Journal of STI Policy and Management

Publication details, including instructions for authors and subscription information: http://www.stipmjournal.org/

Mass Producing Innovation: A Case Investigation on Why Accelerators Might Not Be a Paradox

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Version of record first published: 15 December 2016

To cite this article: Barnes, A. (2016). Mass producing innovation: a case investigation on why accelerators might not be a paradox. *Journal of STI Policy and Management,* 1(2), 117–124

To link to this article: http://dx.doi.org/10.14203/STIPM.2016.70

ISSN 2540-9786 (Print); ISSN 2502-5996 (online)

Accreditation Number: 622/AU3/P2MI-LIPI/03/2015

SCIENCE, TECHNOLOGY AND INNOVATION POLICY AND MANAGEMENT (STIPM) JOURNAL

Volume 01, Number 02, December 2016

FOREWORD by EDITOR-in-CHIEF

We are very pleased to present the second issue of the Science, Technology and Innovation Policy and Management (STIPM) Journal. We are very excited that the journal has attracted papers from many countries. The variety of paper submissions has supported the international-level initiatives of the journal. Since the beginning of the year, a number of articles have been sent to us. Six articles are published in this issue, while others are still under the first or second phase of review and will follow in the subsequent issue.

In this issue, we present six articles on issues of technology and innovation development and policy at national-, regional-, and firm-level, written by scholars from Australia, Japan and Indonesia. The first article investigates the technological capability of the milk processing industry in Indonesia. The second article investigates mass production of innovation in the business model of start-up companies. The third article explores the diverse effects of four types of mobility on university entrepreneurship. The fourth article explores institutional transformations in local innovation systems used by the farmer community of Belu, East Nusa Tenggara, Indonesia. The fifth article analyzes the transition of bioplastic development in Indonesia, and the last article investigates the effectiveness of subsidies in technology adoption using the case study of reverse osmosis membrane technology in Mandangin Island, East Java, Indonesia. All articles have gone through editorial review by prominent experts.

I would like to thank the authors who have submitted articles to *STIPM Journal* for their trust, patience and timely revisions as well as for trusting Editor and Editorial Board. I encourage authors to submit their manuscripts. This scientific work is published widely on an open access policy.

My gratitude also goes to all members of the Editorial Board and reviewers who have contributed to this second issue, all of whom increase the quality of articles in this journal even more. We continue to welcome article submissions in the field of science, technology and innovation policy and management.

We wish you a 2017 Happy New Year!

Jakarta, December 2016

Editor-in-Chief

JOURNAL OF STI POLICY AND MANAGEMENT

Volume 1, Number 2, December 2016

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STI POLICY AND MANAGEMENT
LIPI
Journal homepage: http://www.stipmjournal.org

Mass Producing Innovation: A Case Investigation on Why Accelerators Might Not Be a Paradox

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ARTICLE INFO

Article History:
Received : 10 November 2016
Revised : 7 December 2016
Accepted : 7 December 2016
Available online : 15 December 2016

Keywords:
Accelerators
Start-ups
Innovation
Business model

ABSTRACT

There are a growing number of accelerator programs designed to start and support innovative startup businesses. Many accelerators are increasing the size of their intakes, with some programs now launching over 200 new companies per year. On first inspection the large numbers and consistent approach taken to accelerating the participating companies appears to be in conflict with producing innovative and disruptive companies. This paper uses Y Combinator as a single case study to investigate whether increasing the number of companies within a batch has resulted in longer or shorter timeframes for companies to achieve an exit (through acquisition or initial public offering). The paper finds that the timeframe for achieving an exit for Y Combinator companies is reducing, even while batch size has sharply increased. There is no statistically significant correlation between the cohort size and the initial money raised during the program.

I. INTRODUCTION

Disruptive new ventures are a hallmark of capitalism, where entrepreneurship revolutionizes existing economic structures (Schumpeter, 1942). Creating new industry paradigms can be highly profitable. In the last four decades, high-growth, venture capital-backed startups have accounted for less than half of new US public companies, but have captured over 63% of the total market capitalization (Gornall & Strebulaev, 2015). More recently, over the last ten years startup accelerators have emerged as a new method for incubating and investing in disruptive businesses (Miller & Bound, 2011). Accelerators provide resources (generally in the form of seed funding, networks and mentorship) to groups of participating companies.

The accelerator model was first pioneered by Y Combinator (YC), a program that originated in Boston and now operates from Mountain View in California (Dempwolf, Auer, & D'Ippolito, 2014; Kim & Wagman, 2014; Miller & Bound, 2011). The first cohort (termed 'batch') of YC companies in 2005 featured less than ten businesses. YC has grown over the last decade and now launches over 200 companies each year. Intuitively, there would seem to be a conflict in launching disruptive companies at scale. Indeed, existing research suggests that as companies grow

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http://dx.doi.org/10.14203/STIPM.2016.70

larger, their ability to innovate may decrease (Ackermann, 2012). The team behind YC is not unaware of the difficulty inherent in scaling the pursuit of innovation, and despite this YC has continued to steadily expand. YC's mass production of high-growth companies offers an opportunity for study: does the increasing size of cohorts have a negative effect on startup outcomes? This paper investigates whether there is a relationship between cohort size in a given year on seed investment round size and whether cohort size negatively impacts the average length of time for an acquisition.

A. Can innovation scale?

There is reason to be both optimistic and pessimistic when considering whether innovation can scale. From a simplistic perspective there are certain types of advances that require sufficient size and scale to support the necessary research and development activities. The Large Hadron Collider, for example, offers unique insight into uncharted territory, and in turn may yield disruptive breakthrough findings. Without the support of countless scientists, many countries and many billions of dollars in investment, it would not be possible. However this form of scale—concentrated on a single project—is not what YC and its peers are attempting. Instead, YC's program supports a great diversity of startup businesses, all of which receive relatively few resources. As batch sizes increase, the time and attention from YC must be spread thinner still. To support each company, YC must be able to systematize the elements required to support innovation. Isaac Asimov (2014, p. 2)suggests that "the process of creativity, whatever it is, is essentially the same in all its branches and varieties, so that the evolution of a new art form, a new gadget, a new scientific principle, all involve common factors". If Asimov is correct, and if YC have been able to identify scalable means to deliver enough of the common factors, then there could be the opportunity to improve the outcomes for companies participating in YC, even while the size of cohorts increases.

In contrast to this, there are many examples where innovation has been negatively impacted as group size increases. In academia, research indicates there are decreasing returns as team size grows (Lee & Bozeman, 2005). The productivity of corporate research and development teams decreases as staffing numbers increase, particularly for heterogeneous groups (Cummings, Kiesler, Zadeh, & Balakrishnan, 2013). Venture capital firms seeking to increase the size of their port folios also experience negative performance tradeoffs (Cumming, 2006; Fulghieri & Sevilir, 2009; Kanniainen & Keuschnigg, 2004; Kim & Wagman, 2014). Accelerators too may experience diseconomies of scale (Hallen, Bingham, & Cohen, 2014).

Y Combinator differs from other accelerators in two important respects that may enable it to scale more successfully. First, by being renowned as the premier accelerator globally, YC is able to attract the top tier of potential startup applicants (Hochberg & Kamath, 2012; Pauwels, Clarysse, Wright, & Van Hove, 2016). Attracting the very top tier of applicants (ahead of other accelerators) is particularly important in an industry where outliers are essential (Kim & Wagman, 2014). Second, YC strongly espouses independence and autonomy for the companies that participate in their program. For example, unlike other accelerators which will often provide free or subsidized office space, Y Combinator does not (Radojevich-Kelley & Hoffman, 2012). Paul Graham, one of the co-founders of YC, cited the need for companies to develop their own culture (Stross, 2012). Greater independence may certainly help YC companies innovate.

B. Pros and cons for YC's increasing cohort size

There are potentially many negative impacts associated with increasing the size of an accelerator cohort. If the common factors for innovation described by Asimov are not systematized and designed to scale, then outcomes will be less optimal on average for the participating companies. One obvious effect of larger cohort sizes is the increased competition for investment funding. If the available capital for seed investment is fixed, then increasing the average number of YC companies should result in a lower average seed round for each company. The increased competition for each investor dollar may be compounded by the perception of lower average quality as cohort size increases.

With increasing numbers of heterogeneous companies there will also be limits on the quality of advice and mentorship that can be provided. The homogeneity of advice given to an increasingly large cohort is more likely to be poorly suited to the unique needs of individual companies (Hallen et al., 2014). Unsuitable advice can negatively impact the chances of success.

In contrast to the issues noted above, there are some benefits associated with larger accelerator cohort sizes. One of the primary features of accelerators are the investors and mentors that they can attract (S. Cohen & Hochberg, 2014; Hochberg, 2016). A certain critical mass and prestige is required to attract top-tier investors and mentors (Yin & Luo, 2015). Alumni networks are another important asset positively associated with accelerator cohort size (Hochberg, 2016). The benefits associated with a greater number and quality of investors, mentors, and alumni (all of which often overlap), may help offset the issues identified in Section 1.1.

C. Structure of paper

This paper investigates whether YC's increasing cohort sizes have negatively impacted the outcomes for participating firms. The next section introduces the research methods and data used in this investigation. The third section reports on the results. The paper then concludes with a discussion of key findings, research limitations and suggestions for future research.

II. METHODOLOGY

A. Research design

This paper's motivating research question seeks to identify the potential relationship between the number of firms that Y Combinator includes in its batches and the performance outcomes for those firms. As an experimental design is impractical, this study investigates whether there is a statistically significant correlation between cohort size and outcome variables. The two research questions are:

1) Q1 Is there an effect on the amount of seed funding raised based on the cohort size in the year that the company participated in YC?
2) Q2 Is there an effect on the time it takes for a company to exit based on the cohort size in the year that they participated in YC?

Seed funding amount and length of time to acquisition are only tangentially related to success, but they offer the best insight as no reliable data are available on other outcome measures (such as company valuations).

B. Data selection

This paper focused on a single startup accelerator, namely Y Combinator. YC was chosen for three reasons. First, as the original accelerator, the dataset of YC companies spaned the longest time horizon out of any other accelerator. Second, YC deliberately experimented with changing the sizes and formats of cohorts (see Table 1). The organization has been prepared to reduce cohort sizes when it felt outcomes were being compromised. For example, in 2013 co-founder Paul Graham discussed the conscious intent to scale their process and why they decided to reduce batch sizes: "We're still a bit mystified about what happened. Why was 66 [in one half-year intake] ok and 84 not? Is there some kind of hard limit somewhere between those two numbers? Or will we be able to morph YC to get past that bottleneck as we always have in the past?" (Graham, 2013, p. 2).The fluctuating cohort sizes (compared with a constant increase in cohort size) helped isolate the effects of cohort size.The third reason for selecting YC was more practical: due to YC's relative fame, there was better data available on their portfolio companies available in databases such as Crunchbase. While unrelated to the above three reasons, the author also participated in the program in 2015 and have a level of familiarity and insight into YC's operation.

Table 1.
Size of YC Cohort Per Year, Relative to the Previous Year

Year	Relative size to previous year
2005	Not applicable – no previous year
2006	Higher
2007	Higher
2008	Higher
2009	Lower
2010	Higher
2011	Higher
2012	Higher
2013	Lower
2014	Higher
2015	Lower
2016	Not included - incomplete data

Data was sourced from Crunch base. Crunch base provided the largest public dataset on startup companies, including 991 YC companies (almost all) (Liang & Yuan, 2016). Crunch base included information on a company's starting date, the dates and amounts of investment rounds, and details on acquisitions. As YC did not publicly publish many details on participating companies, only data from Crunch base were used. Accordingly, the 'year' field in Table 1 was based on the first investment round with YC participation recorded for a company in Crunch base and might slightly differ in rare cases to the year the company actually participated in YC.

C. Technique of Analysis

Regression analysis was used to investigate the potential correlation between variables. The investigation considered effect size and statistical significance. Cohen (1994) and Starbuck (2006) outline the importance of considering the magnitude of effects in any interpretation of regression analysis: a statistically significant effect that has little impact is not particularly interesting. Gretl, an open source tool for statistical analysis was used to compute results (Cottrell & Lucchetti, 2016).

III. RESULTS AND DISCUSSION

A. Results

(1) Q1: Does cohort size have an impact on the amount of seed funding raised by each company?

This study first analyzed whether YC's cohort sizes effected the seed funding raised by their portfolio companies. Companies with no funding data recorded in Crunch base were omitted. Table 2 below summarizes the findings. There was no statistically significant relationship (at$p = 0.05$) between the cohort size and the amount of money raised in YC portfolio company seed rounds. In addition to this, the effect magnitude for the size of cohort was very small, suggesting only an extra $780 in funding for each company for each additional peer they have. There was a slight negative relationship between latter years and the amount of funding received, though it was also not statistically significant. The negative trend for more recent years mirrored general industry trends (Morrill, 2015).

The 95% confidence interval for *Cohort size* had a lower bound of –897.51 and an upper bound of 2456.95.

Table 2.
Money Raised Given Cohort Size and Year, Ordinary Least Squares (n=604).

	Coefficient	Std. Error	t-ratio	p-value	Significance
Constant	572189	155614	3.6770	<0.01	***
Cohort size	779.723	854.021	0.9130	0.3616	
Year	−4021.38	20945.6	−0.1920	0.8478	

Mean dependent var	652962.0	S.D. dependent var	966041.7
Sum squared resid	5.62e+14	S.E. of regression	966845.4
R-squared	0.001658	Adjusted R-squared	-0.001665
F(2, 601)	0.498973	P-value(F)	0.607405
Log-likelihood	−9179.739	Akaike criterion	18365.48
Schwarz criterion	18378.69	Hannan-Quinn	18370.62

Table 3.
Average Number of Days for Acquisition Given Cohort Size and Year, Ordinary Least Squares (n=991).

	Coefficient	Std. Error	t-ratio	p-value	Significance
Constant	3770.73	801.863	4.7025	<0.01	***
Cohortsize	−0.0293143	0.0168522	−1.7395	0.08	*
Year	−1.86724	0.399183	−4.6777	<0.01	***

Mean dependent var	8.649849	S.D. dependent var	23.50279
Sum squared resid	507037.7	S.E. of regression	22.65383
R-squared	0.072816	Adjusted R-squared	0.070939
F(2, 988)	38.79585	P-value(F)	6.03e-17
Log-likelihood	−4496.912	Akaike criterion	8999.824
Schwarz criterion	9014.520	Hannan-Quinn	9005.412

Table 4.
Average Number of Days for Acquisition Given Cohort Size, Year and Days Operating, Ordinary Least Squares (n=991).

	Coefficient	Std. Error	t-ratio	p-value	Significance
Constant	22065.8	983.83	22.4284	<0.01	***
Cohortsize	−0.0126571	0.0133487	−0.9482	0.34	
Year	−10.9416	0.488724	−22.3880	<0.01	***
Days Operating	−0.0291152	0.00119681	−24.3274	<0.01	***

Mean dependent var	8.649849	S.D. dependent var	23.50279
Sum squared resid	316974.0	S.E. of regression	17.92063
R-squared	0.420372	Adjusted R-squared	0.418610
F(3, 987)	238.6052	P-value(F)	2.1e-116
Log-likelihood	−4264.143	Akaike criterion	8536.286
Schwarz criterion	8555.881	Hannan-Quinn	8543.737

(2) Q2: Is there an effect on the time it takes for a company to exit based on the cohort size?

The second question investigated was whether there is a relationship between the cohort size and the average time taken for a liquidity event (either an IPO or acquisition). As no Y Combinator company publically listed, the author only considered acquisitions. There were 127 acquisitions in the dataset and the results were summarized in Table 3 below. The 95% confidence interval for *Cohort size* in Table 3 had a lower bound of –0.06and an upper bound of 0.004.

There was a natural ceiling on the maximum number of days for an exit event based on the year that a company participated in YC: the average time taken for companies to be acquired from the 2015 YC cohort was likely much less than average time taken for participants of the 2010 cohorts. To control this ceiling, the author included a variable for the total number of days that the company has been operating in Table 4. The 95% confidence interval for *Cohort size* in Table 4 had an upper value of 0.01 and a lower value of –0.04.

The results in Table 3 and Table 4 did not provide support for any positive or negative impact with increasing cohort sizes. In both regressions there was no statistically significant relationship at $p = 0.05$between cohort size and the average number of days for an acquisition. The effect size was also small and negative: the largest change recorded to cohort size (from around ten participants to 210) would only reduce the average number of days for an acquisition by four.

B. Discussion

(1) Seed round and time to acquisition

This paper began with the question of whether the success of YC's portfolio companies can continue as YC scales the size of its program. YC's program is now twenty times larger than when it began. The investigation of 991 YC companies suggests that the increasing cohort sizes have not had a noticeable impact on the time taken for acquisitions or for the amount of seed funding raised. Note that a statistically insignificant finding does not itself suggest that the tested hypothesis is false (Ellenberg, 2014). However, the narrow confidence interval for the effect size of cohort size does indicate that any potential positive or negative effect is minimal.

The minimal impact that increasing cohort sizes has had on the average amount of seed funding is unexpected. Intuitively one might expect that the greater the number of companies, the greater the competition and lower average investment each would receive. The results in Table 2 suggest that there is a statistically insignificant positive correlation between the size of cohort and the average seed round. Table 5 provides an overview of average seed round and number of YC companies by year. The results suggest that YC's brand as the world's top accelerator may have meant that its companies have been protected from the increased competition amongst peers. As YC's brand has grown, so too has the number of applicants for its programs. This has meant YC has been able to maintain an acceptance rate "below 3%"(Yin & Luo, 2015, p. 23). The negative impact of increasing cohort size is probably more acutely felt by accelerators that lower the entry bar.

The second finding is that YC's increasing cohort size has had a negligible impact on the average time for an acquisition. There is already research showing that participation in an accelerator like YC demonstrates reductions in the average time before acquisition (Smith & Hannigan, 2015). What is unexpected is that cohort size has had no to minimal impact on the average time until acquisition.

(2) Implications for other accelerators

The findings suggest certain implications for accelerators. It does appear that there may indeed be scalable "common factors" when it comes to producing innovative companies (Asimov, 2014, p. 2). YC's success in scaling the size of its cohorts suggests that it has systematized some of them. The literature review identified some of the unique strategies that YC uses to support innovation. The first is its focus on individual autonomy. Practices such as not offering office space are in contrast to "virtually all accelerator companies" (Radojevich-Kelley & Hoffman, 2012, p. 60). By strongly encouraging participating companies to develop their own cultures and environments, YC is attempting to encourage heterogeneity between their portfolio companies.

Table 5.
Average Seed Round and Cohort Size.

Year	Average seed round	# companies	Relative cohort size	Relative seed round size
2005	$52,000	7	Not applicable – no previous year	
2006	$14,000	17	Higher	Lower
2007	$16,333	32	Higher	Higher
2008	$63,636	39	Higher	Higher
2009	$170,714	37	Lower	Lower
2010	$467,667	52	Higher	Higher
2011	$755,346	81	Higher	Higher
2012	$1,353,108	137	Higher	Lower
2013	$1,465,207	88	Lower	Higher
2014	$616,945	216	Higher	Higher
2015	$587,844	169	Lower	Lower
2016	$470,826	117	Not included – incomplete data	

Second, YC has been able to keep acceptance rates low, despite the increase in cohort size. Increasing cohort size at the expense of quality would likely have a negative impact on both seed funding size and acquisition prospects. As YC has been able to maintain and even grow its brand, it has been able to attract an increasing number of applicant companies. With acceptance rates below 3% (which is better than industry averages), selection to YC continues to be a strong quality signal for participating companies (Yin & Luo, 2015, p. 23).

Replicating the success of YC in is not trivial. However, a focus on the elements that will support innovation at scale appears to be an essential ingredient.

(3) Limitations and further research

As with all studies, there are limitations which must be considered with this investigation. A primary limitation is the variables available for investigation. When considering whether cohort size has an impact on firm outcomes, the ideal outcome variable would be firm market capitalization. The length of time taken for acquisition is an imperfect proxy for success. Unfortunately, data on valuation or market capitalization was not available. Further research in the area would benefit from access to such data.

With that said, the limited information on acquisition values seems to suggest that YC's performance is continuing to strengthen. One of the most recent YC exits (and also its largest to date) is Cruise, an autonomous vehicle company, that reportedly sold to General Motors for $1bn (Crunchbase, 2016). Cruise was part of YC's 2014 cohort, which was the largest cohort year for YC to date.

Another potential limitation relates to the incentives of accelerators at scale. For accelerators that are able to develop focused, larger portfolios, there are strategic benefits from exiting underperforming companies quickly (Fulghieri & Sevilir, 2009). This dynamic does not seem to apply as much to YC as it does not have a focused portfolio (the diversity of participating companies appear to be increasing with time) and does not have control over exiting firms (either through acquisition or by shutting them down).

IV. CONCLUSION

The paper finds that the timeframe for achieving an exit for Y Combinator companies is reducing, even while batch size has sharply increased. There is no statistically significant correlation between the cohort size and the initial money raised during the program. Finally, while not a limitation, it is worth noting that portfolio size is a function of an accelerator's business model. The typical accelerator business model "is to invest in a set of ventures with a relatively small amount of money rather than continue to support the ventures in multiple rounds" (Kim &Wagman, 2014, p. 5). Accordingly, accelerators are able to invest in a large number of potential firms. More recently, Y Combinator has opted to adopt a different model, guaranteeing follow on investment in all its portfolio companies up until a valuation of $300 million (Altman, 2015). Given the unique nature of YC's future strategy, there is an opportunity for further and deeper research.

ACKNOWLEDGEMENTS

This paper was presented at the STP International Seminar in Bogor, Indonesia. Thanks to the panel participants for their input and comments which have been incorporated into this paper. The author would also like to acknowledge and thank Assoc. Professor Dr. Damian Hine at the University of Queensland Business School for reading an early draft of this paper.

REFERENCES

Ackermann, S. J. (2012). *Are small firms important? Their role and impact*. Berlin: Springer Science & Business Media.

Altman, S. (2015, October 16). *YC continuity*. Retrieved October 3, 2016, from https://blog.ycombinator.com/yc-continuity-fund

Asimov, I. (2014, October 20). *Published for the first time: A 1959 essay by Isaac Asimov on creativity*. Retrieved November 9, 2014 from http://www.technologyreview.com/view/531911/isaac-asimov-asks-how-do-people-get-new-ideas/

Cohen, J. (1994). The earth is round (p<. 05). *American Psychologist, 49*(12), 997.

Cohen, S., & Hochberg, Y. V. (2014). *Accelerating startups: The seed accelerator phenomenon*. Available at SSRN 2418000. Retrieved from http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2418000

Cottrell, A., & Lucchetti, R. (2016). *Gretluser's guide*. Retrieved from http://ricardo.ecn.wfu.edu/pub//gretl/manual/en/gretl-guide.pdf

Crunchbase. (2016, March 11). Mar 11, 2016: *General Motors/Cruise Automation | crunchbase - General Motors acquires Cruise for $1B in Cash & Stock*. Retrieved October 3, 2016 from https://www.crunchbase.com/acquisition/d7ca7de8846a22a446e474e388617673

Cumming, D. J. (2006). The determinants of venture capital portfolio size: Empirical evidence. *Journal of Business, 79*, 1083–1126.

Cummings, J. N., Kiesler, S., Zadeh, R. B., & Balakrishnan, A. D. (2013). Group heterogeneity increases the risks of large group size a longitudinal study of productivity in research groups. *Psychological Science*, *24*(6), 880–890.

Dempwolf, C. S., Auer, J., & D'Ippolito, M. (2014). Innovation accelerators: Defining characteristics among startupassistance organizations. SBAHQ-13-M-0197. US Small Business Administration. Retrieved from https://www.sba.gov/sites/default/files/rs425-Innovation-Accelerators-Report-FINAL.pdf

Ellenberg, J. (2014). *How not to be wrong: The power of mathematical thinking*. London: Penguin Publishing Group.

Fulghieri, P., & Sevilir, M. (2009). Size and focus of a venture capitalist's portfolio. *Review of Financial Studies, 22*(11), 4643–4680.

Gornall, W., & Strebulaev, I. A. (2015). The economic impact of venture capital: Evidence from public companies. Available at SSRN 2681841. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2681841

Graham, P. (2013). *YC W13 will be smaller*. Retrieved October 3, 2016, from http://old.ycombinator.com/w13smaller.html

Hallen, B. L., Bingham, C. B., & Cohen, S. L. (2014). Do accelerators accelerate? A study of venture accelerators as a path to success. *Academy of Management Annual Meeting Proceedings,* 747–752. https://doi.org/10.5465/AMBPP.2014.185

Hochberg, Y. V. (2016). Accelerating entrepreneurs and ecosystems: The seed ccelerator model. *Innovation Policy and the Economy*, *16*(1), 25–51.

Hochberg, Y. V., & Kamath, K. (2012). *US seed accelerator rankings.* Kellogg School of Management, Northwestern University. Retrieved from http://tech.co/wp-content/uploads/2012/08/Accelerator-Companion-FINAL.pdf

Kanniainen, V., & Keuschnigg, C. (2004). Start-up investment with scarce venture capital support. *Journal of Banking & Finance,28*(8), 1935–1959.

Kim, J., & Wagman, L. (2014). Portfolio size and information disclosure: An analysis of startup accelerators. *Journal of Corporate Finance*, *29*, 520–534.

Lee, S., & Bozeman, B. (2005). The impact of research collaboration on scientific productivity. *Social Studies of Science*, *35*(5), 673–702.

Miller, P., & Bound, K. (2011). *The startup factories: The rise of accelerator programmes to support new technology ventures*. Discussion paper. London: NESTA. Retrieved from http://businessincubation.com.au/wp-content/uploads/StartupFactories-Accelerators-Evaluation-NESTA-June-2011.pdf

Morrill, D. (2015, January 16). *Why is the number of seed rounds raised in 2014 down 30%? Exploring the connection between start-up funding activity and US interest rates*. Retrieved from https://mattermark.com/exploring-the-connection-between-startup-funding-activity-and-u-s-interest-rates/

Pauwels, C., Clarysse, B., Wright, M., & Van Hove, J. (2016). Understanding a new generation incubation model: The accelerator. *Technovation*, *50*, 13–24.

Radojevich-Kelley, N., & Hoffman, D. L. (2012). Analysis of accelerator companies: An exploratory case study of their programs, processes, and early results. *Small Business Institute® Journal*, *8*(2), 54–70.

Schumpeter, J. A. (1942). *Capitalism, socialism and democracy*. Montana: Kessinger Publishing, LLC.

Smith, S. W., & Hannigan, T. J. (2015). *Swinging for the fences: How do top accelerators impact the trajectories of new ventures?* Paper presented at DRUID15. Rome. Retrieved from http://druid8.sit.aau.dk/druid/acc_papers/5ntuo6s1r5dvrpf032x24x5on5lq.pdf

Starbuck, W. H. (2006). *The production of knowledge: The challenges of social science research*. Oxford: Oxford University Press.

Stross, R. (2012). The launch pad: Inside Y Combinator, Silicon Valley's most exclusive school for startups. London: Penguin UK. Retrieved from https://books.google.com.au/books?hl=en&lr=&id=231A_MFcmzkC&oi=fnd&pg=PT6&dq=startup+accelerators+y+combinator&ots=ltuTHXLSFD&sig=l4Qvn5LsvZxZScBI2OZkpqDuYYY

Yin, B., & Luo, J. (2015). *Critical Factors in the Selection of Start-up Incubator Residents.* Available at SSRN 2735465. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2735465

Liang, Y. E., & Yuan, S. D. (2016). Predicting investor funding behavior using crunchbase social network features. *Internet Research*, *26*(1), 74–100. https://doi.org/10.1108/IntR-09-2014-0231