

Startup Funding Stages with Current Statistics (An Explorable Explanation)

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Abstract—Startups play an important role in shaping the world’s economy. According to Kauffman Foundation, nearly 20 percent of gross job creation is done by new businesses including startups. But, as mentioned by Jason Wiens, the Director of Research and Policy with Kauffman Foundation, according to Census data, by 2011, there has been a decline of about 8 percent in the number of startup firms, which, seriously threaten the economic growth (Wiens & Jackson, 2015). This report is our effort to make the entrance of newcomers into the startup world easy, by explaining the startup funding stages as occurring in United States. Using the technique of scroll-telling, we have created an Explorable Explanation to explain the predefined stages of startup funding along with the current statistics for holistic understanding of stages and current scenarios in the industry.

I. INTRODUCTION

Start-ups play an integral role in the progress of the world’s economy. There are various important factors involved in the development of a start-up which include innovative products, novel services, market need, work personnel, required infrastructure and capital. The funding capital or funding investment in start-ups is especially important as it gives a start-up an opportunity to flourish and prove its worth in the market. Due to this prime importance of funding with regards to a start-up, our Explorable Explanation focuses on the various stages and highlights in this process, so that budding entrepreneurs can get insights on the various stages involved as well as the current statistics of the association between the start-up industries and their funding aspect.

The inception of a start-up comes forth with an idea to build an innovative product or provide a unique service to customers. Founders and probably co-founders may join hands and may take funding help from family and friends. The equity gets divided accordingly between these different parties.

The next step in the funding process involves seeking help from outside investors which starts with angel investors. These are individuals who make sizable funding contributions with a view to further advance the start-up in return for a share in the equity.

In the subsequent step, venture capitals come into the funding scenario. These are firms that invest in start-ups with high potential long-term success, expansion and profits. The culmination of the process can be divided into two categories-

Good Exit and a Bad Exit. A “Good Exit” is in the form of an IPO wherein the shares can be sold to the public to raise further funds or even in the form of a merger or acquisition. A “Bad Exit” is in the form of the start-up company running into bankruptcy.

Our Explorable Explanation for start-up funding in the US is aimed to focus on each of these areas to provide the users with a holistic view how the start-up funding works and the scenario over the years of this industry. It takes into account data like the number of start-up ventures receiving funds, investment type and size, funding amount, the number of active investors and valuation data at different stages of the funding pipeline. It also gives a view of the various stages involved in investment, which include seed and angel investments, early-stage and late-stage venture capital, growth equity and exits in the form of mergers or acquisitions, bankruptcies and IPOs. Our scroll-telling feature is intended to provide the user with a roadmap to better understand every step of the process.

Our Explorable scroll-telling explanation- an amalgamation of a series of interactive and animated visualizations and transitions is targeted at aspiring entrepreneurs and investors in the US or anyone in general who may have an interest in the start-up culture in the US. It encompasses the Angel Investments including the yield rate or rate of deal acceptance by Angel Investors, total investments in \$ billion USD by Angel Investors, total start-up ventures receiving funds from Angel Investors and the number of Active Angel Investors. Angel Investments over the years and through different industry sectors are displayed. Moreover, Angel Investment exits-good/bad as well as average exit returns have been shown. With respect to Venture Capitals (VC), the trend of growth or decline of VC Firms, their investments per sector, at different stages and exits with the amount of capital withdrawn can be seen. In addition, the rate at which entrepreneurs have entered the US start-up arena, equity distribution and investment range for each stage have been presented.

II. RELATED WORK

Considering the importance and recentness of startup systems, a lot of organizations are studying their effects on economy along with the recent changes in their growth. Several organizations are also working towards providing resources to new entrepreneurs for establishing their

businesses. Below, we have mentioned the most prominent works done in this field.

A. Ewing Marion Kauffman Foundation

Kauffman Foundation was established in 1960 by Ewing Marion Kauffman, who was an entrepreneur himself. It is one of the largest private foundations in United States (Kauffman Foundation, n.d.). The foundation is working primarily in the areas of Education and Entrepreneurship. Apart from providing financial support to new entrepreneurs, they have also created a website namely Entrepreneurs.org that contains vast resources for entrepreneurs, policy makers and investors for guiding them through the entire process. The resource center of the website contains huge collection of reports and articles related to the different stages as well as products. But, even though the website has all the resources for different funding stages, they are not present in an aggregated manner at the same location and are in the form of long reports that might be difficult to understand for a beginner.

Apart from the resource website, the Kauffman foundation has also introduced the “Kauffman Index” that provides a way to measure the current statistics of startup activity and its relation with different factors like regions, ethnicity or gender of founders, etc. The Kauffman Index is calculated by taking into account three variables namely: the Rate of new Entrepreneurs, Opportunity Shares of new Entrepreneurs and Startup Density. Every year, the foundation releases a report with National Trends for Kauffman Index Startup Activity calculated using current statistics. The report provides an interactive graphical view of startup activity and different factors on which it depends. Figure 1 and 2 are examples of the graphs that are present in the report.

In our report we have utilized some of the data from Kauffman Foundation like the *rate of new entrepreneurs*, and tried to represent it in context with different stages of startup funding in an interactive way.

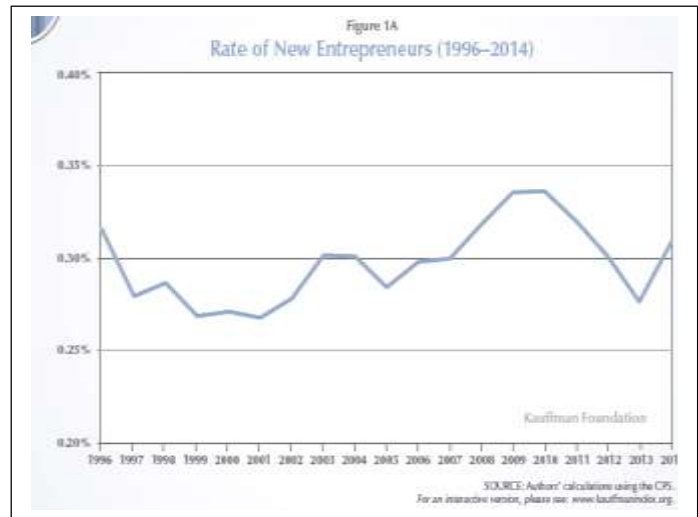


Fig. 2. The rate of new entrepreneurs in United States. This graph was published in the annual report on National Trends in Startup Activity by Kauffman Foundation.

B. Infographics by Funders and Founders

Funders and Founders is a website designed by a group of two Information Designers: Mark Vital and Anna Vital. The website contains different visual representations related to startups and entrepreneurship. They have a mission statement of “inspiring everyone from engineers to moms to do a startup” (Funders and Founders, n.d.). The website contains an infographic namely *How Funding Works – Splitting The Equity Pie With Investors* depicting the different stages of startup funding and the distribution of equity among investors at every stage (Funders and Founders, n.d.). Furthermore, the infographic explains the range of investment requires at each stage and the different founders and investors along with their shares. It is followed by paragraphs of text to explain the infographic. Figure 3 displays a part of the infographic.

Although, the infographic contains all the information about the theoretical concepts of the different funding stages, they do not show current statistics for the industry at these stages. Also, displaying such a huge information via a small infographic has resulted in increasing the complexity of the visualization. Furthermore, the visualization does not provide interactions for further understanding of the complex topic or for doing comparisons. In our visualization, we have taken the information from this infographic like the equity distribution and range of investment, and have tried to display it in more interactive and easy way and also to facilitate comparisons between these values in different stages.

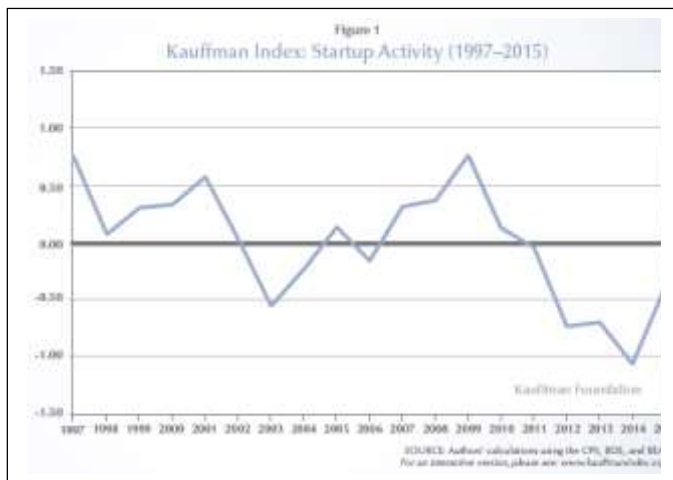


Fig. 1. The startup activity as measured by Kauffman Index. This graph was published in the annual report on National Trends in Startup Activity by Kauffman Foundation.

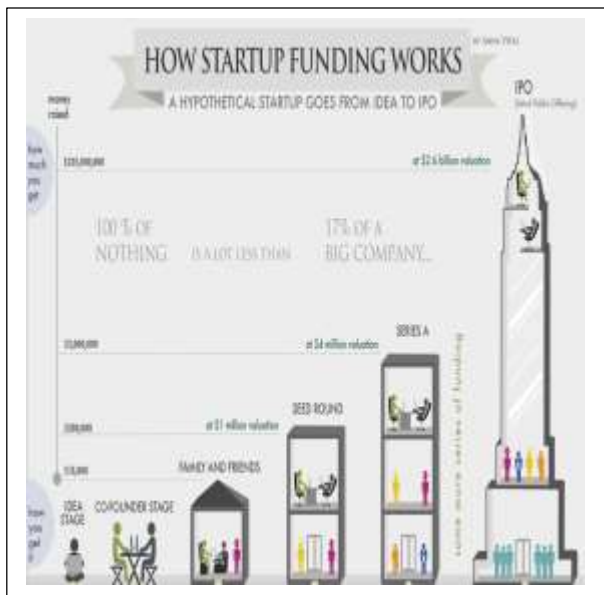


Fig. 3. A part of the infographic designed by Funders and Founders describing the different stages of startup funding. Source: <http://fundersandfounders.com/how-funding-works-splitting-equity/>



Fig. 4. The chart for Angel Investments on Quandl.com. Three buttons are given at the top to filter the data. Source: <https://www.quandl.com/collections/usa/usa-startups-venture-capital>

C. Collections by Quandl.com

Quandl is an open source website that hosts a huge collection of financial and economic data collected from different sources and provided to users in multiple formats like Comma Separated Variable format, XML format, Excel Table format, etc. Along with the feature of downloading the data in different formats, they also provide simple visualizations of the data with minimal interactions.

In the field related to this project, Quandl has created a collection namely *Startups and Venture Capital* that includes data, description as well as few visualizations (line charts) for different funding stages for a startup. The data present in this collection is taken from multiple sources including the Bureau of Labor Statistics, the National Venture Capital Association, the Center for Venture Research, the Cooley Venture Financing Report, the Kauffman Foundation, and Crunchbase (Quandl, 2016). The data in the collection is categorized by different stages like Seed Stage, Venture Capital Stage, etc. and include current statistics about the details like investment ranges, number of actively investing firms, exits and acquisitions, etc. For each stage, a basic visualization of line graph is also provided with filtering capabilities. Figure 4 provides example of the visualizations provided.

Although, the data is very extensive the visualizations are very simple and do not facilitate exploratory analysis or comparisons between stages. In our project, this website has served as the major data source from where we have extracted maximum data and then have created interactive visualizations for them.

III. METHODS AND APPROACH

As discussed in the abstract and introduction, the goal of this paper is to understand the process of the establishment of the startups, the stages it goes through as it evolves and the factors that are accountable for drop in the capital and the exits of the firms and investors that were responsible for its growth and sustainability.

This process of from initiation to becoming a successful firm with Initial Public Offering (IPO) is a steady and gradual process with a number of crests and troughs. The approach adopted to explain these steps in detail with analysis of various factors affecting at every step is that of a story board. In other words this story board approach is termed as 'Scrolly-telling'. In the next few sections of this paper, each step of this elaborate analysis would be presented in the story format along with the results from the graphs to easily understand the nuances of every step.

A. Startup Valuation

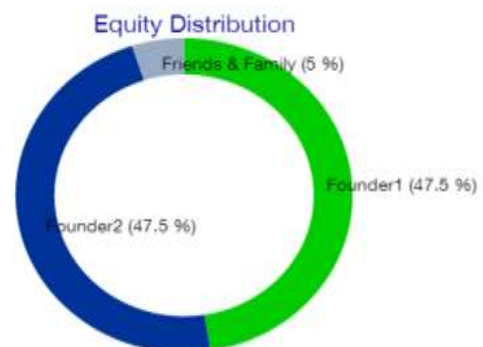


Fig 5 Equity Distribution

According to the gathered data and the analysis performed by us, the initial stage starts with an idea which is either self-funded or funded by friends and family. At this stage the equity (Fig 5) is distributed amongst the founder, cofounder and the friends and family with the highest stake residing with the founders and the remaining share is allotted to the family who acts as the investors. Also, according to the data taken from Kauffman Foundation (Fig 6) the amount of investment made at this stage is up to twenty thousand dollars.

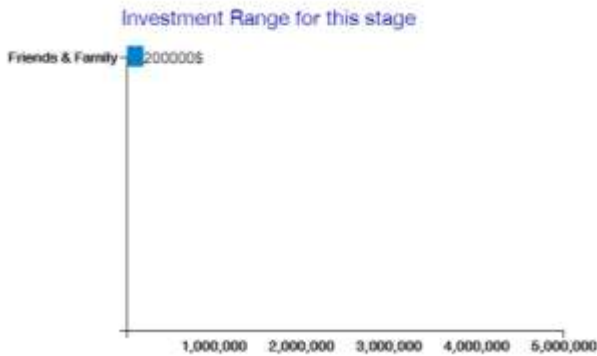


Fig 6 Investments by Friends and Family

The data in Fig 7 also highlights the fact that the rate of new age entrepreneurs has seen some pitfalls especially between the period 1999 and 2001 and also saw a steep fall between the period 2011 and 2013. But, post-recession there is a steady rise in the rate of increase in the number of entrepreneurs.

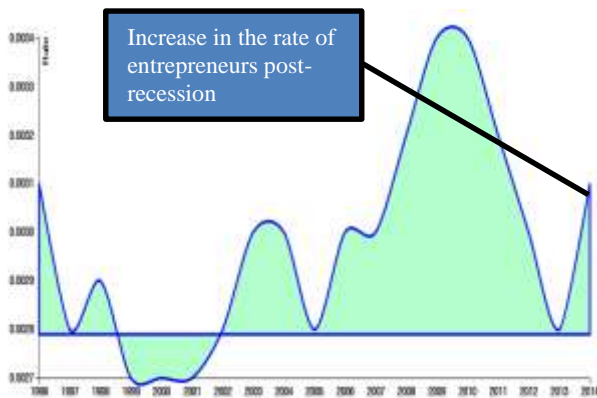


Fig 7 Rate of Entrepreneur population in the USA

Thus, with an initial plan of action and initial investment in hand the entrepreneurs are set to implement their idea into a concrete product. At this point, it highly depends on the approach they adopt to implement this idea and the time it takes to create the first working prototype in order to attract new investors which would help increase the outreach of this new startup firm. Thus, the next phase of the analysis is about the Angel or Seed Investments.

B. Angel Investments

This is the first stage of expansion for a firm where outside investors called Angel investor firms raise funds for the growth of the startup. This is termed as the first investment

agreement between the founders and the investors which focuses on equity. Thus, the pie chart in Fig 4 shows the difference between the equity distribution at this stage and the stage before this that is when the investors were family and friends. The angel investors claim around 20% of the total stake of the firm. Also, the investment at this stage rises to around 1 Million dollars

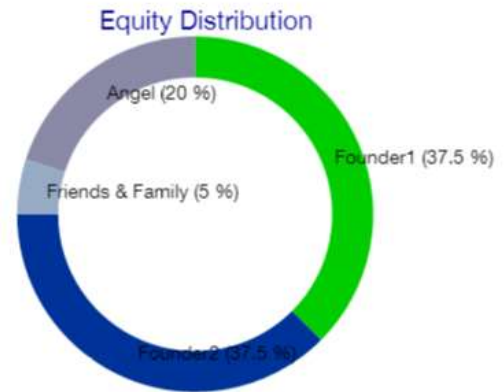


Fig 8 Equity Distribution in Angel Investment Stage

The graph in Fig 9 shows the trend of deal acceptance by angel investors over the years. It depicts a rise in the number of angel investors between 2004 and 2008 and fell gradually between 2008 and 2010. The probable reason for the rise in the early 2000 would be the effect of the dot com bubble. Also, the fall in the in the number of investors points to the fact that the startup culture was affected due to the recession.

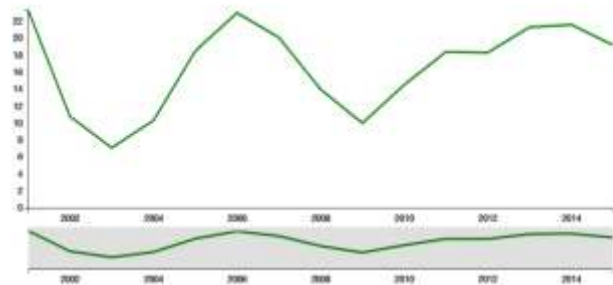


Fig 9 Trend of deal acceptance by Angel Investments over the years

C. Angel Investments by Sectors

The data in Fig 10 highlights many facts about this stage and which industry attracts the most angel investments. On the other hand, it shows the sector in which angel investors are interested in investing their capital where they can expect a significant amount of returns. Thus, the graph shows that Software industry tops the chart by a fair deal followed by Healthcare and then Biotechnology.

Software	295	28%
Healthcare	229	22%
Hardware	35	3%
Biotech	137	13%
Telecom	16	2%
Manufacturing	12	1%
FinancialProductsAndServices	46	4%
ITServices	48	5%
IndustrialOrEnergy	90	9%
Retail	82	8%
Media	63	6%

Fig 10 Angel Investments by Sector



Fig 12 Equity Distribution & investment in Venture Capital Stage

The graph in Fig 13 shows a sudden rise in the number of firms investing venture capitals in the startups. Again, the probable reason for this rise could be linked to the huge influx of .coms in that period. After 2000, even though the venture capital firms did not increase but still the number of firms remained almost constant.



Fig 13 Venture Capital firms investing in startups

D. Angel Exits and Returns

It sometimes happens that the firm is not able to incur the expected amount of ROI and profits. There could be numerous factors responsible for this state of the firm. In such cases, the Angel investors either withdraw their share of capital and thus eventually the firm comes to a halt or the angel investors and the founders decide merger with other big companies in order to avoid bankruptcy. Thus, the graph in Fig 11 shows there was a decrease in the number of mergers and acquisitions between 2008 and 2010 as this period showed a steady growth of the startups and a substantial turnaround which prevented the firms from filing bankruptcy or signing agreements for mergers and acquisitions.

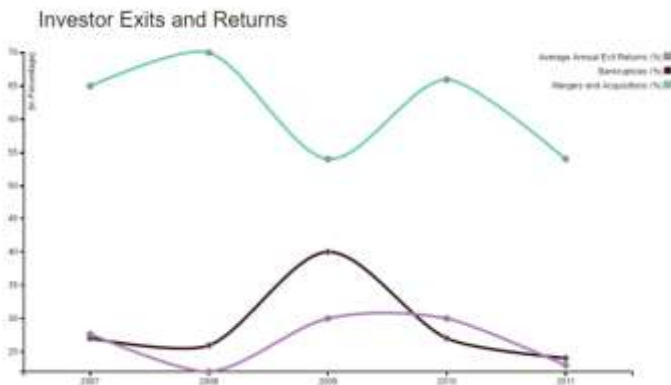


Fig 11 Angel Exits and Returns

F. Venture Capital Investments by Sectors

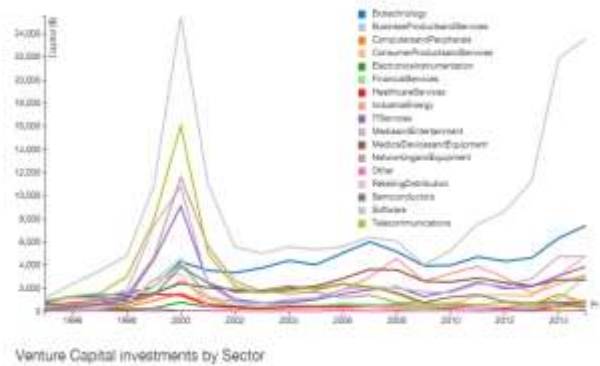


Fig 14 Venture Capital Investments by Sectors

E. Venture Capital Investments

If the startup crosses this stage of Angel Exits and Returns then it seeks investments from Venture Capitalists. These firms specialize in investing high amounts of funds in potential startups with expected high returns. Fig 8 shows that the investment amount rises to 5 Million dollars. The share of equity distribution remains more or less same as in the Angel investment stage (Fig 12).

The graph in Fig 14 shows the distribution of capital invested by the venture capital firms in various sectors over the years. Also, this graph in coordination with the analysis presented above depicts a rise in the investments by venture capital firms in the year 2000 which marked the .com boom in the USA. This year changed the face of startups. As seen in the graph, there was a sharp rise in the investments which again dropped between the period from 2002 and 2008 after which it gradually increased and again found momentum in 2013 and 2014.

G. Venture Capital Investment Stages

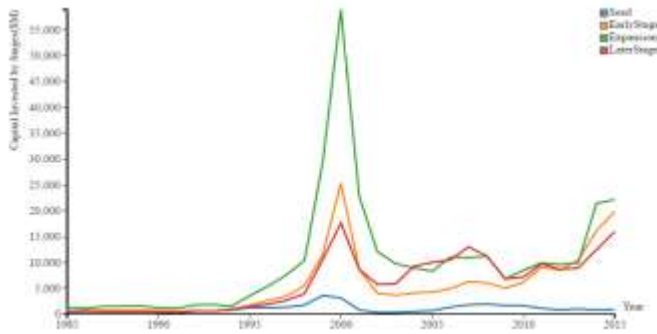


Fig 15 Venture Capital Investment Stages

The venture capital firms invest significantly in the following stages:

- **Early Stage:** It is first round in the VC stage also called Series A round. Generally this stage raises between \$3M - \$5M in exchange for 20% of the company.
- **Expansion Stage:** Very few companies are able to make until this stage. This is the stage where the startups start expanding their business by attracting more clients and in turn more capital as the returns increase due to increasing business. The graph in Fig 15 shows a rise in the investments at the expansion stage by the venture capital firms in the year 2000.

H. Venture Capital Exits

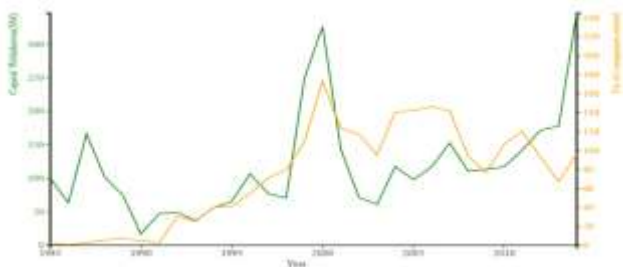


Fig 16 Capital Withdrawn and Venture Capital firms exited

If a company cannot sustain the growing competition and if it cannot maintain the financial stability desired by the venture capital firms then these firms withdraw their share of investments from the startups. Thus, the graph in Fig 16 reiterates the previously seen scenario where the year 2000 showed a rise in the startups and also a steady rise in the investments by Angel investment firms by sector as well as venture capital firms by sector and by stages. But, due to the boom in the number of startups and a large of capital invested in these firms not all startups could survive this competition and thus, this graph shows the increase in the number of venture capital firms opting out of these companies. One of the reasons could be that not all the firms were able to sustain the demands of these investors.

Finally, if a startup successfully survives through all these stages and emerges triumphed then it requests investments

from the people other than investors. This is termed as Initial Public Offering. This is when the startup turns into a successful company which then offers its stakes to the public. Thus, the firm is no more a startup and has its own listing of shares in the market.

IV. RESULTS

This ‘scrolly-telling’ interactive visualization gives a detailed overview of the steps involved in establishing a startup firm right from its inception to its establishment. It helps the target audience in understating the statistics based on graphics and numbers about the trend of the startup culture in the USA over the years.

Each graph gives a thorough and comprehensive analysis of each and every stage involved in the process of developing a startup. Based on the analysis presented in this paper the user can very easily derive actionable insights from the graphs. The target audience would be able to analyze and answer some initial questions like how many active angel investors can be approached, what is the probability of an angel investor or a venture capital firm investing in the startup in a particular sector, in which stage do the venture capital firms invest more and so on. The answer to these questions would give the users a fair idea of where to start and which firms to approach for the initial round of investments. With the relevant information in hand based on the visualizations to support the data, the founders can smoothly sail their way through all the stages to reach the final stage of IPO. Also, with the help of the elaborate analysis presented there is a good amount of chance that the startups would be successful as the founders can anticipate the future based on the information presented.

V. DISCUSSION

We have created the Explorable Explanation with an aim to display the information to the audience in an appealing and easily understandable way. This will help the audience to easily glean insights from the different series of visualizations presented. This Explorable Explanation represents the qualitative and quantitative aspects of the data on funding and investments for start-ups. The main goal is to equip aspiring entrepreneurs with the required information through user-friendly visualizations so that they can get acquainted with the funding process and approach the process of funding their start-ups in the correct manner. In addition, we have also presented the statistics over the years and at different start-up funding stages, to make the user more cognizant of the start-up funding scenario through different years. The other audience for our system includes new investors, for whom the investment trends will be useful so that they make proper investments as well as simply any person with an interest in the start-up culture, which will help to enhance their learning.

From a visualization stand-point, our Explorable Explanation tries to effectively utilize an array of visualization features. We have used a scroll-telling format, animated transitions in individual visualizations, brushing over a secondary navigation line graph causing changes to the main

graph, changing the range of Y-axis values with different user selections while keeping the X-axis intact, thorough view of sector and year specific Angel investments using a combination of a histogram and pie-chart akin to a dashboard, pop-out tooltips using bootstrap.js, filtering using legends and dual-axis. In addition, a variety of charts have been used by us in order to display the pertinent information appropriately to make it easily understandable. These visualization graph types include horizontal and vertical bar charts, donut chart, area chart, single and multiple line graphs, linear graph with basis interpolation, histogram and pie-chart.

<https://www.quandl.com/collections/usa/usa-startups-venture-capital>

Wiens, J., & Jackson, C. (2015). *The Importance of Young Firms for Economic Growth*. Kauffman Foundation.

VI. FUTURE WORK

The system currently provides basic details and description related to funding stages predefined at the United States. The same system can be used to provide a holistic approach of funding stages and current statistics of the entire world, in order to facilitate comparisons between different regions. But, this might make the system a bit complex and also prove to be tedious as huge datasets have to be manipulated and compiled for this reason.

The startup funding stages are accompanied by pre and post valuations of the companies. These valuations have significant effect on the number and nature of investors attracted by the company during each stage. In future, the system could be expanded to include the details about these valuations and how they affect the success at each stage.

The Venture Capital round of startup funding comprise of a long series of smaller rounds named as Series A, Series B, and so forth. In the project, only Series A round is explained in detail as it is the most important round. As a future work, the system could be expanded to include description about the other series rounds as well.

In the initial project proposal, we thought about analyzing the effects of startup activity and current statistics over world economy. But, as the dataset was very huge, we limited the scope of the project to funding stages and current statistics. In future the same project could be expanded to further analyze the effect of the current startup activity on the world and its economy.

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