

BACKGROUND

Women-owned businesses are growing **2X faster** than all businesses nationwide, and yet, they **only receive 2.8%** of venture capital (VC) funding.

Our goal is to help female entrepreneurs understand the VC funding landscape by producing a model to predict success of raising funds while also investigating gender bias and providing recommendations.

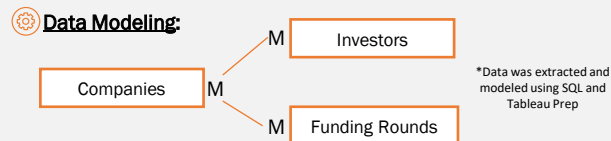
DATASET & PRE-PROCESSING

- Target Dataset:** Crunchbase, Industry Research
1. Sample Crunchbase Companies (110K records)
 2. Crunchbase Investors (57.3K records)
 3. Crunchbase 2019 Funding Rounds (15.3K records)

- Qualitative Surveys:**
- Met with 5 Investors from different genders and 3 founders to discuss their experience with funding and biases that exist

- Cleansing Effort:** Python, Tableau
1. Replaced nulls, splitting fields and transposing data
 2. Created Boolean fields for Women Led/Founded companies
 3. Added additional fields for tree model to support
 4. Removed fields and encoding data

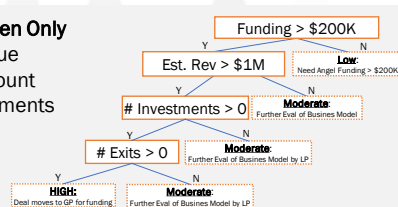
DATA MODELING



CLASSIFICATION METHOD (ML)

- Decision Tree: Women Only**
1. Estimated Revenue
 2. Total Funding Amount
 3. Number of Investments
 4. Number of Exits

- Possible Outcomes:**
1. Low, Moderate, High



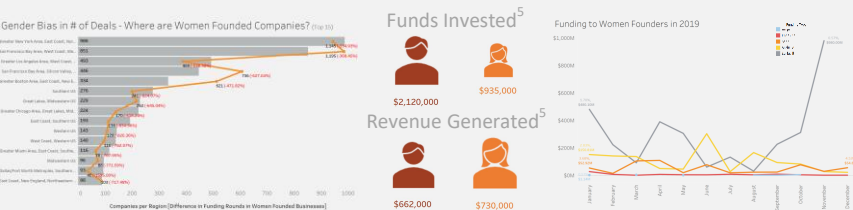
INSIGHTS

IS THERE A BIAS IN VC FUNDING?

50.8%¹ of the US population is women. Yet women only make up 11 percent of investment partners (VCs) in the US and are only included in 17% of VC deals².



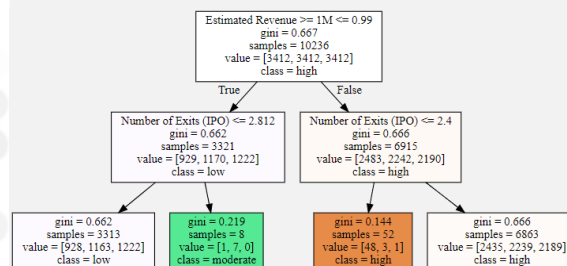
The lack of inclusion creates a clear bias. VC firms make minimum investments throughout all funding stages in W/O/F businesses resulting in **up to \$3T** in missed opportunities. Organizations led by Women report 18-69% more profit in their industries³ and the stock prices outperform men on average by 20%⁴.



LIKELIHOOD OF CLOSING AN INVESTMENT DEAL

Teneika Askew, Shermeen Velani, Lauren Tang, Tina Wong, Hima Bindu Bhardwaj, Shea Tuli

The model is designed to support women entrepreneurs...



Development of the Model Required:

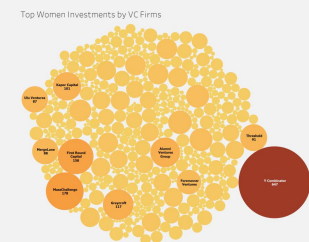
- Encoding of Estimated Revenue Range to effectively fit and evaluate the model
- KNN Imputation (K nearest neighbor imputation) to handle the null values by predicting the missing values
- Decision Tree to clearly articulate the problem and analyze all possible outcomes of each decision and the probability that a user will achieve them
- Random Forest Classifier performed better than decision tree. Our best model was a Random Forest model with accuracy 78.6%
- The inputs to our model were number of investments, number of IPO exits, and estimated revenue. The Funding Amount was our target variable which was used to evaluate our model
- Correlation Matrix to understand the collinearity between variables

VENTURE CAPITAL IS A BIASED SYSTEM: HOW WOMEN OWNED BUSINESSES CAN BEAT IT

Teneika Askew, Shermeen Velani, Lauren Tang, Tina Wong, Hima Bindu Bhardwaj, Shea Tuli

RECOMMENDATIONS

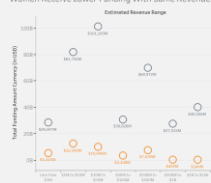
LOW OUTCOME



There is a disproportionately low number of deals received by women in comparison to men in several states. We suggest women-owned businesses headquarter their company in states where the ratio is higher, such as California, New Jersey, and New York. Some states like New Jersey also have startup incubator or accelerator programs. There are also ecosystem building programs to build networks and traction (Female Founders Collective, DivInc, etc.). This would increase the probability that the startup receives a higher amount of funding.

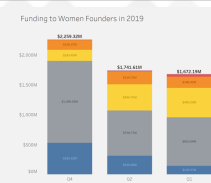
MODERATE OUTCOME

Women Receive Lower Funding With Same Revenues



According to the order of decision criteria produced by the model, it is vitally important for women entrepreneurs to confidently and positively estimate their revenues instead of underestimating the expected revenue, especially when they pitch their startups before VC investors. The revenues should also be supported by any traction or momentum the company has gained over time to support the business model.

HIGH OUTCOME



Women-owned businesses with IPOs or Investments raise more funding, have more exits and a high probability of receiving additional funding. We would recommend pitching in the fourth quarter to generate a higher amount of capital. If you have not generated enough investments or exit opportunities. For venture capitalists, we recommend diversifying the venture partners by adding more women so that they can provide their unique perspectives in funding new startups

REFERENCES

- 1 - <https://www.census.gov/quickfacts/tables/US/LFE046218>
- 2 - <https://ncaa.org/research/ncaa-deloitte-human-capital-survey/>
- 3 - https://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/paga_053168.pdf
- 4 - <https://www.cnbc.com/2019/10/18/firms-with-a-female-ceo-have-a-better-stock-price-performance-sp.html>
- 5 - BCG Report <https://www.bcg.com/en-us/publications/2018/why-women-owned-startups-are-better-bet>
- 6 - <https://www.morganstanley.com/ideas/venture-capitalist-funding-diversity-entrepreneur-gap>

- # VENTURE

WOMEN

- # WOMEN

Teneika Askew, Shermeen Velani, Lauren Tang, Tina Wong, Hima Bindu Bhardwaj, Shea Tu



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SYSTEM: HOW



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SYSTEM: HOW

CAN BEAT IT YOUR FUTURE OUTCOME

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Women-owned businesses are growing 2X faster than all businesses nationwide,
and yet, they only receive 2.8% of venture capital (VC) funding.



Our goal is to help female entrepreneurs understand the VC funding landscape by producing a model to predict success of raising funds while also investigating gender bias and providing recommendations.



BACKGROUND



QUALITATIVE SURVEYS

Met with 5 Investors from different genders and 3 founders

Discussed their experience with funding and the biases that exist in the investor landscape

- How much do qualitative attributes matter?
- Does having a woman on the VC board affect the company's estimated revenue?



TARGET DATASET

Sources: Crunchbase, Industry Research, Census Bureau

1. Sample Crunchbase Companies (110K records)
2. Crunchbase Investors (57.3K records)
3. Crunchbase 2019 Funding Rounds (15.3K records)

- We also leveraged industry research and reports to create a full picture



PRE-PROCESSING

Tools: Python, Tableau

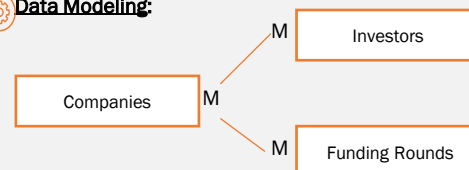
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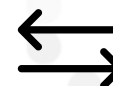
DATA MODELING



Data Modeling:



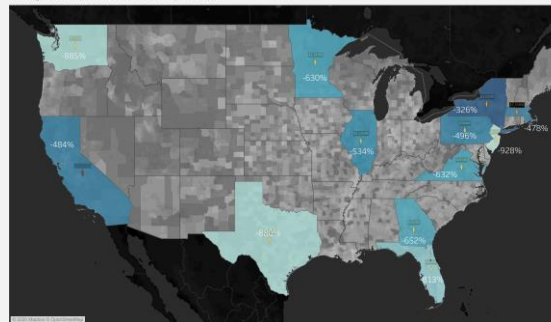
*Data was extracted and modeled using SQL and Tableau Prep



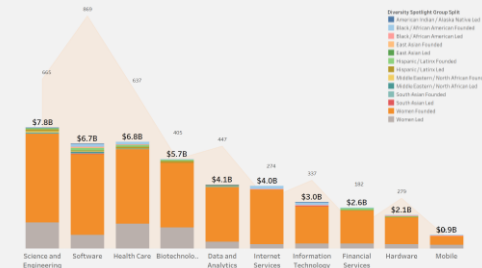
IS THERE A BIAS IN VC FUNDING?

50.8%¹ of the US population is women. Yet women only make up 11% of investment partners (VCs) in the US and are only included in 17% of VC deals². Resulting in less diverse investments.

% of Women Founded/Led



Top Industries for Diverse Founders (by Deal Count and Funding)



BACKGROUND

Women-owned businesses nationwide raised over \$500M in venture capital (VC) funding in 2020.

Our goal is to help women-owned businesses understand the funding landscape and provide recommendations for raising funds and providing recommendations.

DATASET

Target Dataset

1. Sample Crunchbase
2. Crunchbase
3. Crunchbase

Qualitative Survey

Met with 5 Investors to discuss their investment criteria and exist

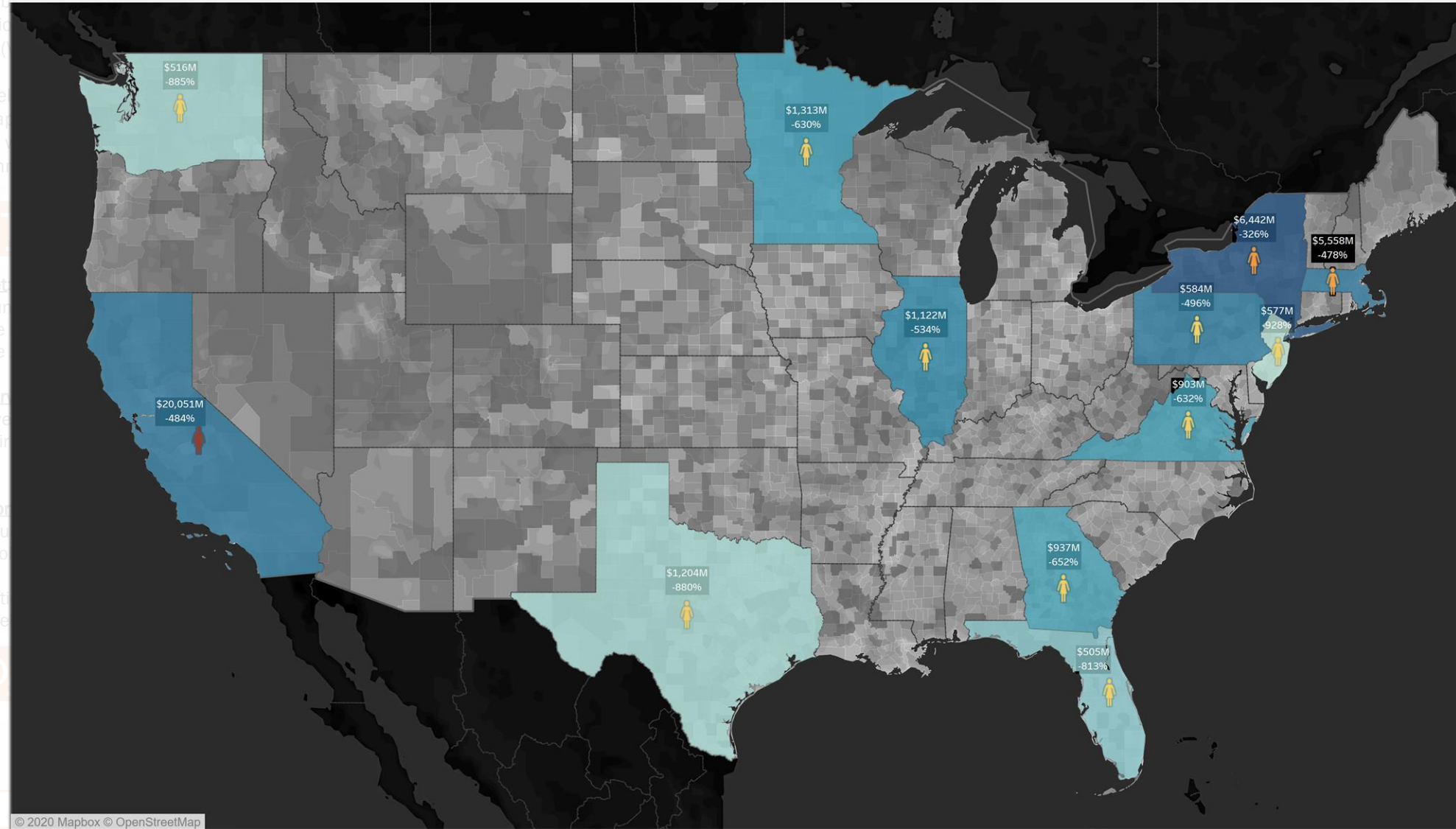
Cleansing Effort

1. Replaced null values
2. Created Boolean flags for companies
3. Added additional fields
4. Removed fields

Data Modeling

Companies

Wondering Where to Headquarter? Here's Where Women Owned/Led Raised \$500M+



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M Funding Rounds

IS THERE A BIAS IN VC FUNDING?

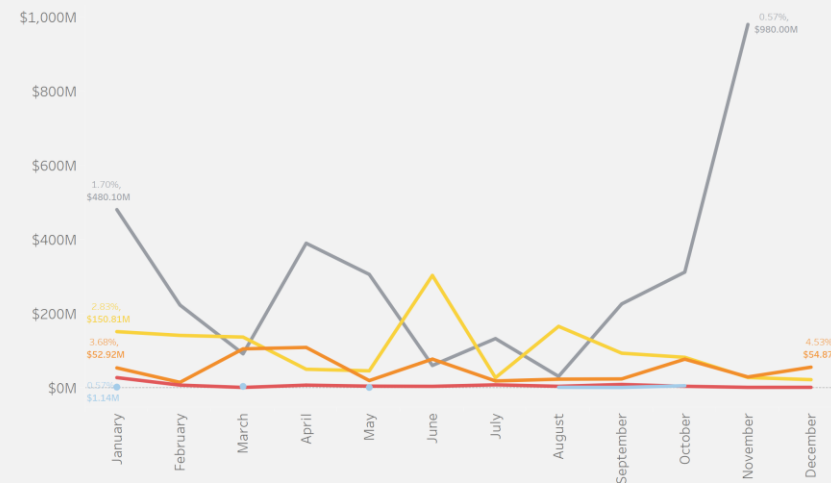
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IS THERE A BIAS IN VC FUNDING?

Organizations led by Women report **18-69% more profit** in their industries³ and the stock prices **outperform men on average by 20%**⁴ but women continue to see low funding MoM.

Funding to Women Founders in 2019





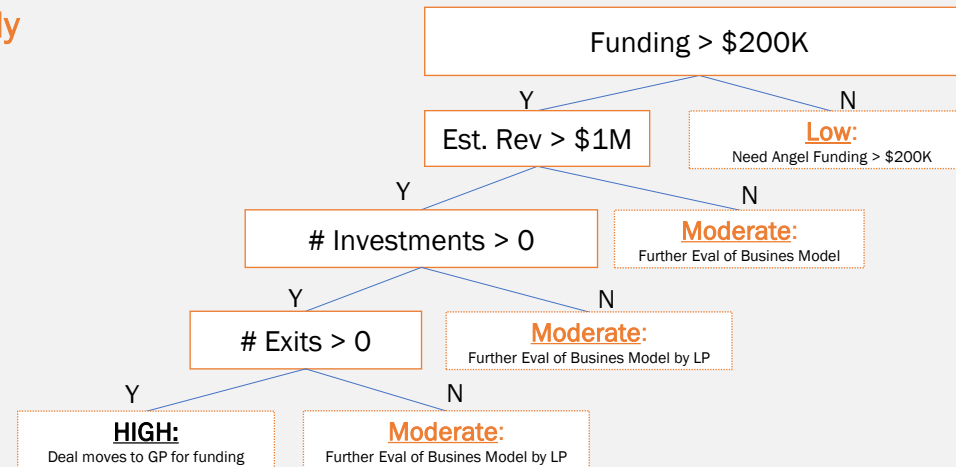
MACHINE LEARNING

CLASSIFICATION METHOD

Decision Tree Scope: **Women Only**

1. Estimated Revenue
2. Total Funding Amount
3. Number of Investments
4. Number of Exits

Possible Outcomes:
Low, Moderate, High



LIKELIHOOD OF CLOSING AN INVESTMENT DEAL

Development of the Model Required:

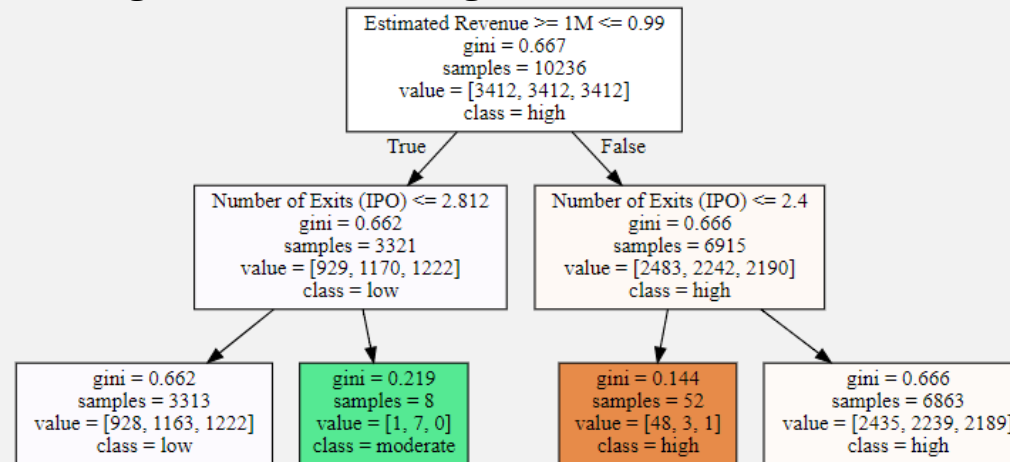
- **Encoding** of Estimated Revenue Range to effectively fit and evaluate the model
- **Correlation Matrix** to understand the collinearity between variables
- **KNN Imputation** (K nearest neighbor imputation) to handle the null values by predicting the missing values

	Total Funding Amount	Est. Revenue Range	Number of Exits (IPO)	Number of Investments
Total Funding Amount	1.000	-0.173	0.131	0.209
Est. Revenue Range	-0.173	1.000	-0.127	-0.086
Number of Exits (IPO)	0.131	-0.127	1.000	0.906
Number of Investments	0.209	-0.086	0.906	1.000

RANDOM FOREST CLASSIFIER VS. DECISION TREE

Development of the Model Required:

- **Random Forest Classifier** performed better than decision tree. Our best model was a Random Forest model with accuracy 78.6%
- The inputs to our model were number of investments, number of IPO exits, and estimated revenue. The Funding Amount was our target variable which was used to evaluate our model



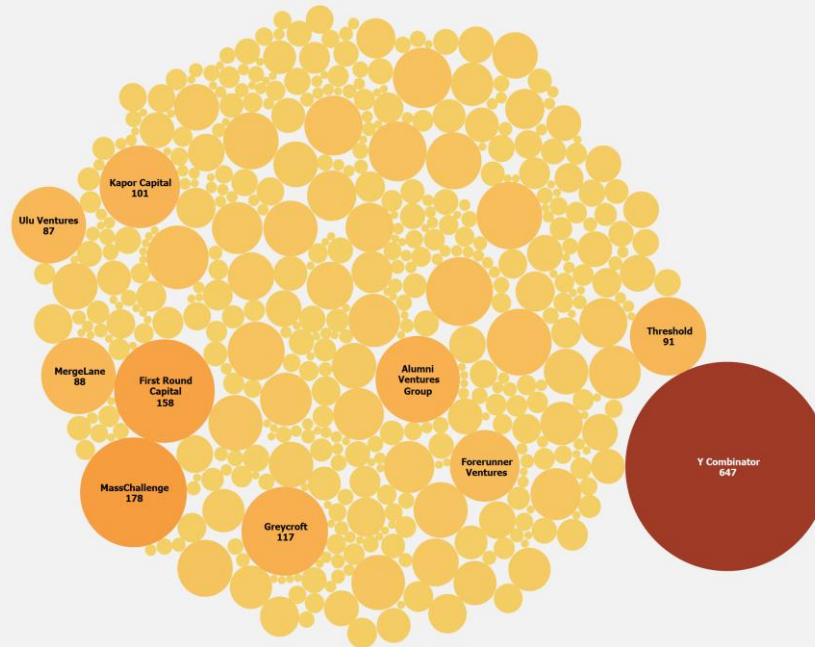
[LINK TO PYTHON NOTEBOOK](#)



RECOMMENDATIONS

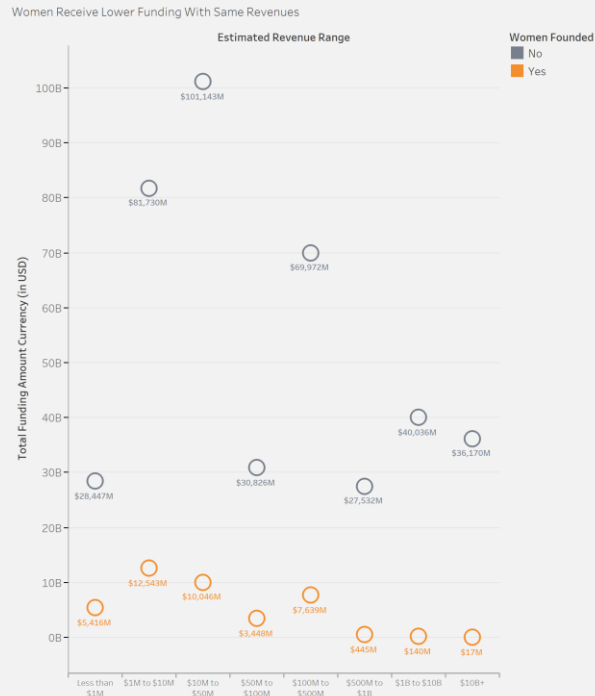
LOW OUTCOME

Top Women Investments by VC Firms



Due to disproportionately low number of deals received by women in comparison to men in several states, we suggest women headquarter in states where the ratio is higher, such as California, New Jersey, and New York. Women should also enroll in incubator or accelerators to maximize their network and capital. Ecosystem building programs also build networks and traction. this would increase the probability that the startup receives a higher amount of funding.

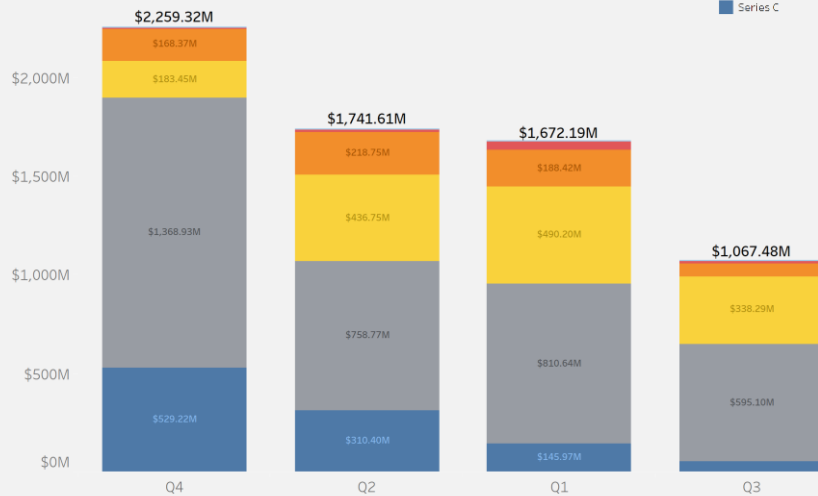
MODERATE OUTCOME



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HIGH OUTCOME

Funding to Women Founders in 2019



Women-owned businesses with IPOs or investments raise more funding, have more exits and a high probability of receiving additional funding. We recommend pitching in the fourth or second quarter to generate a higher amount of capital.

For venture capitalists, we recommend diversifying the venture partners by adding more women so that they can provide their unique perspectives in funding new startups

NEXT STEPS

This starter model and tool could provide women and investors more insights into funding for women-found or led businesses.

We currently only categorize the funding that a female founder would receive but plan to improve the model so that we can quantify the estimated funding amount that women-owned businesses will receive.

This would provide more targeted recommendations for the businesses.

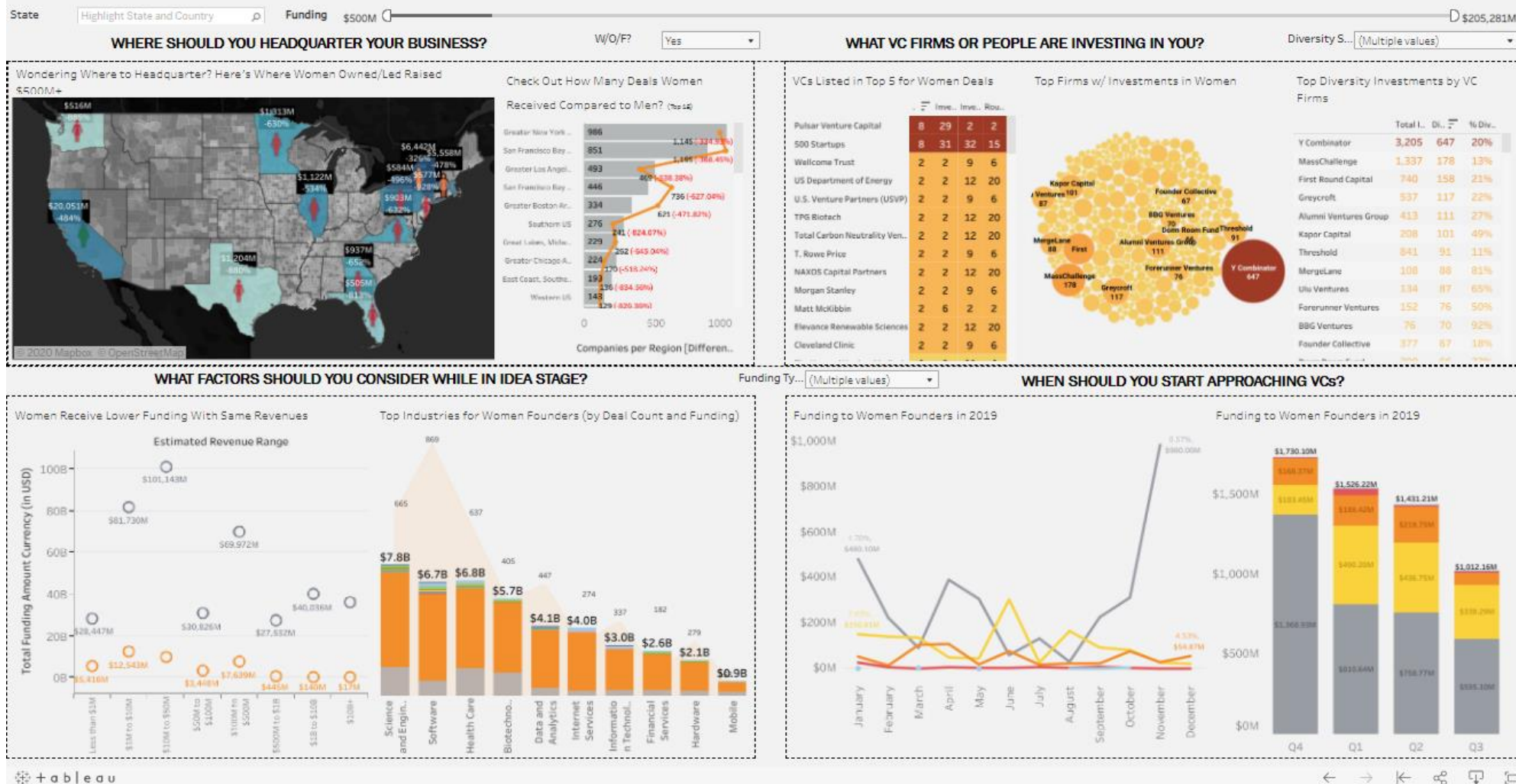


DEMO

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VENTURE CAPITAL IS A BIASED SYSTEM: HOW WOMEN OWNED BUSINESSES CAN BEAT IT



The Biased VC System

Edit Details

Viz Author: Teneika Askew

Women-owned businesses are growing 2X faster than all businesses nationwide, and yet, they only receive 2.8% of venture capital (#VC) funding. This project was built to inform women-owned/led businesses.

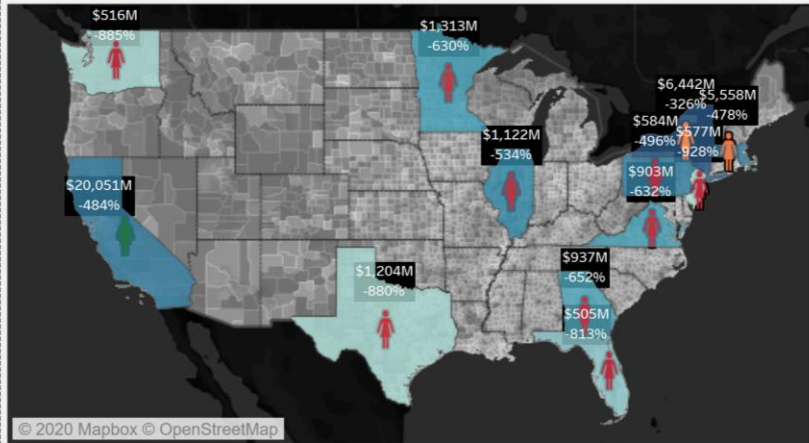
VENTURE CAPITAL IS A BIASED SYSTEM: HOW WOMEN OWNED BUSINESSES CAN BEAT IT

State No items highlighted Funding 500,000,000 to 205,280,568,492

WHERE SHOULD YOU HEADQUARTER YOUR BUSINESS?

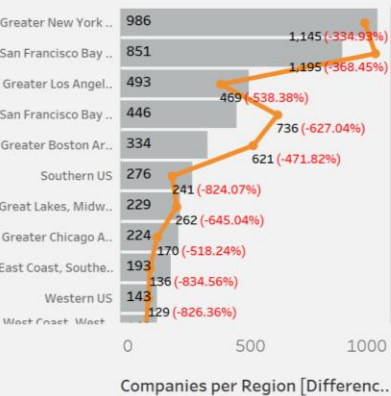
W/O/F? Yes

Wondering Where to Headquarter? Here's Where Women Owned/Led Raised \$500M+



Check Out How Many Deals Women

Received Compared to Men? (Top 15)



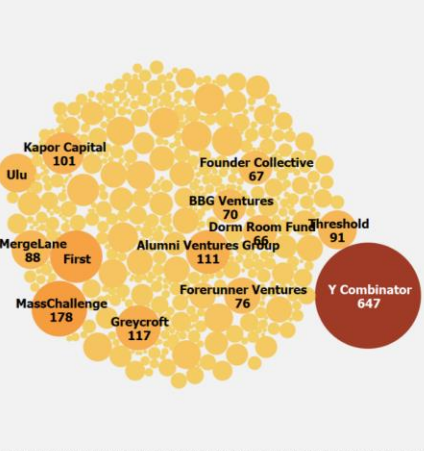
WHAT VC FIRMS OR PEOPLE ARE INVESTING IN YOU?

Diversity S.. Multiple values

VCs Listed in Top 5

	Dive..	Inve..	Inve..	Rou..
Pulsar Venture Capital	8	29	2	2
500 Startups	8	31	32	15
Wellcome Trust	2	2	9	6
US Department of Energy	2	2	12	20
U.S. Venture Partners (USVP)	2	2	9	6
TPG Biotech	2	2	12	20
Total Carbon Neutrality Ven..	2	2	12	20
T. Rowe Price	2	2	9	6
NAXOS Capital Partners	2	2	12	20
Morgan Stanley	2	2	9	6
Matt McKibbin	2	6	2	2
Elevance Renewable Sciences	2	2	12	20
Cleveland Clinic	2	2	9	6
The Howard Hughes Medical	2	2	9	6

Top Firms w/ Investments in Women



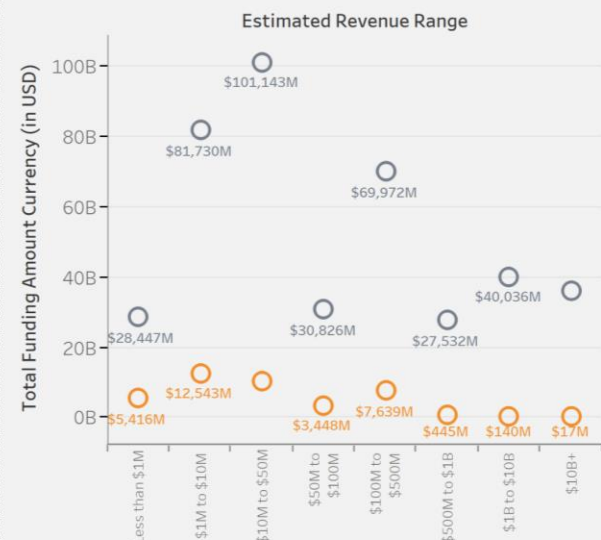
Top Diversity Investments by VC Firms

	Total I..	Divers..	% Div..
Y Combinator	3,205	647	20.2%
MassChallenge	1,337	178	13.3%
First Round Capital	740	158	21.4%
Greycroft	537	117	21.8%
Alumni Ventures Group	413	111	26.9%
Kapor Capital	208	101	48.6%
Threshold	841	91	10.8%
MergeLane	108	88	81.5%
Ulu Ventures	134	87	64.9%
Forerunner Ventures	152	76	50.0%
BBG Ventures	76	70	92.1%
Founder Collective	377	67	17.8%
Dorm Room Fund	290	66	22.8%
Floodgate	222	55	24.8%

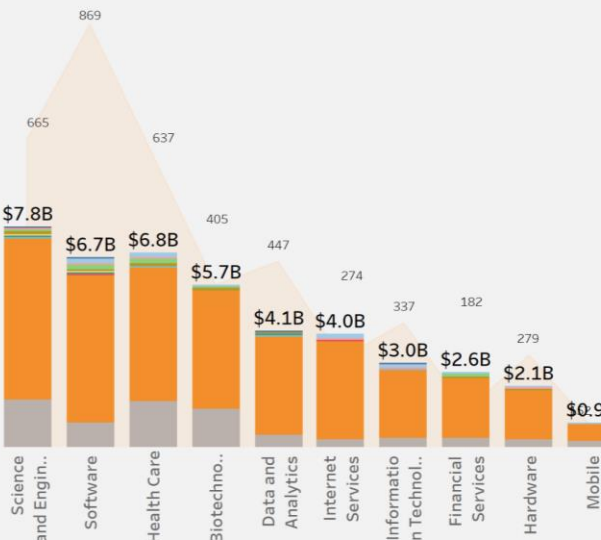
WHAT FACTORS SHOULD YOU CONSIDER WHILE IN IDEA STAGE?

Funding Ty.. Multiple values

Women Receive Lower Funding With Same Revenues

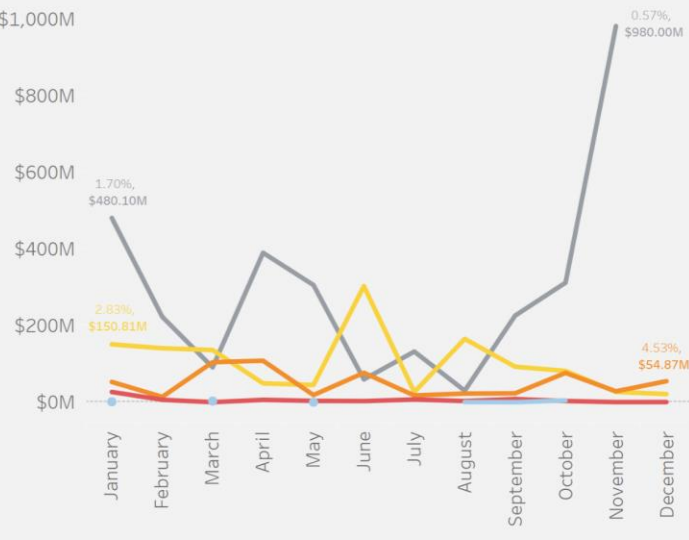


Top Industries for Diverse Founders (by Deal Count and Funding)

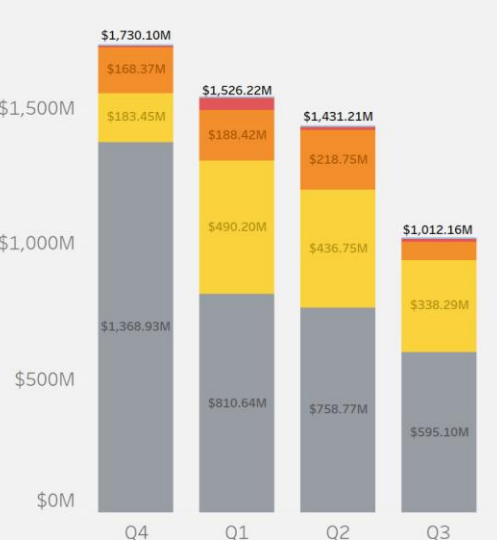


WHEN SHOULD YOU START APPROACHING VCS?

Funding to Women Founders in 2019



Funding to Women Founders in 2019



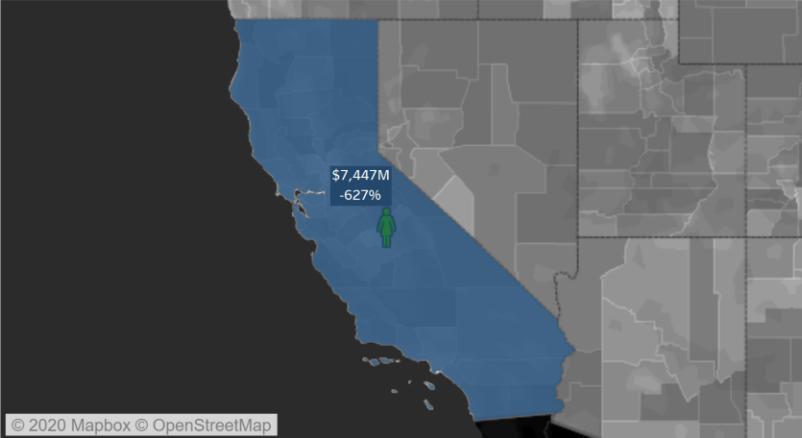
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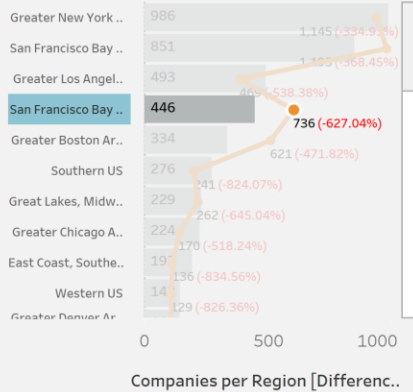
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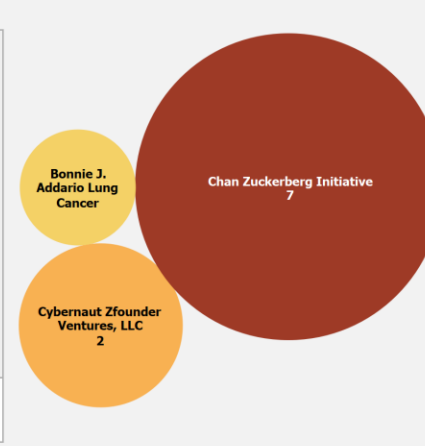
WHAT VC FIRMS OR PEOPLE ARE INVESTING IN YOU?

Diversity S.. Multiple values

VCs Listed in Top 5

	Dive..	Inve..	Inve..	Rou..
Venrock	1	9	1	
Ullas Naik	3	4	3	
Streamlined Ventures	3	4	3	
Redmile Group	1	9	1	
Polaris Partners	1	9	1	
Inc.	1	1	5	
Hercules Capital	1	1	5	
General Atlantic	3	4	3	
Frazier Healthcare Partners	1	9	1	
Elysium Venture Capital	1	11	4	
Consensus Lab	1	11	4	
CNBC	1	11	4	
Cheung Kong Holdings	3	4	3	
Casdin Capital				

Top Firms w/ Investments in Women



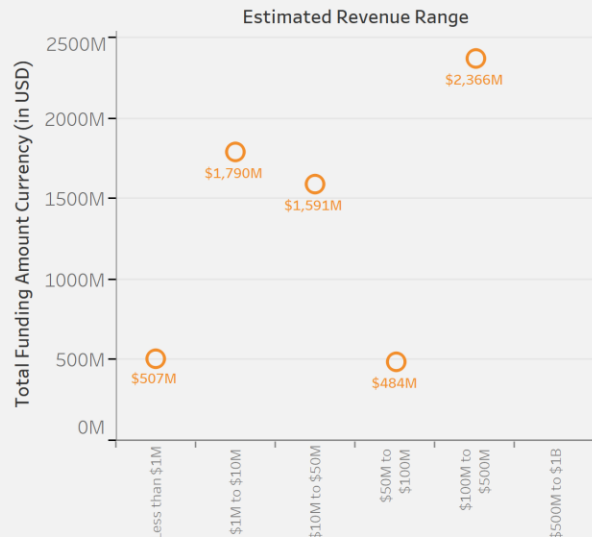
Top Diversity Investments by VC Firms

	Total In..	Diversi..	% Diver..
Chan Zuckerberg Initia..	34.00	7.00	20.6%
Cybernaut Zfounder V..	3.00	2.00	66.7%
Bonnie J. Addario Lung..	2.00	1.00	50.0%
Critical Path Inc.	3.00		
BGOGO	1.00		
Amunix	1.00		
Align Technology	2.00		
AcelRx Pharmaceuticals	1.00		

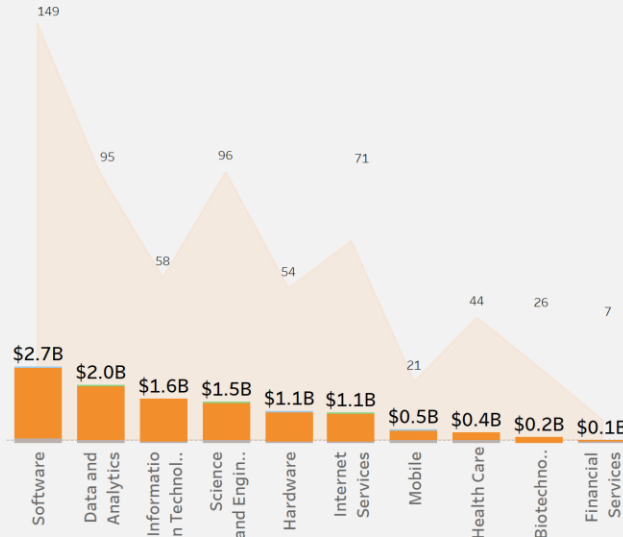
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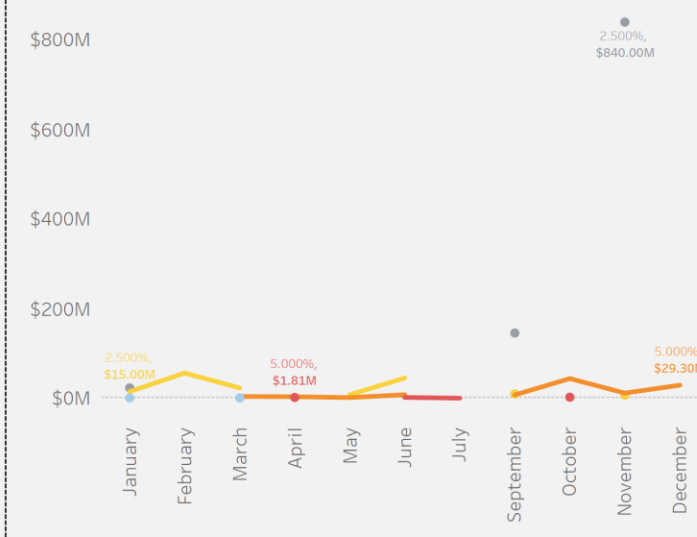


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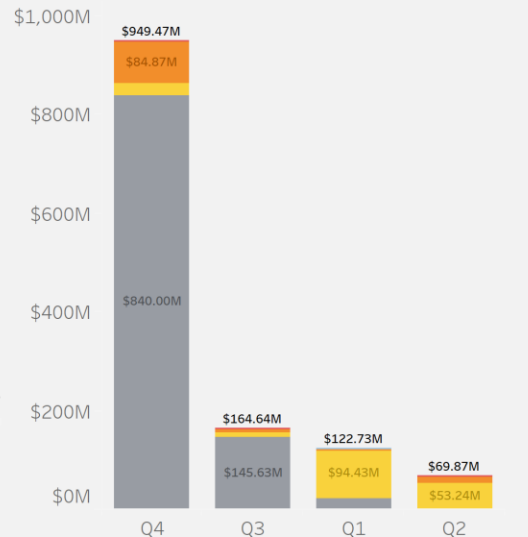


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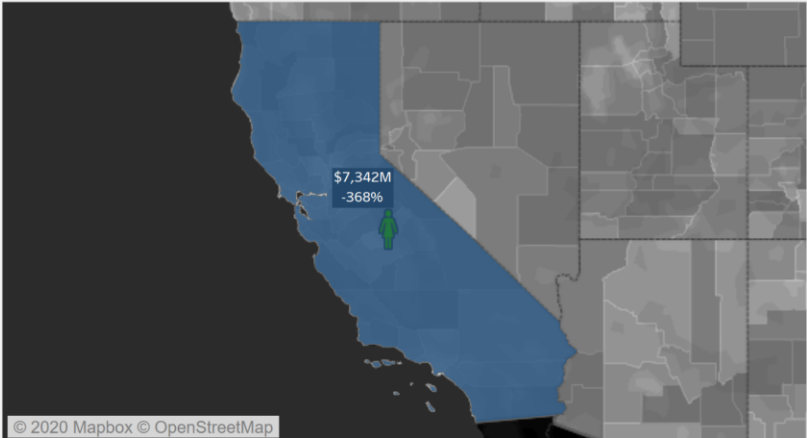


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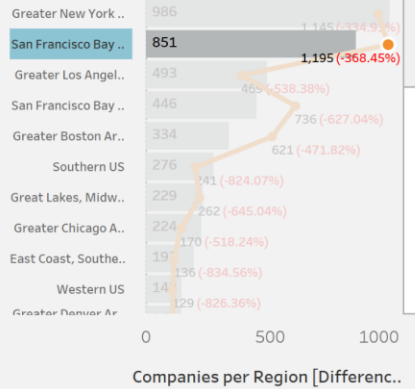
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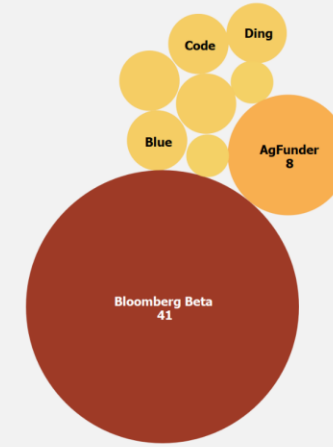
WHAT VC FIRMS OR PEOPLE ARE INVESTING IN YOU?

Diversity Score Multiple values

VCs Listed in Top 5

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T. Rowe Price	2	2	9	6
Morgan Stanley	2	2	9	6
Cleveland Clinic	2	2	9	6
The Howard Hughes Medical..	1	1	11	4
Pontifax AgTech	1	1	11	4
Novartis	1	1	11	4
Maverick Ventures	1	1	11	4
F-Prime Capital	1	1	11	4
Version One Ventures		1	6	4
Uncork Capital				

Top Firms w/ Investments in Women



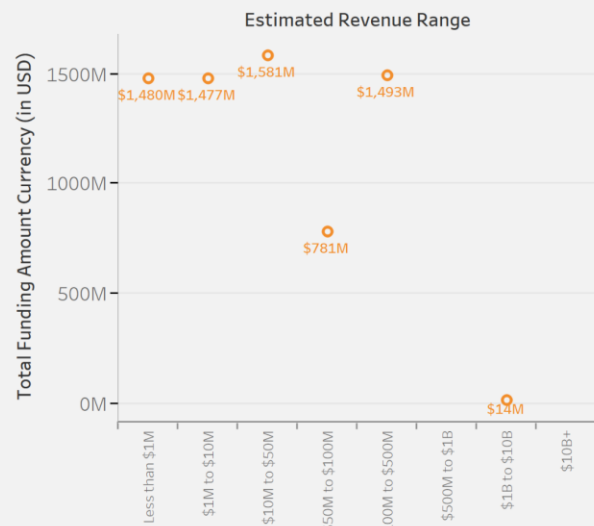
Top Diversity Investments by VC Firms

	Total I..	Divers..	% Div..
Bloomberg Beta	189.0	41.0	21.7%
AgFunder	29.0	8.0	27.6%
Ding Ventures	8.0	2.0	25.0%
Code for America	2.0	2.0	####
Castlight Health	2.0	2.0	####
Builders VC	32.0	2.0	6.3%
Blue Shield of California	4.0	2.0	50.0%
Caribou Biosciences	1.0	1.0	####
Adaptive Path	1.0	1.0	####
Eventbrite	4.0		
Decipher Capital			
Credit Karma	1.0		
Conscious Capitalism			
Brandless			

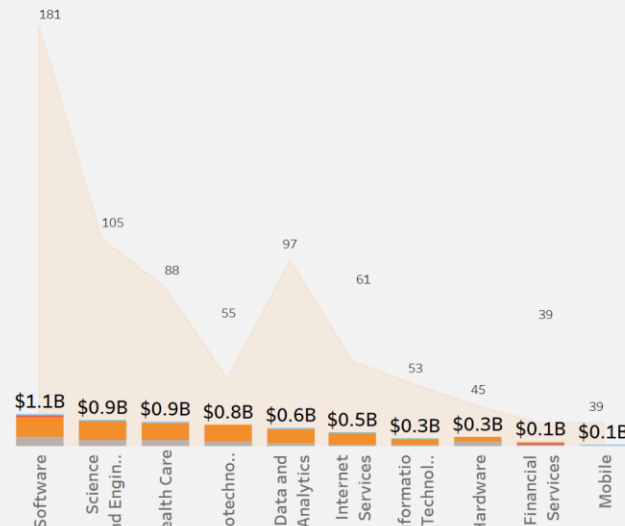
WHAT FACTORS SHOULD YOU CONSIDER WHILE IN IDEA STAGE?

Funding Type Multiple values

Women Receive Lower Funding With Same Revenues

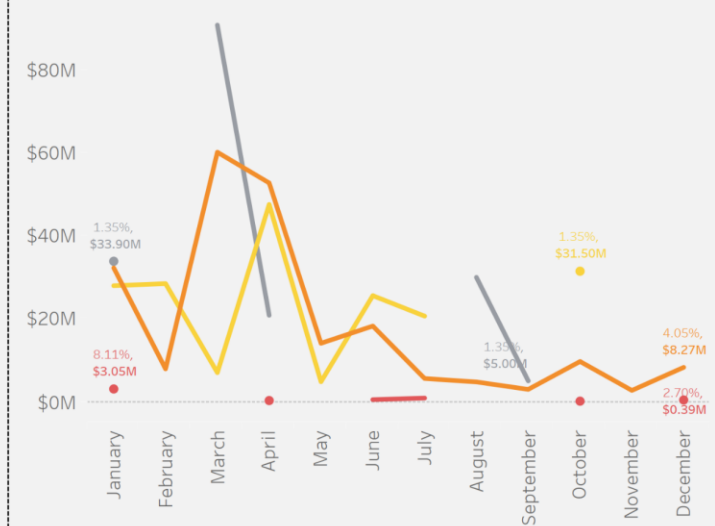


Top Industries for Women Founders (by Deal Count and Funding)

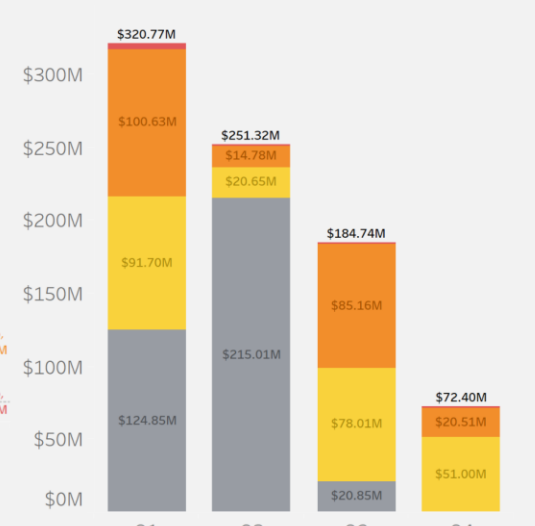


WHEN SHOULD YOU START APPROACHING VCS?

Funding to Women Founders in 2019



Funding to Women Founders in 2019





QUESTIONS