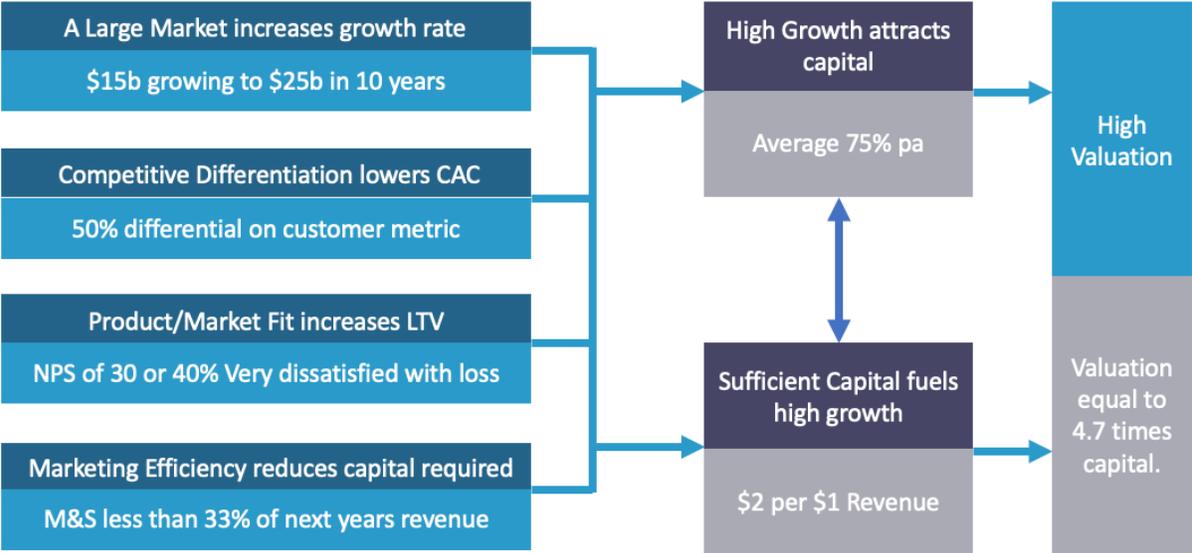


Scaleup Math

The hidden economics behind successful tech companies

Scaleup Math



Creating a Successful Scaleup

Creating a successful scaleup is a difficult proposition. In fact, only 1% of companies that get seed capital ever become Unicorns or have an IPO. One way to further our understanding of the challenges that are faced in this endeavor, is to develop a data-driven approach. Using data effectively will assist CEOs and founders of our startups and growing companies answer questions such as:

- How do we maximize our potential?
- How do we know when we have the right strategy?
- How fast should we be trying to grow?
- How much capital should we raise?
- How should we allocate my expenditures to optimize growth?

Companies are eventually judged on economics; the ability to turn ideas and cash into growth. Unfortunately, current stage/milestone frameworks don't address the economics of growth. Understanding the economics can accelerate growth and reduce capital requirements and increase the chances of a firm becoming a Unicorn.

This document presents the math of successful scaleups. It summarizes many of the metrics that are essential for a firm to understand and develop its path to a world class company. The data included in this report focusses on software and in many cases, SaaS based firms. Further research will contribute metrics for other types of firms. Other types of firms however, can use these metrics to understand the basics of growth as many of them apply to multiple industries. With these metrics in hand, a firm in another industry can look at data from a variety of sources to determine benchmarks for their own industry.

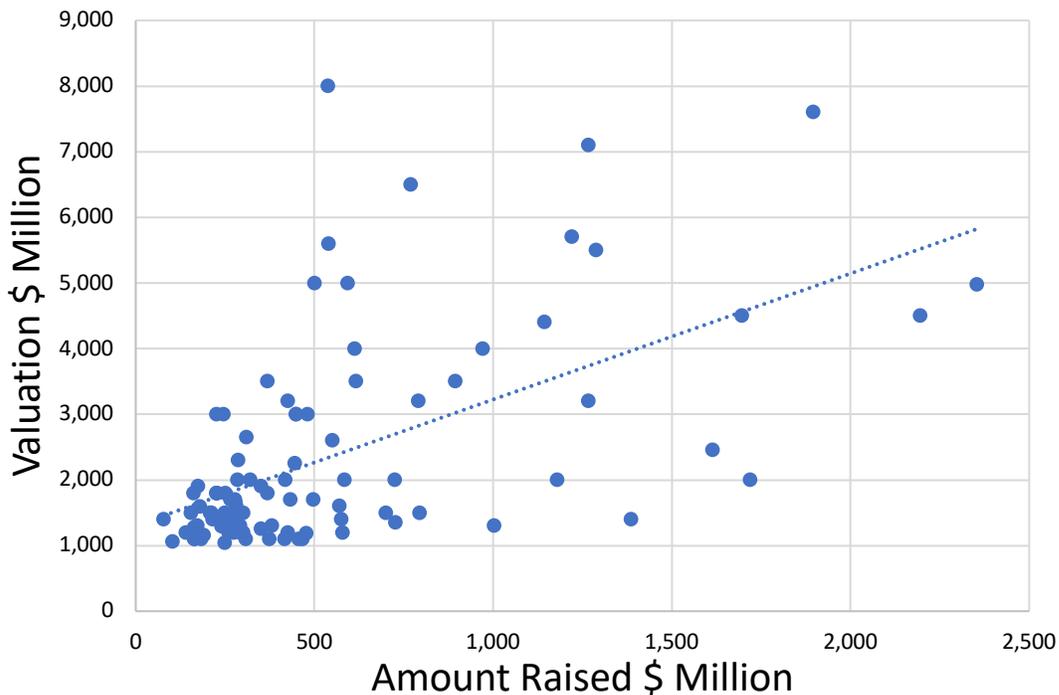
A word or two of warning. This is a work in progress and there may be other factors that we discover in future research. We don't have all the answers but we are hoping we are asking the right questions. Finally, there are many perspectives on rapid growth and the creation of successful scaleups and this is just one, an economic perspective.

Unicorn Revenue

Companies need revenue of about \$125 million to become a Unicorn

One debatable mark of scaleup success is becoming a Unicorn. With a high growth rate, a company will be able to raise capital and achieve the valuations necessary to become a one. The first issue in creating a Unicorn is how big does the company need to be. One way to look at this is to first look at valuation compared to the amount of capital invested. This can be referred to as a capital multiple. To examine a company's capital multiple, you can look at the ratio of capital raised and valuation as shown on the following chart.

Exhibit 1
Relationship Between Capital Raised and Valuation for Unicorns



The average Unicorn has a capital multiple of 5.7 (i.e. valuation divided by the capital raised is 5.7 times). The median value of the capital multiple is 4.7. The correlation between the amount raised and the valuation is still strong at .57.

A Unicorn has a valuation of at least \$1 billion. By examining the ratio of valuation to capital, we can compute that a Unicorn, will need to raise approximately \$212 million of capital to become a Unicorn. Given a ratio of capital to revenue of a median of 1.7 times (discussed later in this paper), this means that a potential Unicorn will need to increase revenue to approximately \$125 million in 10 years. This implies an annual compound growth rate averaging about 75%.

Market Size

A Larger Market Drives a Higher Rate of Growth Your Market needs to \$25 billion 10 years from Startup

The first requirement for creating a Unicorn is to be in a large market. In terms of market type, 88% of the software companies that went public from 2013 to 2020 were selling horizontal applications. And of the companies serving vertical markets, only 3 went public after 2015. The problem with vertical markets is that it is usually difficult to find a vertical market large enough to support a public company. The second rule about markets is that the best markets are usually consumer or corporate markets.

Many years ago, investors would say that an entrepreneur needs to show that their company is entering a market of at least \$1 billion in size. Unfortunately, since those simpler times, the size of the companies going public has increased and the Total Addressable Market (TAM) for those firms has come to be much larger. How much larger can be seen by examining the prospectuses for those software companies going public from 2013 to 2020. Exhibit 2 shows the average market size of firms when they went public.

Exhibit 2

Average Market Size when Going Public \$ Billion US

Market Type	Horizontal	Vertical
Consumer	364.5	359.0
Corporate	36.8	8.6
SMB	77.3	7.5

Looking at the results obtained by software companies that went public in the last decade, we can figure out what TAM is enough to get a company to \$125 million in about ten years. To do this we looked at over 100 companies and determined from their prospectus what their TAM and revenue was.

This result of this work is illustrated with the financial situations of Uber, Dropbox and Xactly.

Exhibit 3
Total Addressable Market

Company	Total Addressable Market (\$B)	Revenue (\$M)	% of Total Addressable Market
Uber	\$2,500	\$14,147	0.45%
Dropbox	\$50	\$1,107	2.21%
Xactly	\$7	\$61	0.87%

The average firm that went public achieved revenue in 10 years that was 0.75% of their TAM. The median of this group recorded 0.51% of their TAM as revenue. In fact, there is a pattern as to how much revenue can be achieved based upon the number of years from startup. The following chart shows that relationship

Exhibit 4
Achievement of Total Addressable Market

Years from Startup to Prospectus	Average % of TAM Achieved	Median % of TAM Achieved
6 or less	0.49%	0.25%
7 or 8	0.59%	0.51%
9 or 10	0.77%	0.61%
11 or 12	1.00%	0.48%
13 - 15	0.83%	0.61%
More than 15	1.18%	0.84%

From this we can compute the TAM needed to get to revenue of \$125 million in 10 years. If you want to get to \$125 million then you need a market of about \$25 billion 10 years from startup using the median number.

Companies will want to figure out potential TAM before they start up a business. This is also a calculation that they will want to come back to whenever they are evaluating strategy as it is the foundation for all potential future growth.

Competitive Differentiation

Higher Competitive Differentiation Reduces Customer Acquisition Cost You Need a 50% Differential on a Customer Metric

In whatever market a firm chooses to operate, it must ensure that its products or services are highly differentiated from those of the competition. This might be by emphasizing quality or speed on some dimension or by reducing cost.

A firm also needs to be able to measure that competitive differentiation on the same basis that clients will measure it. This is often a nebulous area but market research and asking clients how they rate a product or service to competitive ones on a number of different bases will enable a provider to develop a scoring system against which it can target and track progress.

Exhibit 5
Dimensions of Product Differentiation

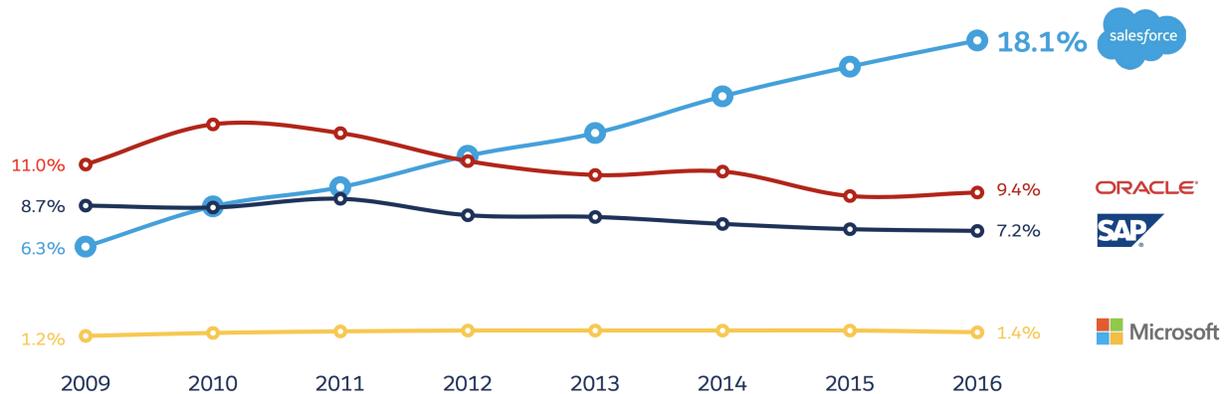
Quality	Speed	Cost
Performance	Transaction	Capital
Features	Delivery	Operating
Reliability	Implementation	Fixed
Conformance	Learning	Variable
Durability	Support and Service	
Service		
Design		
Vendor Experience		
Vendor Knowledge		

Salesforce is an example of a company that was a successful differentiator. They took an on-premise product that used to cost tens of thousands to buy and months to install and made it available in the cloud immediately for a low price per user per month. They were founded in 1999 when the CRM market was \$3.3 billion. When they went public in December of 2003, they had \$51 million in revenue and identified their TAM at \$7.1 billion. Their ability to differentiate their product drove them to the number one position in the industry by 2012 and they now have over 19% of a \$48 billion industry.

Exhibit 6 Salesforce Market Penetration

Extending Our CRM Market Leadership

Taking share in the most important enterprise software market



Amazon is a great example of a provider that has very well-defined points of competitive differentiation. In fact, unlike almost all companies out there, Amazon has figured out how to compete on all three dimensions of quality, speed and cost simultaneously. What is important about its basis of differentiation is the magnitude of difference which in most cases is greater than 50%. And this is the number to aim for, a differential of 50% on a metric that the customer uses for evaluation.

A startup will typically set its objectives for competitive differentiation before it starts developing a product. This is the stage when they might want to enter an accelerator program to begin with product development. With a minimum viable product, they will begin to do trials with customers and potentially earn revenue.

Product/Market Fit

Increasing Product/Market Fit Increases the Customer Lifetime Value You Need a Net Promoter Score of over 30

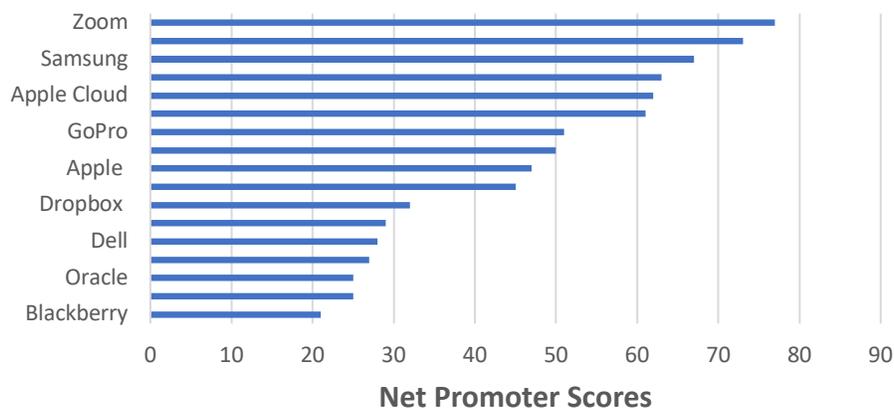
It's not enough to get a product into the customers hands, it has to stick and that is where product/market fit comes in. If you have good fit, you'll increase the lifetime value of a customer.

To determine product/market fit, one technique used is to calculate the Net Promoter Score (NPS) for each of the provider's target market segments. NPS measures client experience through the use of a 10-point scale used to answer the question: "How likely is it that you would recommend (your startup) to a friend or colleague?" Respondents are grouped into:

- Promoters (score 9 – 10) - loyal enthusiasts
- Passives (score 7 – 8) satisfied but unenthusiastic clients
- Detractors (score 0 – 6) unhappy clients

To calculate the NPS, subtract the percentage of detractors from the percentage of Promoters, getting a score that is between -100 and 100. Exhibit 7 shows the NPS for major tech firms.

Exhibit 7
Net Promoter Scores
Source: customer.guru



When an NPS score is measured among all clients, one will hopefully obtain a small but positive score. The key to segmenting clients is to find patterns of clients that as a subset, would have a much higher NPS. Some commentators say that a firm needs an NPS of at least 60 to show product market fit although that is perhaps excessive when one sees what major providers manage to score.

Another metric that can be used is one based upon customer satisfaction. Asking a customer how dissatisfied they would be if they were no longer able to use a certain product is a good thing to measure. Research has shown that there is good product/market fit when 40% of customers say they would be very dissatisfied if they were no longer able to use a product.

When a firm begins to do measurements of this type, it is unlikely that they will achieve NPS scores above 30 or Very Dissatisfied ratings above 40%. The key to success is to segment the market of respondents by use case or user persona until these measures are reached. These represent the best initial target markets for the product as they will produce higher lifetime value and ramp sales up faster. As firms progress, they will need to come back to these measurements to evaluate market opportunities.

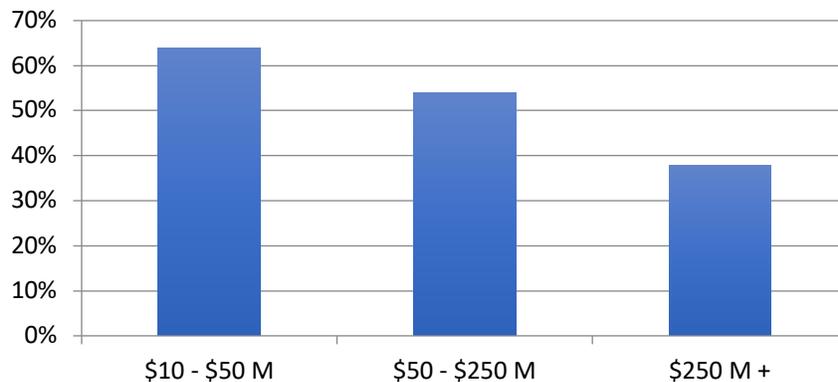
At this stage of a startup's development, they are typically funding a search for product market fit with pre-seed or seed funding. As they begin to get customers, they would be below revenue of \$1 million and at this level they need to grow revenue or users at a rate of 10% to 20% a month.

Marketing Efficiency

Increasing Marketing Efficiency Reduces Capital Requirements You Need M&S to be less than 33% of Next Year's Revenue

Perhaps the biggest factor in fueling growth is marketing and sales (M&S) expenditures. Across the companies in a recent study, M&S as a percent of revenue was substantial (refer to Exhibit 8). The average spend was 54% of revenue. As the average level of M&S as a percent of revenue declined from about 65% to about 53%, loss levels dropped. There is a correlation of 0.43 between M&S as a percent of revenue and growth rates, likely indicating the importance of M&S spending in driving revenue.

Exhibit 8
Marketing and Sales as a % of Revenue



Marketing efficiency measures the direct costs associated with driving revenue. This is sometimes referred to as unit economics, expressed on a unit basis where the client is the unit. There are several important metrics that a company can look at to measure efficiency.

1. The first thing to measure is customer Long Term Value (LTV). This represents the average long-term value of any customer acquired including upgrades, downgrades and churn.
2. The second is Customer Acquisition Cost (CAC) which is the total cost of marketing and sales to acquire a customer.
3. Using CAC, one can compute CAC Payback. Lower CAC paybacks indicate a higher client need and help preserve cash flow. A CAC Payback in months should be below 12 months

for SaaS companies below \$1 million in revenue, rising to around 13 months when a firm is over \$5 million in revenue.

4. One can also examine the ratio of LTV to CAC. Clients with a high LTV to CAC ratio are likely to see greater value in a solution. Commentators have determined that an LTV/CAC of greater than 3 is a level above which a firm is doing well and below which a firm is challenged.
5. Another metric is Net Dollar Retention - the total beginning revenue minus any revenue churn (caused by departing clients, or clients who have downgraded) *plus* any revenue expansion from upgrades, cross-sells or upsells all divided by beginning revenue. Data would suggest that a level of 100% of net dollar retention is required for marketing efficiency. Surprisingly, there is not much of a difference between firms of different sizes. For all firms there was a correlation of 0.28 between net dollar retention and growth rate, a reasonable correlation. This means that improving net dollar retention can positively affect growth rates.
6. Finally, another metric to look at is M&S as a percent of next year's revenue. The amount being spent today normally drives next year's revenue. The following chart shows this metric for several companies. What it shows is that lower M&S as a percent of next year's revenue reduces capital requirements. Keeping M&S below a level of 33% by segmenting your market and serving those with a better ratio will lower capital requirements and boost growth in the short term.

**Exhibit 9
Market Efficiency**

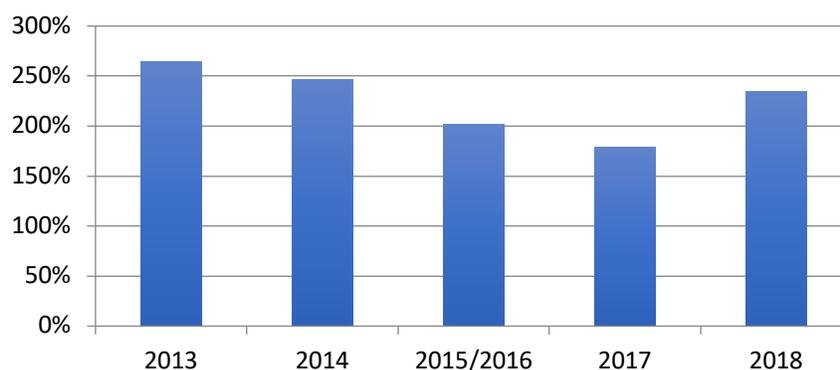
Company	M&S % of Next Year Revenue	Capital % of Revenue
Shopify	22%	92%
Dropbox	23%	106%
Cloudera	62%	326%
Box	80%	341%
Average	37%	218%

Capitalization

Sufficient Capital Drives High Growth The Average Company Needs up to \$2 of Capital for \$1 of Revenue

Fundamentally, it is almost impossible to become a world-class company without significant amounts of capital. A recent study found that there is a correlation of 0.67 of capital to revenue. Exhibit 16 showcases just how much capital various companies had available as a percentage of revenue just before they went public (shown by year of IPO). Among the companies studied, the average amount of capital as a percent of revenue in the year before their IPO is 230%. This means that for companies that go public, they raise, on average, \$2.30 of capital for every dollar of revenue while they are still privately held.

Exhibit 10
Capital as a Percentage of Revenue Available to
Companies by Year of IPO



From those software companies in that study it was determined that the average capital to revenue ratio of was 2.30 (the median equals 1.7) and the range was from .2 to over 14. But only nine had a capital efficiency ratio below 1 and 13 had a ratio of greater than 3 times.

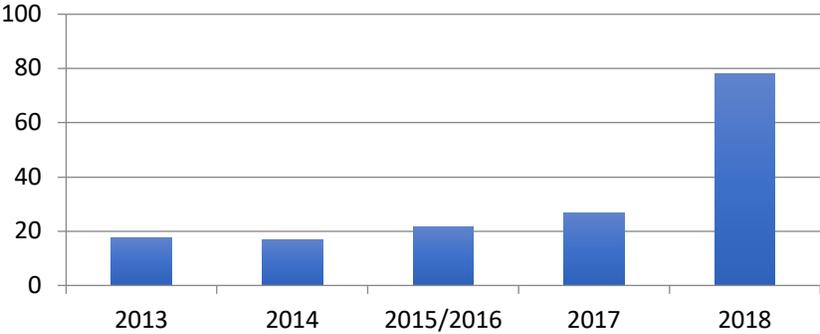
$$\text{Capital Efficiency} = \text{Invested Capital} / \text{Revenue}$$

What was not surprising from the data was the relationship between capital efficiency and revenue growth. There was a moderate positive correlation of .25 between the two indicating that the higher the capital to revenue ratio, the higher the growth levels. The greater the amount of capital that is invested to produce a dollar of revenue, the greater the losses can be to drive revenue growth.

Financial velocity is another metric that is useful. It represents the rate at which a company acquires and consumes capital. It is calculated by dividing the total amount of capital obtained by a firm by the number of years it has been in existence and is measured in millions of dollars per year.

$$\text{Financial Velocity} = \text{Invested Capital} / \text{Years in Business}$$

Exhibit 11
Financial Velocity
(\$M raised per year of existence)



Overall, there is a correlation between financial velocity and the valuation of Unicorns (0.51) as well as between financial velocity and Pre-IPO value for software firms going public (0.55). We recently identified 34 US based Unicorns with a valuation of \$1 billion. These companies had financial velocities of 10 to 33. (They had raised \$10 to \$33 million per year of existence.) Based on this, we established a cut-off financial velocity of \$10 million per year as an indicator that a company was on track to become a unicorn.

Overall, the best figure to use for firms in the software sector is the ratio of capital to revenue. A number around 2, or \$2 of capital for every \$1 of revenue would be expected. With higher marketing efficiency, a lower ratio could be achieved.

The Need for Growth

The higher the growth rate, the higher the valuation
Companies need to achieve an annual 75% growth rate for 10 years

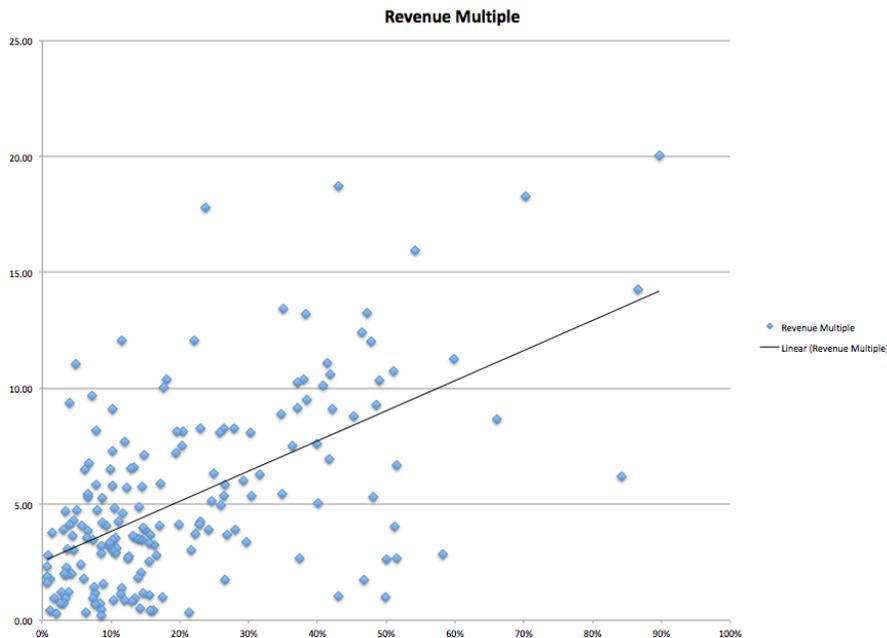
If you have entered a large market with a highly differentiated product, have good product/market fit and marketing efficiency then by adding capital you can generate growth. To create a Unicorn, the most important thing is growth. Growth creates value in a technology company and it has a dual effect: first, higher growth rate results in higher revenue, which increases one dimension of the valuation formula. And secondly, the increased growth rate increases the revenue multiple, which is the other dimension in the formula:

$$\text{Revenue} \times \text{Revenue Multiple} = \text{Valuation}$$

Growth rate increases revenue multiple

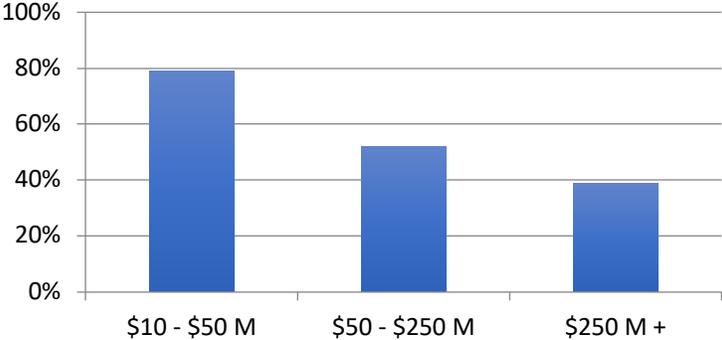
One can look at public markets to see whether this relationship between growth rate and valuation holds up over a broad range of companies. Exhibit 12 shows the results of 180 public software companies whose revenue in 2016 was over \$100 million

Exhibit 12
Public Software Company Revenue Multiples



Growth rates of companies going public has changed over the last few years as companies have delayed their IPOs and greater returns were earned by venture capitalists. The low end of expected growth rates for IPOs has increased somewhat from 15% to above 20%, the top end of the range of expected growth rates has declined from approximately 200% to about 75%. The relationship between average growth rate and revenue level is also further confirmed in Exhibit 12, showing a declining rate of growth as companies grow, from an average 39% to 79% for the smallest firms.

**Exhibit 13
Revenue Growth Rates**



Finally, if everything lines up, a company will need to achieve growth rates as follows:

**Exhibit 14
Required Revenue Growth Rate**

Size	Capital % of Revenue
Less than \$1 million	10% to 20% per month
\$1 – million to \$5 million	100% to 200% per year
\$5 million to \$50 million	100% a year
Over \$50 million	60% a year
Average	75% a year

Creating your own Scaleup Math

This paper has presented Scaleup Math for a typical software company. This math might not work specifically for you. If the math doesn't work, the structure should work as the elements will be the same for all companies no matter what business they are in. In particular, the concepts of product differentiation and product/market fit will be exactly the same.

If the precise math doesn't work then what you need to do is to conduct similar research using companies that are comparable to your own. You can get the financial statements of companies that have gone public through the SEC. Look at their prospectuses to see what their TAM was and look as well for marketing efficiency and capitalization numbers. Using these ratios from a number of companies as they go public will enable you to create your own Scaleup Math.

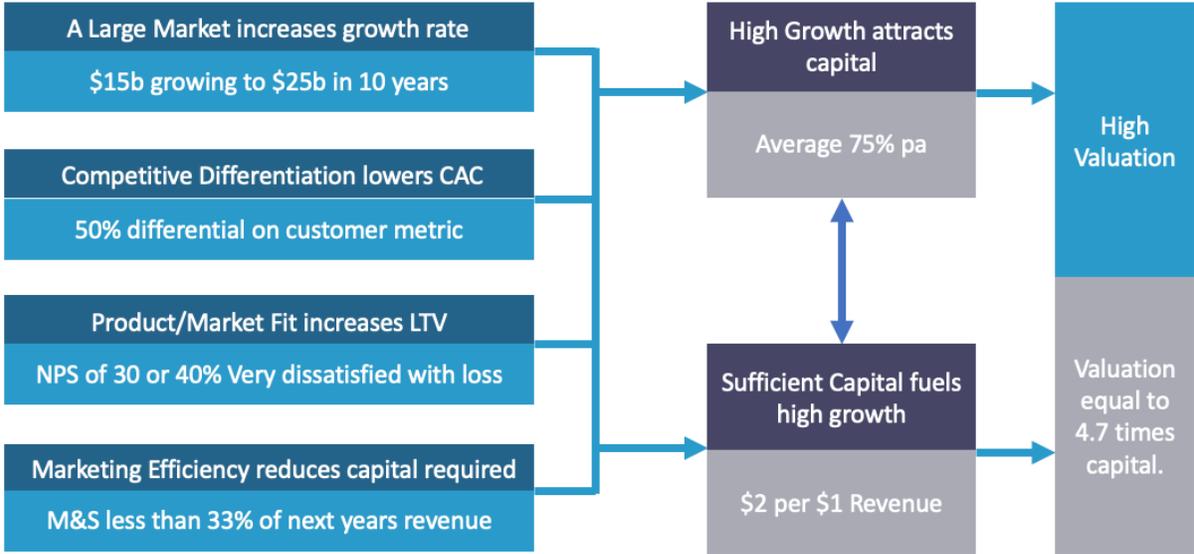
At each stage in your company's growth you should expect to figure out the math for one of the factors in Scaleup Math. These factors correspond to the Marmer Stages promoted by Startup Genome. As you fill in the blanks for each of these phases, you will proceed to the next stage of development and obtain capital to support your growth. A company should try to figure each of these out in the order presented as if you don't, you could end up wasting resources. In particular, a company should not try to scale or obtain capital for scaling until it has found a big market, determined competitive differentiation, have excellent product market fit and good marketing efficiency. Trying to proceed to scale earlier than this will waste a lot of capital in the process. The following chart helps to understand the process.

Exhibit 15
Scaleup Math Stages

Stage	Objective	Target Metrics	Revenue Growth	Funding Used
Ideation	Find a large market:	Secondary or primary research on sales of existing direct substitute shows a market of \$20 billion annually	Not applicable	Founder
Discovery	Strong competitive differentiation:	Multiple dimensions of quality cost and speed using known metrics shows 50%	Not applicable	Accelerators

		differential on multiple metrics		
Validation	Excellent product/market fit: Meeting strong triggers with a product that crosses the chasm	NPS of 30 or more 40% very dissatisfied with product termination	< \$1 m – 10% - 20% pm \$1 - \$5 m - 100% - 200% pa	Seed
Efficiency	Marketing efficiency: LTV to CAC CAC Payback Net logo retention	Target M&S as a percent of next year's revenue above 3:1 or 300%	\$1 - \$5 m - 100% - 200% pa >\$5 m - 60% to 100% pa	Series A
Scale	Capital sufficiency: Industry specific capital requirements to support growth	Capital divided by Revenue (Software) Lower bound 1:1 Target 2:1 Maximum 3:1	>\$5 m - 60% to 100% pa IPO Stage - 60% pa	Series B +

Scaleup Math



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The Narwhal Project

We help companies accelerate their growth. Working at the intersection of strategy, marketing and finance we provide companies with the analytical tools to make strategic decisions that will fuel their growth and valuation. We help them figure out the best markets to serve, how to differentiate effectively, ensure product market fit, improve unit economics and raise capital.

The Narwhal Project was also established to conduct research in order to discover the underlying factors that are essential to create world-class technology companies. Our objective is to understand how companies can accelerate their growth and how governments, companies, and academia can identify and adopt best practices in technology commercialization.

For more information on The Narwhal Project: narwhalproject.org

Charles Plant

Charles Plant, a serial entrepreneur and innovation economist is founder of the Narwhal Project. Charles has been an officer, director or investor in over a dozen technology companies and a consultant to multiple governments in Canada, South America and Europe. He was co-founder and CEO for 15 years of Synamics, a telecommunications software firm that provided mass calling platforms to telcos. Active for much of his career in the world of finance, Charles has worked in venture capital, as well as investment and corporate banking.

He has written over 35 research papers and one book entitled *Triggers and Barriers: A Customer Perspective on Innovation*. He is currently working on his second book; *Scaleup Math*

As an educator, Charles spent seven years on the faculty of York's Schulich School of Business teaching in the MBA program and has taught innovation and entrepreneurship at the University of Toronto. He has an MBA in marketing, is a Chartered Accountant and is currently pursuing a PhD in Economics.

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