Roadmap: TruCol
A decentralised collaboration protocol for test-driven development

September 6, 2022

1 Introduction

Welcome, this document presents our market analysis for the TruCol company. The objective of this document is to provide some basic insight into the order of magnitude of the potential of the TruCol company to generate returns for its potential investors. Based on various pitch templates, [?], and private communications, we intend to convey this information through sharing our model and estimate of the following market parameters for the TruCol company:

- **Total addressable market (TAM)**, or total available market, is the total market demand for a product or service, calculated in annual revenue or unit sales if 100% of the available market is achieved[?].

- **Serviceable available market (SAM)** is the portion of TAM targeted and served by a company's products or services[?].

- **Serviceable obtainable market (SOM)**, or share of market, is the percentage of SAM which is realistically reached[?].

Since we currently have little experience on this topic within our team, we are making our data and assumptions as transparent as possible, both in this document as in our code. This way, we hope to improve our model based on your feedback by enabling you to experiment with it yourself. Additionally, because the market analysis consists of a rough estimate, three different estimation methods are considered for generating the TAM, SAM and SOM estimates. The redundancy is introduced in an attempt to establish some frame of reference within the results. The assumptions and data points for the respective models are specified explicitly in this document with an identifier, and where relevant, this identifier is used in the comment of the code to link the document and code.

The models are described in section 4 (the Python models themselves are included as appendices in **??** to **??** respectively). The results of these models are presented in section 5. To shed some light on how sensitive the model is to for example changes in assumptions, a sensitivity analysis is presented for each model in section 6. Next, the results and sensitivity of the models are discussed in section 7 and a conclusion is provided in section 8.

We invite you to tinker with the assumptions and models yourself! The data and plots in this report are automatically updated if you run `python -m code.project1.src`. If you experience any difficulties in running the code, simply reach out to us, (click on issues on the GitHub page) and we are happy to get you running the code.

2 TruCol Company Business Model

Since the market size estimation models are somewhat of an abstract/subjective task, three different approaches are used in an attempt to establish some reference material with respect to accuracy.

Before the model is presented, it is important to realise that we propose an optimisation service. This means that if a certain activity, e.g. a logistics company has operational cost of 5 \$million/day, our service is only able to earn at most the margin of improvement we are able to bring our customer. Suppose the independent usage of the TruCol provides the customer with a 2% optimisation in their operational costs, yielding them $5.000.000 \cdot 0.02 = 100.000/day$\$. Suppose our expertise is able to enable them to yield a 3% optimisation by identifying the relevant development/system processes and supporting them in improved test specification. In that assumption our company would bring them an additional 3-2=1% which would translate roughly to 50.000\$. That would be the value we bring to the logistics company in this hypothetical scenario.

In reality this example is oversimplified, the 2% the company could get by themselves would involve some risk pertaining to inaccurate test specification which could lead to loss of the bounty. Our company reduces this risk by providing test-specification security expertise. Furthermore, our interaction with the client may bring the client experience that can be applied in future applications of the TruCol protocol, hence the value to we bring to the client is larger than the amount they gain in terms of optimisation w.r.t. the case where they use the protocol themselves.

3 Markets

To use the Top Down Model, section 3.1 describes the TAM in which the TruCol company will operate. To this end, section 3.1.1 discusses the market size of the logistics market, and the profit within that market. Due to time-constraints and lack of data, some datapoints and assumptions of the logistics market are applied to other sectors such as the automated trading market and pharmaceutics market in section 3.1.2 to get some insight in their respective market sizes. Furthermore, section 3.1.3 provides some qualitative insight in the potential future markets that are highly suited for the TruCol protocol. These emerging markets are accordingly expected to be relevant markets to address in the near future.

3.1 Total Addressable Market

To compute the TAM, SAM and SOM, some form of market definition can be used. To this end, it is considered valuable to specify what the TruCol company does, where it adds value and how it does that. Furthermore, since these three aforementioned estimates pertain to a potential future, the potential, yet deemed feasible, activities of the TruCol company are included.
The TruCol company provides advice and support to companies on how they can get the most out of the TruCol protocol. To understand this, the following assumptions are shared. Under these assumptions, one can conclude that an economically rational company would try to off-load as much of their required tasks into the TruCol protocol as it would minimise their operational costs and/or improve algorithmic efficiency of their solutions.

- **asu-0:** Solutions to tasks that are completed using the TruCol protocol are deterministically verifiable.

- **asu-1:** Solutions to tasks that are completed using the TruCol protocol are of sufficient quality.

- **asu-2:** Tasks that are completed using the TruCol protocol can be solved for the lowest cost price that is currently available in this world.

- **asu-3:** No personnel needs to be attracted, screened, hired nor fired for tasks that are completed using the TruCol protocol.

- **asu-4:** Companies can benefit from public particular solutions to their task specifications.

- **asu-5:** By sampling from a bigger talent pool (this world), the average performance of the solutions will be better than what is produced by the in-house talent pool, or, for equal solution performance, a faster rate of development can be obtained on average for an equal or lower price.

We help companies identify the tasks for which they can use the TruCol protocol, and we assist them in writing safe test specifications that are not easily hackable. This implies that under the given set of assumptions, the TAM for the TruCol protocol can be defined as the total costs that the companies (and consumers) in this world are willing to pay for assistance on using the TruCol protocol.

3.1.1 TruCol Total Addressable Logistics Market

This sub-sub section illustrates a rough method of estimating the logistics sub-segment of the TAM for the TruCol protocol. To do this, an example of algorithmic optimalisation within the logistics market as presented by McKinsey & Company is generalised conservatively to a rough estimate of the total logistics market size.

A clear example of a logistics company successfully hiring a support for algorithmic optimalisation is documented by McKinsey & Company in the "how they help their clients" segment of their website[**?**]. The study how reports McKinsey's team, among which McKinsey's Strategic Network Analytic Center, helped an Asian logistics company. With McKinseys team, the logistics company realised an *in line haul network cost* reduction of 3.6% while reducing their *transit time* with 0.8%, yielding an overall 16% increase in profit for the logistics company, without compromising the quality. To use this report as a valuable resource to generate some rough estimates on market size, the following assumptions are made:

- **asu-6:** The logistics company made a net profit by hiring McKinsey & Company in this particular ordeal.

- **asu-7:** The example of a 16% increase in profit is generalizable to a conservative potential 0.1% of profit increases through algorithmic optimalisation across the entire logistics industry.

- **asu-8:** Companies are willing to pay at least 1 % of their potential profit increases for the assistance the TruCol company provides in identifying opportunities for optimisation and for improving test-specification security.

Based on those assumptions, one could find a potential yearly profit increase across the entire logistics sector by summing the net profit of the logistics sector. [?] claims that this company [?] valued the logistics market at 8.1 trillion in 2016. Additionally, [?] claims [?] estimates the logistics market value will grow to 15.5 trillion in 2023. However, no figures on profit are found. Therefore, individual companies are explored.

For DHL one can find on pdf page 37/170 in [?] that the annual profit for DHL in 2019 was 4.1 billion.

For UPS one can find on pdf page 4/257 in [?] that the annual unadjusted operating profit for UPS in 2020 was 7.7 billion. Note, [?] says UPS had a net operating profit of 1.1 billion in Q1 of 2020, implying they had to almost double their average profit in the remaining three quarters of 2020 to be consistent with an annual 7.7 billion.

For FedEx the net income as reported for 2020 has been 1.29 \$ billion in pdf page 2/17 [?].

- **Asu-9:** The net income as reported (GAAP) by FedEx can be interpreted as the profit by FedEx.

Next, the claim that fragmentation of the global market implied in 2016 that Deutsche Post DHL, Ceva Logistics, UPS, and FedEx, control less than 15% of that global market allows estimating a limit on the net global profit made in the logistics market based on the following assumptions:

- **Asu-10:** The market segment in the global logistics market maintained by the combination of DHL, UPS and FedEx is at most 15% in 2020.

- **Asu-11:** The profit in the remaining 85% of the global logistics market has the same average yearly profitability per percent market share as the combination of DHL, UPS and FedEx.

Based on assumptions 1-11 one could estimate an upperbound of

$$
\begin{aligned}
net-profit_{DHL+UPS+FedEx} &= 4.1 + 7.7 + 1.29 = 13.09 billion \\
\frac{net-profit_{global\_logistics}}{net-profit_{DHL+UPS+FedEx}} &= \frac{0.85}{0.15} \\
net-profit_{global\_logistics} &= net-profit_{DHL+UPS+FedEx}\frac{0.85}{0.15} \\
net-profit_{global\_logistics} &= \frac{13.09 \cdot 0.85}{0.15} \\
net-profit_{global\_logistics} &= 74.2 billion
\end{aligned}
\tag{1}
$$

Hence, if each of those companies in the logistics sector could increase their profits on average annually by .1% using algorithmic optimisation, and if they would use the TruCol protocol to do that, and if they would be willing to invest 1% of that profit in our support and assistance in getting the most out of the TruCol protocol, we would currently estimate that this would yield roughly an income of $74.2 \cdot 0.001 \cdot 0.01 = \$0.74 million$

3.1.2 Additional addressable markets

Since the TruCol company is market agnostic, we also seek to assist in algorithmic optimisation outside the logistics market. Several markets are worth mentioning in particular as we expect them to either heavily rely on algorithmic optimisations, or because they are particularly suited for the TruCol protocol.

- **(Automated) trading** In the highly competitive market of (automated) trading, algorithmic optimisations are key to making successful trades.

- **Space Sector** The space engineering sector already has a relatively high test driven development[?], this lowers the adoption costs of the TruCol protocol relative to most industries. Furthermore, space applications are heavily mass constrained, which generally makes them highly energy constrained as well. These energy constraints emphasise the importance of algorithmic optimisations, for example in telecommunications satellites and swarm robots.

- **Innovative Materials Research** The domain of material science has been adopting algorithmic search strategies to find new materials [?].

- **Pharmaceutical Industry** Another example of a large market that has been shifting to adopt algorithmic search strategies to find new medicines.

Each of these are multi-billion dollar markets which can contribute to the TAM of the TruCol company.

3.1.3 Emerging markets

Beyond those listed markets, the following emerging markets could be great opportunities for the TruCol company to latch in and grow along in.

- **Neuromorphic Computing** This field is developing new complexity theory to adapt to the unconventional computation methods. This is an interesting opportunity to explore the versatility of the TruCol protocol.

- **Quantum Computing** This is another upcoming field with many new algorithmic implementations. The newness of the field may suggest that the amount of optimisation and exploration to be done is relatively high, possibly indicating a relatively large potential for the TruCol protocol. However, currently our team does not yet contain experience in this type of algorithmic developments.

- **Artificial Intelligence** With the introduction of GPT-3 the world has seen an example of an AI engine that is able to generate code for some basic tasks [?]. The TruCol protocol could catalyse the usage of such AI engines that are able to write code based on requirement specification. We expect that users of the TruCol protocol will develop a tactical advantage on requirement specifications for AI engines.

4 Market Analysis Model

This section describes the model that is used to perform the market analysis for the TruCol company service. The model will be used to estimate the yearly revenue that is projected for this company. Typical estimation models to do this for startups are:

- *Top Down Model* - Starts with a large population with known size that make up the target market, and then narrows the market size down to the specific market segment.

- *Bottom Up Model* - Takes current pricing and/or usage of product as a starting point and extrapolates up/outwards to compute the potential market size.

- *Value Theory Model* - estimates the value provided to customers and estimates how much of that value can be reflected in the product pricing.

Since the TruCol company does not yet have a large body of current pricing and product usage, the Bottom Up Model is not used in this market analysis document. Similarly, the Value Theory Model is omitted in this market analysis as it is most powerful on historical data which is not yet available for the TruCol protocol. Since the market sizes of most sectors in which the TruCol company intends to operate, the Top Down Model is used to derive a rough estimate of the projected yearly revenue for the TruCol company.

4.1 Top Down Model

5 Results

5.1 Top Down Model

The code listed in the appendices generated the following estimates for the total addressable market sizes for the TruCol company.
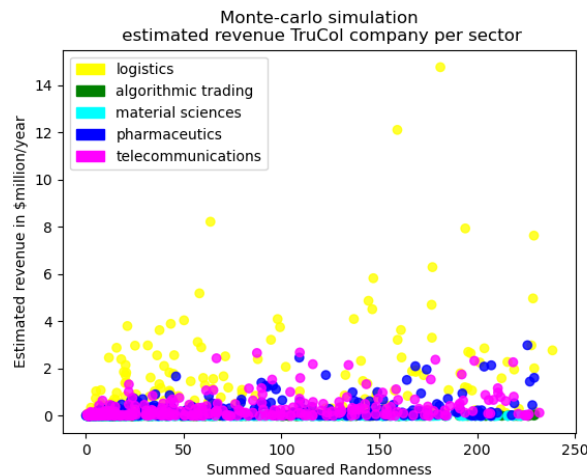

Figure 1: A scatterplot generated by a Monte-Carlo simulation to provide an impression on the estimated projected total addressable market per sector for the TruCol company.
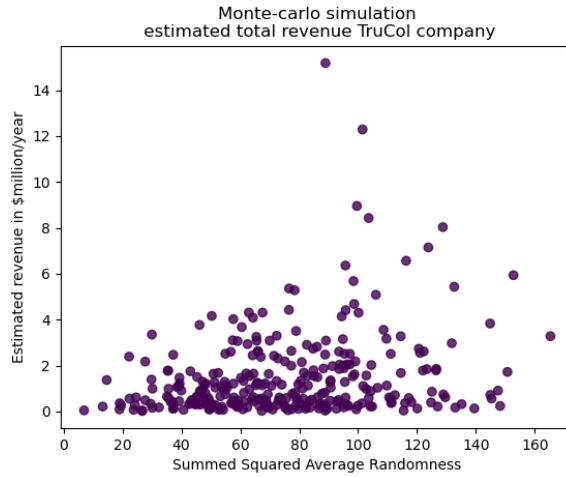
Figure 2: A scatterplot generated by a Monte-Carlo simulation to provide an estimate on the projected total addressable market for the TruCol company.

6 Sensitivity Analysis

6.1 Top Down

Omitted due to time constraints. Can be generated upon request.

7 Discussion

We expect that the main points for improvement in this analysis are the datapoints that are used. In particular, the generalisation of the profit margin of the logistics sector to other sectors could be replaced by the actual data of the other sectors. Furthermore, the profit margin of the logistics sector could be searched directly instead of deriving it based on the of its larger companies.

8 Conclusion

A rough estimate based on various datasources has been generated to estimate the yearly revenue of the TruCol company. Additional iterations with improved datapoints is recommended to obtain a more accurate estimate. The market analysis does not yet include the growth that may be captured in diversification, emerging markets such as neuromorphic computing and in-house automation/AI-engines. Before taking these potentials into account, however, a more accurate assessment of the starting market is recommended.