to determine the various features and pain points that exist in each of our competitors, and synthesized this in part in Market Research, but also in another separate collection of User Feedback. We've also asked experienced users to try our prototype system, and have iterated on both the general recommendations from experience using competitors, and the direct feedback on our product to further improve our design.

Market Research

Our Market Research was composed of several segments. We first conducted a literature review, and then surveyed users of competing platforms to understand specific benefits and drawbacks of each platform.

We reviewed the Penn-Lehman Automated Trading Project from 2003 (paper), which was in part led by our advisor Michael Kearns. In particular, they built the Penn Exchange Simulator, which was like an experimental ECN that merged Island order books with orders placed by virtual trading clients, and also provided a backtesting environment. This was generally built with C on Unix/Linux, and had an integration with live market data to allow users to simulate live trading. We wanted to integrate some of the useful features from this paper and abstract out some trading concepts in game format. We also reviewed a paper designed on the RIT market simulator (paper) which allowed us to better understand the RIT simulator and what features it provided, allowing us to draw from this.

The second part of our market research was user feedback from past interns and trading competition participants. In particular, we surveyed users for feedback on the RIT market simulator, Jentry (the Jane Street manual exchange), ETC (the Jane Street electronic exchange), UChicago electronic "Xchange", and the DRW exchange. This gave us valuable insight on what features are useful, and what we should aim to fix, and is available in a user feedback document in our files upon request.

Intellectual Property

The main intellectual property of our project would likely lie within the games that are designed to be played on our platform. We will create a few basic scenarios that are based on similar games that have been played previously in competition and internship scenarios, but these are of creative nature and should not be publicly available (in code form) and may be considered Intellectual Property.

Cost and Revenue Model

Costs:

The two sources of anticipated costs will be hosting costs (to host the web application, backend servers, and databases) and advertising. We expect that most of our costs will likely be from the former, as word of mouth advertising is key for our product, as we need entire organizations to be interested enough to adopt it together. The costs should be generally low as our product is entirely digital and will be designed for scalability on the cloud, and increase linearly with the usage of the platform.

Revenue:

We plan to implement a subscription based model with three tiers, Individual, Educational, and Enterprise. While we've preliminarily decided to have these designations, we have not yet priced each tier other than the free-level Individual tier.

The Individual tier is targeted at people trying to use the platform by themselves, familiarize themselves with some basic trading concepts, and perhaps demo the platform before making a jump to one of the higher tiers. This tier is designed to be free and give limited access to the platform, including the ability to try 2-3 of our preloaded game scenarios and fully interact with our front-end UI.

The Educational tier aims to provide a fuller view of what the platform looks like, at a cheaper price to the enterprise-level software. In particular, we could offer students and professors associated with academic institutions a free trial period of several months, allowing not only to access a selection of preloaded scenarios but also build their own, as well as run games that also allow usage of the algorithmic endpoint on the engine. Educational tier users are likely to be limited to some number of self-created games, and possibly on the number of users that can join a game at once.

The Enterprise tier is designed to provide all features to potential users in the industry, allowing a large number of connections (up to software limitations), unlimited game creation and designs, and access to a full range of self-designed games. This allows firms as much freedom and flexibility as they would desire in training their employees. This could also possibly include extensions such as excel plugins, ability to draw from a live data feed, etc.