

The Rhineland Ecosystem: Vision 2025

A study by Startup Genome
On behalf of the Ministry of Economic
Affairs, Innovation, Digitalization and
Energy of the State of North Rhine-
Westphalia



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1. Executive Summary

The ecosystem assessment and the current stage of development of Rhineland in the ecosystem Lifecycle Maturity model strongly suggests three key areas to focus on, starting now and with a time horizon of 3 – 4 years. These are as follows:

Scaleup: Accelerate top startups to large scale exits to create a pull effect across the entire ecosystem

Deep Tech: Improve the rate of university spinoffs in Deep Tech

Startup Output: Significantly increase the number of startups overall to widen the startup funnel

These priorities should be underpinned with supporting measures improving on:

Mentorship and Global Connectedness

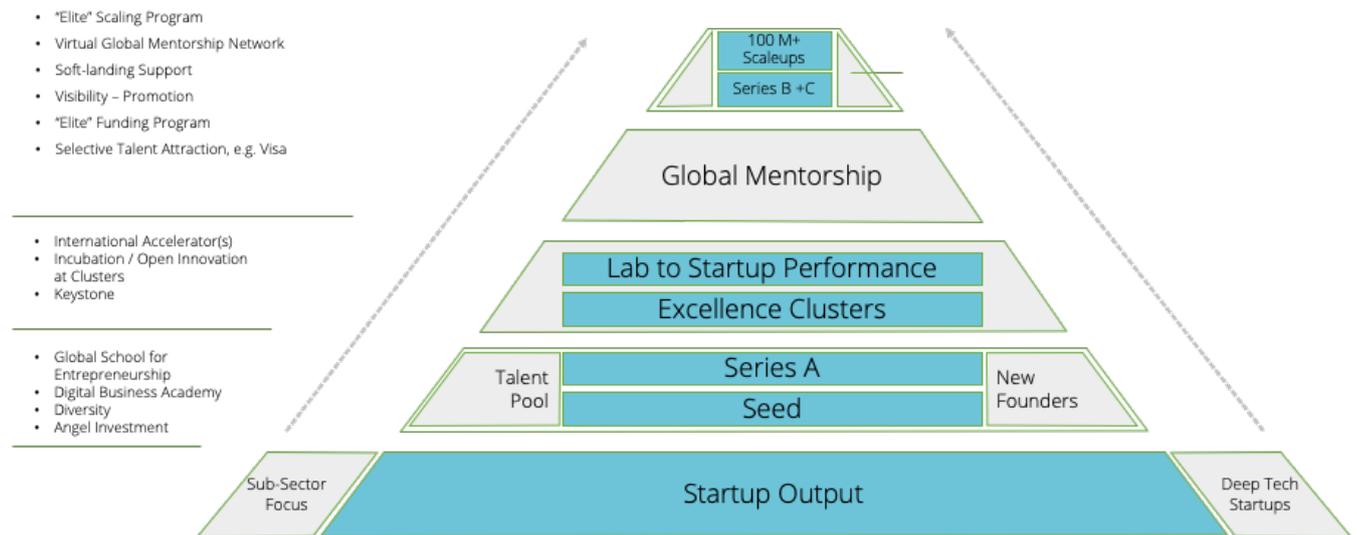
Late Stage Funding

University activation and Lab-to-Startup Performance

Activation of graduates, experienced workforce and Female Entrepreneurship

Entrepreneurial Skills Development

Seed Stage Funding and Angel Investment



Following the recommendations of Vision 2025 would position Rhineland as a **Top 30 Ecosystem globally** by 2025.



2. Methodology - Presentation and Overview

The following chapter contains a brief summary of project phase I, its results and most important recommendations for action that follow. The focus is on Rhineland, defined as the metropolitan area around Aachen, Bonn, Cologne and Düsseldorf¹.

In order to further develop and establish Rhineland as a start-up hub, the state ministry commissioned a comprehensive study consisting of two project phases. The aim of phase I was a comprehensive evaluation of the local startup ecosystem. For this purpose, data from local startup founders was collected in an online survey, which 130 founders completed. 43% of the respondents come from Düsseldorf, 28% from Aachen, 22% from Cologne and 7% from Bonn (percentages rounded).

Founders answered over 200 questions on the topics of *market reach and ambition*, *connectedness*, *startup funding*, *founder demographics*, *team* and finally *sales*. The analysis was complemented with external data sets from Pitchbook, Crunchbase and Dealroom. These provide deeper insights and historical data through standardized information on financing rounds and exits in the entire ecosystem.

The study compares results with the average of the respective Peer Group², a composite of startup ecosystems in the same phase. In addition to the aggregated average, the specific values for Copenhagen, Barcelona, Montreal and Melbourne are shown in graphs: these are ecosystems in the same phase as Rhineland. In addition, the values of Boston and Berlin are displayed, both cities that are in a further developed phase – and considered aspirational for Rhineland. The direct comparison reveals the main strengths that can be built on, as well as weaknesses in a region.

In order to complement the analysis from phase I, qualitative interviews were conducted with a variety of stakeholders within the Rhineland ecosystem. While only founders were interviewed in Phase I, qualitative discussions covered a range of stakeholders such as investors, policy makers, academia and what we call *Startup Support Organizations*: accelerators, coworking spaces and incubators.

¹ At times, the state of North Rhine-Westphalia as a whole is considered for completeness.

² The associated peer group, i.e. cities in the same development phase for which data is available, are the following: Paris, Toronto-Waterloo, Sidney, Montreal, Atlanta, Barcelona, Houston, Helsinki, Miami, Jerusalem, Vancouver, Copenhagen and Melbourne.



Due to the outbreak of the pandemic covid-19 and the resulting travel restrictions, qualitative interviews had to be conducted digitally. In March 2020, individual discussions were held with 15 actors.

The discussions yielded the following priorities:

- There is no comprehensive exchange between the cities of the Rhineland, "church tower thinking" is widespread, which all participants in the conversation regretted
- Startups are often relatively underfunded, mainly due to too small seed rounds for too few startups
- Government initiatives such as the start-up grant are important and good, but there are no funding and support programs to take companies to the next level and particularly to assist them with expanding to international markets
- Companies are locally successful, but struggle in the scaling phase - skills such as "growth hacking" or the lack of first-class, international mentors were addressed
- Lack of diversity with regard to female founders and female talent in startups

Short Snapshot of the Context of Rhineland

- Strongly populated and densely populated: 8.7 million inhabitants in the Rhineland metropolitan area, around 18 million in North Rhine-Westphalia (NRW)
- Polycentric structure with major cities Cologne, Düsseldorf, Bonn, Aachen
- Industrial agglomeration: 6 DAX companies³ (and a total of 9 within the State of NRW) and 20 of the 50 largest private companies in Germany are located in the Rhineland, in addition to 750,000 small and medium-sized companies
- Extremely high concentration of science and research: 71 universities in NRW, including 2 elite universities and 10 clusters of excellence in Rhineland

Lifecycle Analysis: Rhineland in early-Globalization phase

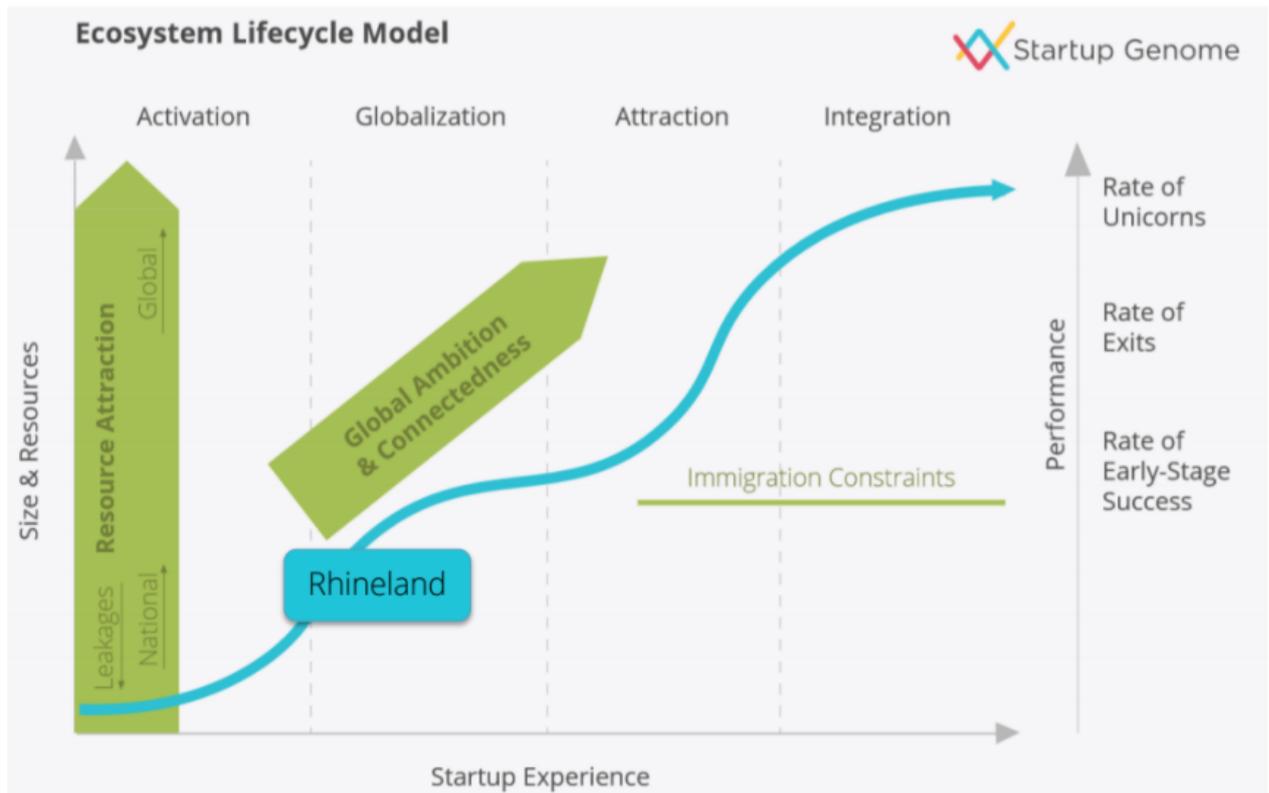
The development of startup ecosystems is a complex and diverse process. Like their analogies from ecology, they go through different stages, each with different characteristics. The "Ecosystem Lifecycle" model makes it clear how an ecosystem compares with others and which measures can be taken most effectively and effectively.

³ Deutsche Telekom, Deutsche Post, Bayer, Metro, Uniper, Ceconomy



As shown in exhibit 1 below, Startup Genome divides ecosystems into four development phases: Activation, Globalization, Attraction and Integration. Each phase has very different characteristics and impulses that enable the ecosystem to develop from one level to the next. The more startups and resources are in an ecosystem (y-axis) and the more experience (x-axis), the more advanced the ecosystem is in its development. At the same time, more mature ecosystems have a much higher rate of exits, as well as coveted unicorns: startups with value / evaluation of over \$ 1 billion.

Exhibit 1: Ecosystem Lifecycle Model⁴

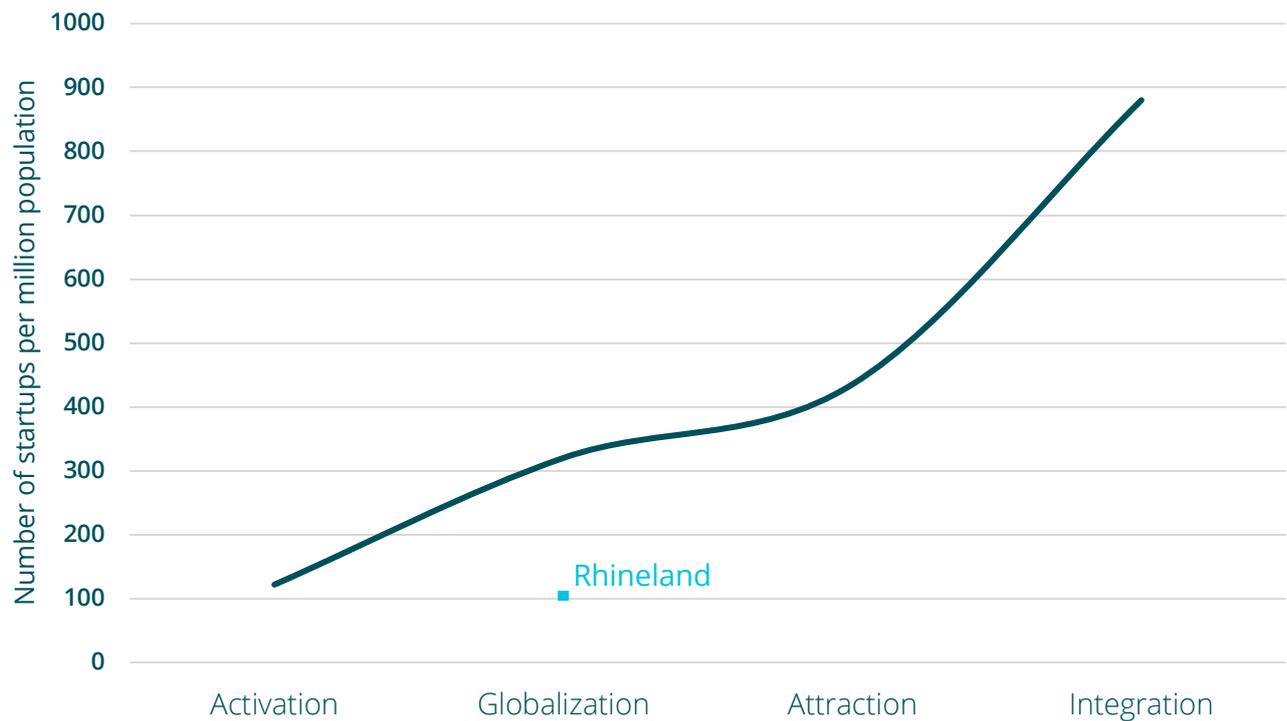


With 900 registered startups, a startup density of 103.45, which describes the number of software startups per 1 million population, and six 50M\$ + exits in the past 10 years, Rhineland is in the early Globalization phase. This phase is characterized by a still relatively small number of active start-ups. Relative to its large population, the region underperforms compared with other peers in the Globalization phase, as the next graph shows.

⁴ Unless otherwise indicated, all graphs in this report result from Startup Genome research and are proprietary to Startup Genome.



Exhibit 2: Startup Density



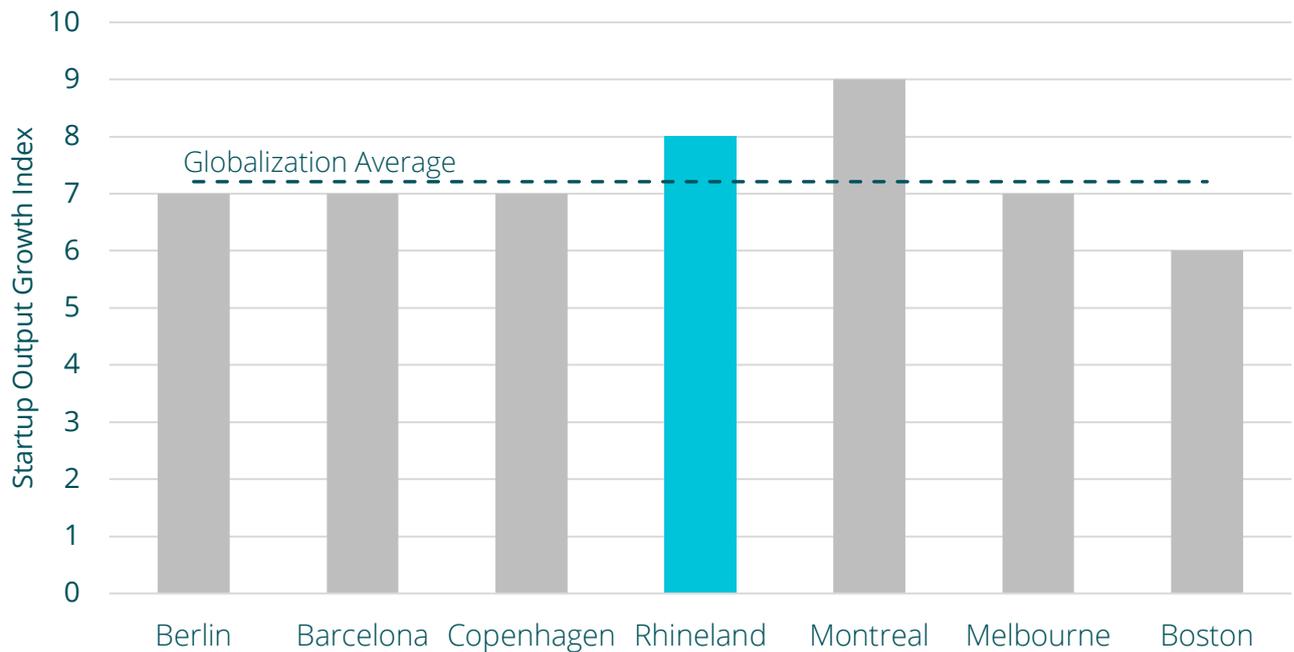
Rhineland is below the curve - there are not enough active start-ups, given the population and compared to the average of peers (shown in blue in the graphic) in the same phase.

This may partially be explained with a “drain-effect” that occurs when teams leave the region to move to the capital or abroad to further drive the growth of their companies. The Startup Monitor NRW 2019 describes that almost three quarters of Berlin’s founders completed their studies in another state, which means that they moved there in order to start a business. In contrast, only 34% of founders with a degree in NRW completed their studies in another federal state. In this phase, the main goal of the political decision-makers must not only be to keep local founders in the region, but also to convince founders from elsewhere of the attractiveness of the Rhineland region.

At the same time, the number of start-ups in Rhineland is growing relatively faster than that of the comparison group (e.g. Copenhagen and Montreal), which could be an indication that particular political initiatives at universities and support for young “Would be” founders are bearing fruit.



Exhibit 3: Rate of Startup Output Growth is higher than peers



Value creation is an exponential process

In 2008, one out of the top ten largest companies in the world was in tech. Today, it is seven out of ten. The sector went from a small part of the global value chain to the major economic powerhouse of the world. Similarly, the global startup economy continues to grow, generating \$2.8 trillion in value from 2016-2018 and growing over 20% when compared to the previous period.⁵

Despite all of the value being created globally, Rhineland is not capturing its fair share of the world's fastest growing value creation engine, neither internationally nor in direct comparison with the best of other German States. In the following, we shortly outline the theoretic concept of value creation in startup ecosystems. Then, we show 2 scenarios within a 5-year vision for Rhineland, dubbed Vision 2025, and quantify the enormous untapped opportunities of a larger ecosystem with more successful startups and scaleups.

Startup ecosystems create direct value by means of high value job creation and tax revenue. They also drive innovation, competitiveness and efficiency of the industries they operate in, thus are having much larger effects on the whole economy. In terms of job creation, for example, our data show that one job created in a startup triggers the creation of an additional four jobs in the wider economy⁶.

⁵ 2019 Global Startup Ecosystem Report, Startup Genome

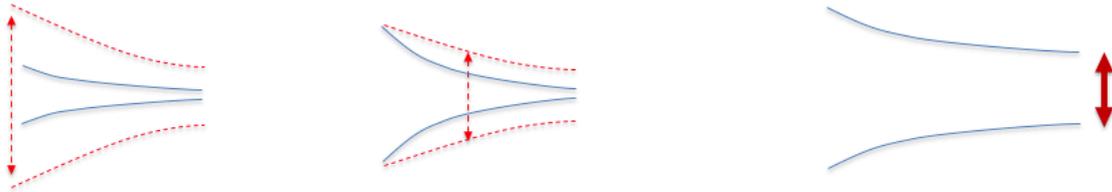
⁶ The Multiplier Effect of Innovation Jobs," MIT Sloan Management Review, Kauffman Foundation, Startup Genome analysis



Regional Enabling Factors **x** **Ecosystem Success Factors** **=** **Economic Impact**

Increase the number of startups
= Grow funnel

Increase startup success rate
= Change shape of funnel



1. Growing the funnel: We need to increase the number of startups that are being founded, thus significantly increasing the chances of success in later stages (a function of sheer numbers). More startups directly translate into more chances of success.
2. Widening the shape of the funnel: We need to improve the conditions for young startups to successfully grow and to successfully master the initial phases of their scaling journey (a function of startup quality).
3. Creating economic impact: The actions mentioned here result in a powerful ecosystem with thriving scaleups. Visible valuations and exits that can serve as role models for local ecosystem participants put the Rhineland ecosystem on the international talent and investor map and directly and indirectly trigger positive economic impact for the economy.



3. Vision 2025 - Scenarios to accelerate Rhineland

Following the theory above, our first imperative must be to further increase the number of startups (Startup Output) in Rhineland as well as tackling the low number of scaleups companies. Based on Rhineland's current phase and geographical positioning, we strongly believe there is further potential to grow Startup Output and drive scaleup creation to more significantly grow economic impact.

In order to illustrate this, we run 2 scenarios which illustrate startup output growth, effects on increasing the scaleup segment as well as additional employment and economic value created.

- Scenario 1: Rhineland increasing its startup output growth rate from current 6.29% to 10%
- Scenario 2: Rhineland increasing its startup output growth rate from current 6.29% to 15%

2020	Output	Scaleup Rate	# of Scaleups + Exits	Average jobs per scaleup	Employment Scaleups	Employment Startups	Direct Employment	Indirect Employment Generated
Current situation	900	1.11%	10	105	1,050	6230	7,280	29,120

The table above shows the status quo in Rhineland and will be discussed item by item: For a population of 8.7M, 900 startups are active in the ecosystem. With 10 scale-ups, the scale up rate is 1.11%⁷, which means that 1.11% of startups eventually succeed in achieving a valuation of \$100M or more.

On average, each of the scaleups in Rhineland employs 105 people, which means that the 10 scaleups in the region provide direct employment to 1,050 people. Data from our founders' survey in Rhineland yields that on average, a startup in the region has 6 staff on payroll, which means that 6,230 people are employed by Startups in Rhineland. Adding these numbers, we see that a total of 7,280 people is directly employed by the startup segment in Rhineland.

Using the earlier presented Kauffman Foundation's factor 4 for indirect jobs created, these startups are responsible for a total of 29,120 jobs created in the local economy.

⁷ Scaleups are defined as companies valued at 100M\$+ for the time period between 2015-19. This is calculated using 1) exit value: companies that exit at 100M\$+ or greater, 2) disclosed valuations: Startups with disclosed valuations of 100M\$+ after a funding round and 3) Estimated valuations: Valuations calculated based on the size of Series A, B, C+ rounds. The Dilutions assumed are based on global medians: Series A = 25% Dilution, Series B= 18% Dilution, Venture C onwards = 10% Dilution



2020	Ecosystem Value per Startup (\$M)	Total Ecosystem Value (\$M)
Current situation	\$3.04	\$1,433.18

Startup Genome calculates an ecosystem value for Rhineland of 1.43B\$. This reflects standardized calculations that are part of our methodology based on

- 1) exit value: companies that exit at \$100m+ or greater
- 2) disclosed valuations: Startups with disclosed valuations of \$100m+ after a funding round and
- 3) estimated valuations: Valuations calculated based on the size of Series A, B, C+ rounds. The dilutions assumed are based on global medians: Series A = 25% Dilution, Series B= 18% Dilution, Venture C onwards = 10% Dilution

While these numbers seem impressive at first sight, they are not yet sufficient for Rhineland to reach the position warranted by the strengths of its local economy and size of its metropolitan area population of 8.7 million.⁸ Hence, we outline a five-year vision for Rhineland, Vision 2025, which shows where Rhineland could be in five years if its current growth trajectory was accelerated.

2025	Output in 2020	Growth Rate	Output in 2025	Scaleup Rate by 2025 ⁹	# of Scaleups + Exits
Growth at current trajectory	900	6.3%	1,221	1.3%	16
Scenario 1: 10% Growth	900	10.0%	1,449	1.7%	25
Scenario 2: 15% Growth	900	15.0%	1,810	2.8%	51

In the first row, we calculate the number of startups and scaleups in Rhineland in 2025, applying its current growth rate of 6.29%. Without any additional policy action, Rhineland will see its startups increase from 900 in 2020 to 1,221 in 2025. Currently, there are 10 scaleups, which will increase to 16 in 2025 when continuing on the current growth trajectory.

Scenario 1 and 2 in the table show how many startups as well as scaleups Rhineland could have in 2025, when targeted interventions lead to higher growth rates such as a startup output growth rate of 10% and a proportional scaleup rate of 1.73%. If Rhineland were to adopt these rates, it would

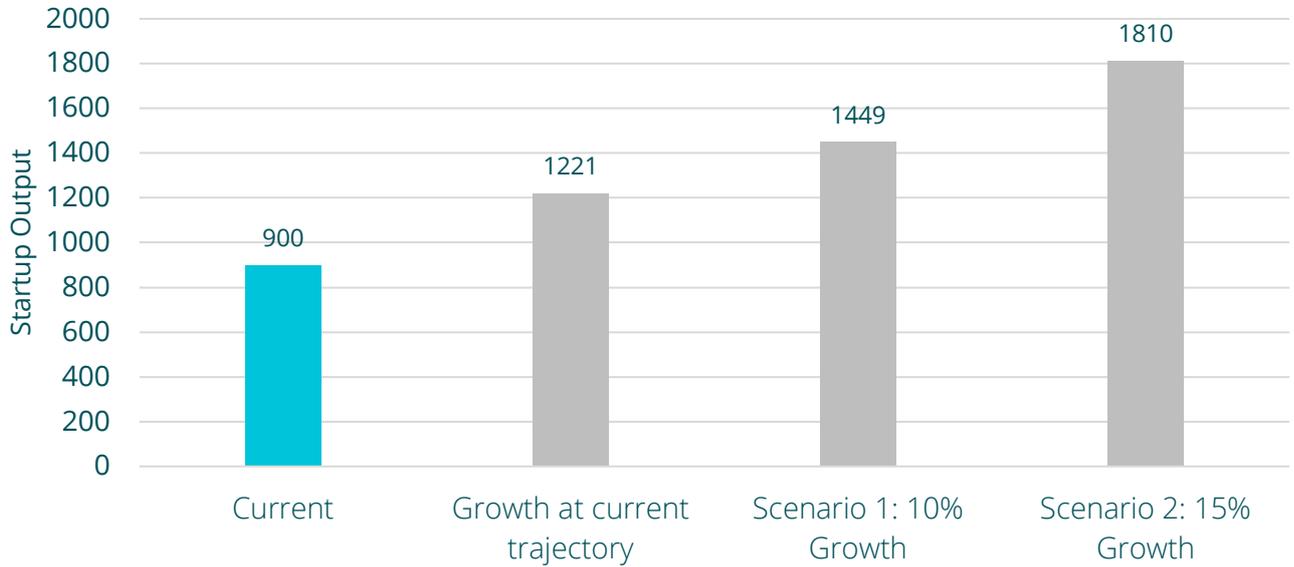
⁸ Statistisches Bundesamt / Own calculations

⁹ Please note that scaleup rates increase in line with the exponential growth function of ecosystem value. Rhineland growing at its current trajectory of 6.29% will result in the ecosystem reaching an improved rate of scaleup success without additional intervention. The same mechanisms apply to startup value and average job creation numbers



have 1,449 startups instead of 1,221 in 2025 and 25 scaleups instead of 16. In Scenario 2, this climbs to 1,810 startups by 2025 and 51 scaleups as compared to 1,221 startups and 16 scaleups.

Exhibit 5: Startup Output Potential in Rhineland



Applying these increased numbers to employment created, while accounting for a higher average number of jobs per scaleup (in scenario 2, we use 245 average jobs per scaleup, which is the average of scaleups in the Globalization phase, or the *phase average*), we see that a total of 14,346 direct employment positions, with 57,385 indirect employment. In scenario 2 this grows to the startup ecosystem directly employing 24,810 people, with indirect employment of 99,238.

2025	Average jobs per scaleup ¹⁰	Employment Scaleups	Employment Startups	Direct Employment	Indirect Employment Generated
Growth at current trajectory	105	1,680	8435	10,115	40,459
Scenario 1: 10% Growth	175	4,375	9971	14,346	57,385
Scenario 2: 15% Growth	245	12,495	12315	24,810	99,238

¹⁰ Please note that the number of startup job creation grows in line with the exponential growth function of ecosystem value. Rhineland growing at its current trajectory of 6.29% will result in the ecosystem achieving higher numbers of average startup employment even without additional intervention. The same mechanisms apply to startup value and average job creation numbers.

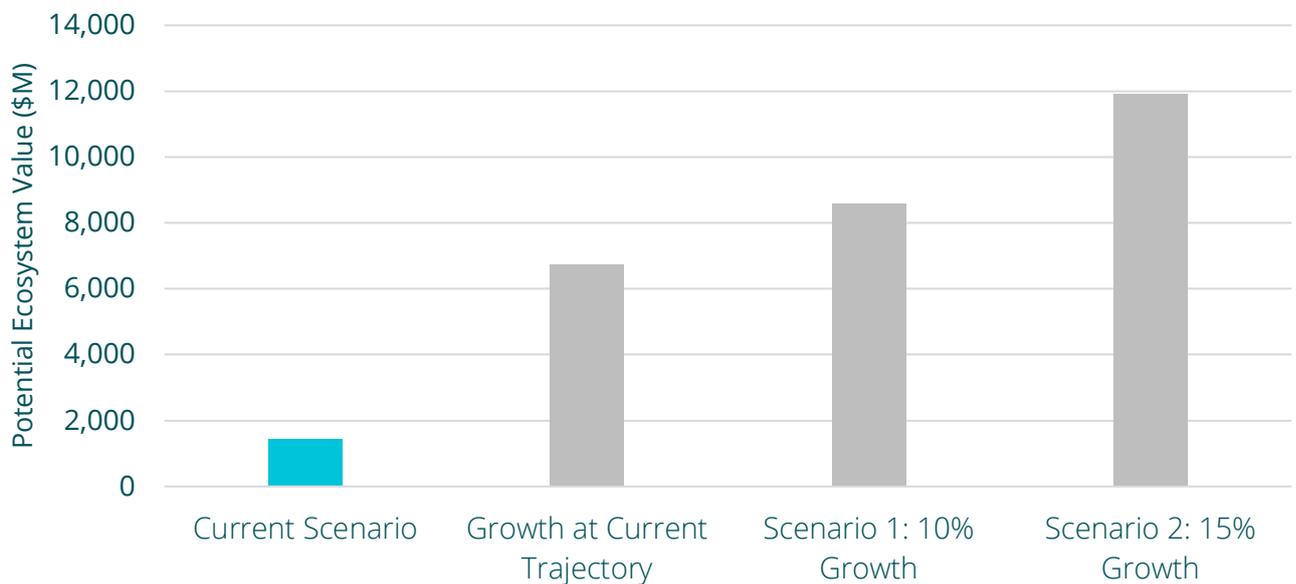


Once again checking for ecosystem value, we see that scenario 1 would yield an addition of 1.85B\$ in ecosystem value, while scenario 2 would trigger an additional 5.18 B\$ in ecosystem value.

2025	Ecosystem Value per Startup (\$M) ¹²	Total Ecosystem Value (\$M)	Gain in Ecosystem Value (\$M)
Growth at current trajectory	\$5.51	\$6,725.1	
Scenario 1: 10% Growth	\$5.92	\$8,580.8	\$1,855.7
Scenario 2: 15% Growth	\$6.58	\$11,911.3	\$5,186.2

We believe these scenarios to be ambitious but also realistic. In the preparation of this report we have run this model for all clusters globally, performing on Globalization Phase averages, as well as for Berlin to compare with a more aspirational (Integration Phase) ecosystem. The growth numbers are significantly higher and not realistically achievable within a five-year time horizon.

Exhibit 6: Potential Ecosystem Value



¹² Ecosystem Value per Startup = $[1819.54 * (\text{Startup Output})^2 + (3.29E+06) * (\text{Startup Output}) + (5.88E+08)] / \text{Startup Output}$



If we were to succeed with the outlined – and conservative – scenario of 10% annual growth, Rhineland would approach the TOP30 ecosystems globally, measured in total ecosystem value.

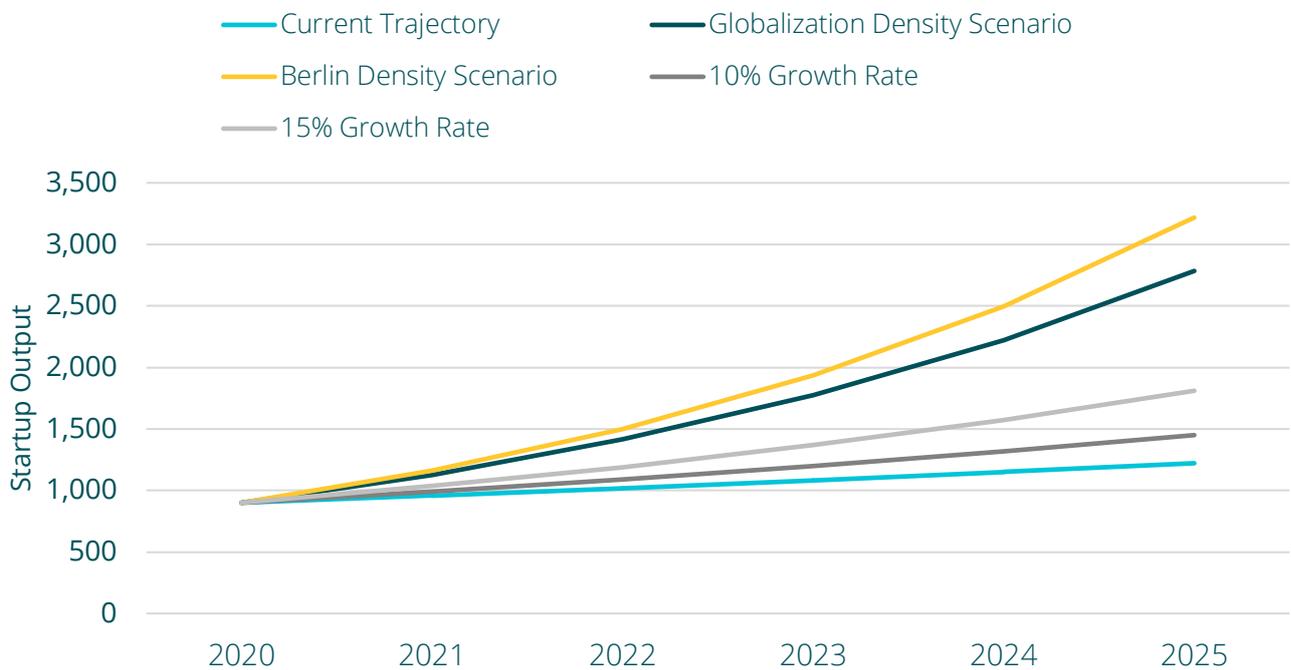
With conservative growth of 10% Rhineland would be a TOP30 Ecosystem globally by 2025.

How to get there?

When thinking through this strategy, two questions are top of mind. “Is it realistic to propose that we can accelerate the growth of a startup ecosystem to the level outlined in the scenario?” and “If yes, how do we get there?”

With the ecosystem counting 900 tech startups currently, it is growing at a rate of 6.29%, which means it will reach about 1,221 startups in 2025 if this growth rate remains unchanged. In order to grow by 10%, 15% or grow as fast as peers in the Globalization phase or even Berlin, the growth trajectory needs to be accelerated, which is shown in the graph below.

Exhibit 7: Startup Output Trajectory



The difference between 6.29% (current growth) and 10% (projected) growth rate is a net gain of around 50 startups yearly in the first four years in order to reach the target of 1,441. This number is feasible and requires targeted actions which will be described in further detail in the remainder of this report, such as:



Growing the Number of Startups (Startup Output) by **reducing unnecessary startup death by means of better funding and by more intense university engagement**: Rhineland has four large universities and a significant number of smaller universities and technical colleges. (NRW in total has 71 universities and colleges). If we were to succeed in increasing the rate of university related startup creation with these educational institutions and universities in Bonn, Cologne, Aachen and Düsseldorf each creating a net extra 10 startups per year, that would lead to an additional **40 startups p.a.** And a total of 160 in the 5-year period until 2025.

Similarly, Rhineland has 10 Excellence Clusters that are intended to **spearhead Research and Innovation in select High Tech sectors**. If we could create on average 1 new startups p.a. at each of these select Excellence Clusters, we would be adding **40 startups** in the next five years. We believe that a focus on select institutions - or select industrial subsectors and technologies - should be a key priority for Rhineland.

Increasing the Scaleup success rate and creating larger exits by greater activation of the local economy. Famous scale-ups and unicorns can inspire entrepreneurially minded people to make the jump to entrepreneurship. Famous scaleups can also increase the rate of serial entrepreneurship by re-engaging those who have succeeded or failed before. Visible scaleup success and a few high profile exits provide role models and motivation across the entire ecosystem, thus creating a “pull effect” across the entire startup ecosystem funnel.

The theoretical argument might be made for Rhineland to catch up with its peers or even with Berlin, which is in the Integration Phase. This would require increasing the startup population to more than 2,500 and 3,000 startups respectively when taking into account the large size of Rhineland. We do not believe such modelling to be realistic and indeed have not witnessed any ecosystem in our member network to show such dramatic growth rates.

Economic Spillover Effects

Scenario 1 and 2 both bring in an additional technology-based economic multiplier, not counted in our estimates presented here. Positive spillover effects results from the fact that tech companies to a significant degree export their products and services globally (selling mostly outside of their national markets) and significant proportions of venture funding from international investors (foreign direct investments).

Moreover, the existence of a significant and performing startup ecosystem elevates the performance of the whole economy. It does so by driving innovation and factor productivity and by attracting global knowledge and global talent and capital. The opposite also holds. A lack of access to a high performing startup ecosystem can be very damaging, even if a region produces top-level technology and patents. The universities in the Raleigh-Durham (USA) “Research Triangle,” for instance, have high levels of technology creation and are highly ranked, but they do not produce successful startup



entrepreneurs like UCLA, UCSD in San Diego, Cambridge, UK, and the University of Waterloo, Canada, despite being a world-leading technology center. Our recent engagement with the Municipality of Seoul further underpins this - whilst still being the leader in tech R&D and patents globally, the system is struggling in converting research in viable businesses and economic impact.

The presence of a very well-resourced startup ecosystem (with VCs, knowledge and talent) is a key asset for a region to thrive.



4. Scaling

One of the main acceleration factors for the growth of an ecosystem are impressive \$100M + exits, which shine like a lighthouse far beyond the region and thus attract resources such as capital and talent. They also represent a high motivation for potential newcomers, providing for inspirational “Heroes” to follow.

Hence, the political “exit” goal at this stage should be to produce a series of valuations and exits over \$ 100 million that position the ecosystem nationally or regionally as an outstanding place to start and scale a business, and thus start a cycle of positive reinforcement and the attraction of outside capital and knowledge.

Key Objective: By means of accelerating top startups to \$100 M exits, we seek to create the top of the ecosystem pyramid and to create a pull - or activation - effect along the entire ecosystem funnel.

Road map:

- Establish an elite scaling program

Learn from:

- Tech Nation, UK: Future Fifty
- The Lazaridis Institute, Toronto-Waterloo, Canada
- Scaleup Nation, Amsterdam, The Netherlands

Road Map:

- Build bench strength through global mentorship network

Learn From:

- GEN Accelerate

Road Map:

- Build a broader softlanding network

learn from:

- GIA Singapore

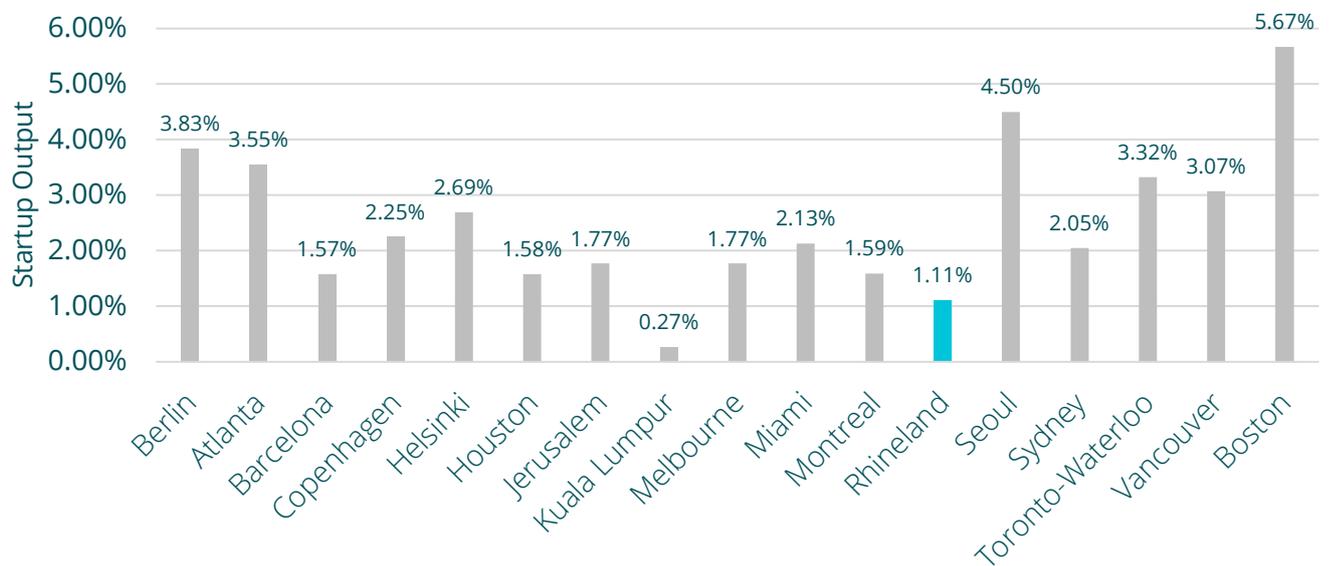


Status Quo Rhineland - Underperformance in Scaleup Creation

The Rhineland region with 1.11% Scaleup Creation significantly underperforms in regard to creating larger companies when compared to its peers in the same ecosystem lifecycle phase, e.g. to Copenhagen (2.25%), Melbourne (1.77%) and Montreal (1.59%) showing significantly higher values.

When looking at the more aspirational Integration Phase ecosystems such as Berlin or Boston, the distance to frontier is even more pronounced, with companies in Berlin standing a chance of 3.83% of and the highly mature environment in Boston delivering a staggering 5.67%.

Exhibit 8: Scaleup Creation - Globalization Phase + Integration Phase Benchmarks



The following table provides an overview of exits in the Rhineland in the tech and life science sector in the past 10 years, i.e. since 2010.¹³

Company	Amount (USD)	Year	Type	Origin City (HQ)	Sector
Trivago	\$1,000,000,000	2012	Acquisition	Cologne	AdTech
Rigontec	\$550,389,068	2017	Acquisition	Bonn	Biotech
Boxine	\$336,000,000	2019	Acquisition	Düsseldorf	Education

¹³ Data retrieved from Dealroom, PitchBook, Crunchbase, as well as the Ministry of Economic Affairs, NRW.



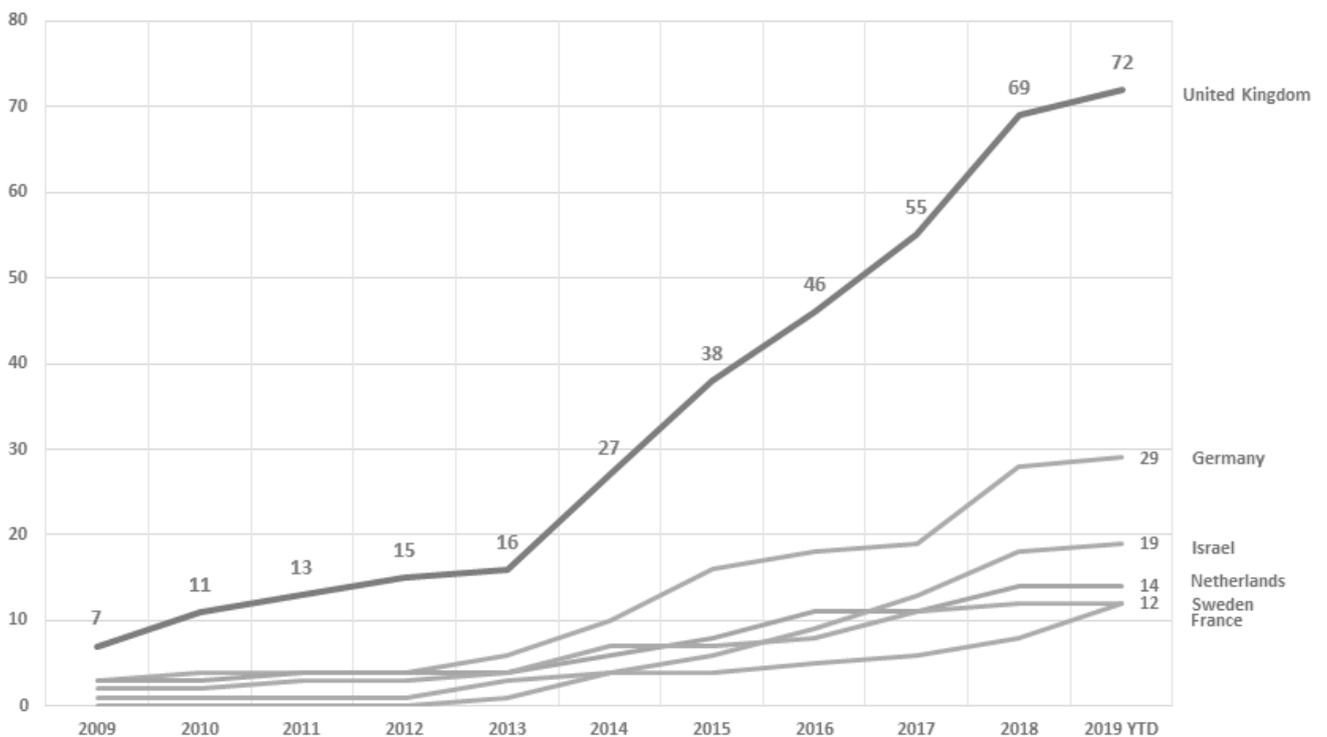
ESL Gaming	\$116,015,818	2015	Acquisition	Cologne	E-Sports
Cardionovum	\$103,870,000	2015	Acquisition	Bonn	Healthcare
Sividon	\$57,283,217	2016	Acquisition	Cologne	Life Sciences

Since 2010, there were seven local startup exits of 50M+ which were classified as tech (software) or life sciences. It's important to note that companies with exit rounds which have been formed as spin off companies are not captured, since this invalidates their startup status.

Forming a scaleup segment is difficult for almost all ecosystems outside the few globally leading cities such as SF, NYC and London.

As shown in exhibit 9, even today's number three ecosystem - London - struggled for many years to counteract the then trend of great early stage businesses to experience significant issues in their scaling journey. Many businesses then either defaulted or prematurely sold to large tech competitors, thus not realizing their full value and economic impact on the local economy. Note the strong pick up in unicorn growth, coinciding with the launch of the UK's elite growth program *Future Fifty* in 2014/15:

Exhibit 9: Cumulative number of unicorns per country¹⁴



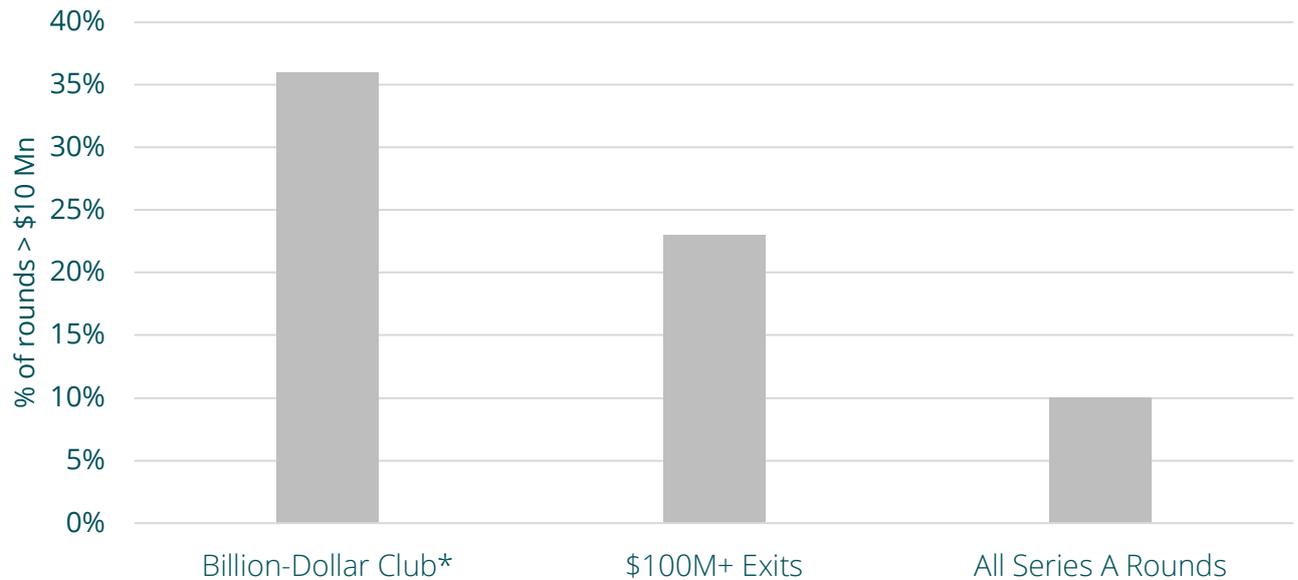
¹⁴ Dealroom.co. - Includes companies founded since 1990 and reached \$1B valuation up to May 2019



A Matter of Capital? Larger Funding Rounds seem to correlate with Scaling success

A scaleup segment may be a direct function of capital and indeed on the surface, our data in regard to large scaling rounds - that is funding above 10M US\$ per round - seems to correlate strongly with 100M\$ exits and the aspirational unicorn club.

Exhibit 10: Causal relationship between large funding rounds and scaleup production

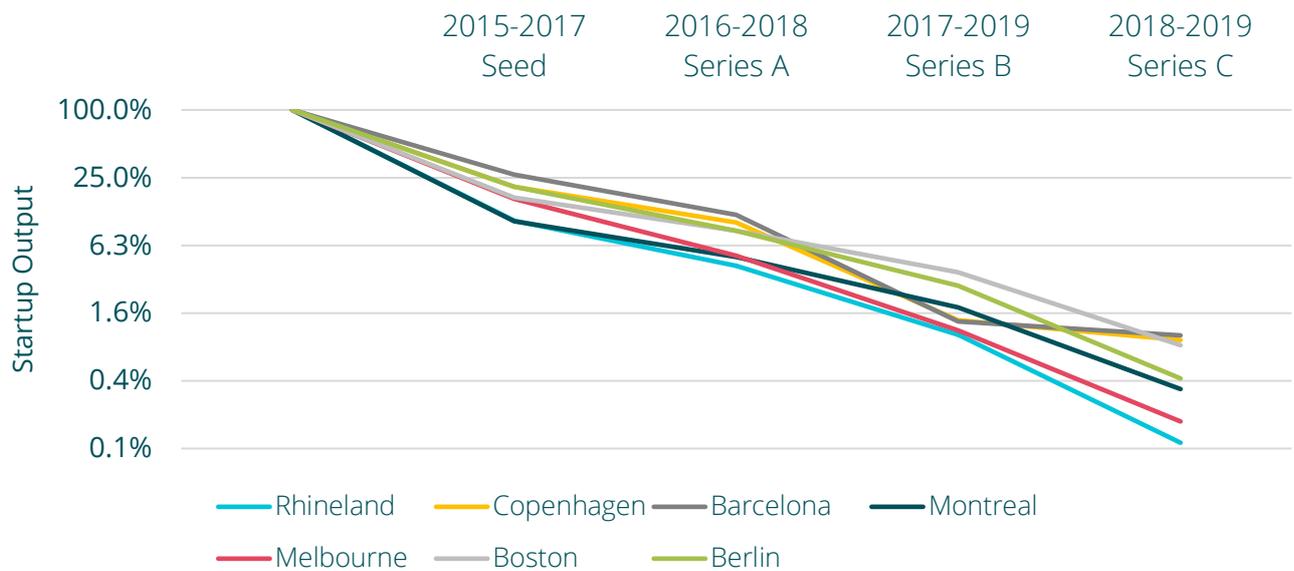


At a high-level comparison, in Rhineland, about 2.5% of all Series A rounds are large (>10M US\$) in the above-mentioned context, positioning the region amongst the phase average of Globalization ecosystems.

However, when dissecting the funding data into their individual stages, it becomes evident that Rhineland's scaleups do not attract the significant follow-on funding rounds that fuel scaleup growth in other peer ecosystems. The distance to frontier here is between 1.5 - 2x in regard to Series B funding and 8-10x in regard to Series C; the latter of which is almost non-existent in the region. Our data are supported by the qualitative interviews we have conducted, with both founders as well as VC investors being critical as to the availability of later stage capital and more significant funding rounds.



Exhibit 11: Funding round funnel with peer and aspirational benchmarks



Can we address the scaling issue in Rhineland by ramping up late stage capital?

The data on funding as well as inputs from qualitative interviews suggest that addressing the late stage funding gaps might be the silver lining solution for the ecosystem. And indeed, the famous Yozma program in Israel is an example for a public private partnership that sought to address funding issues and to this day is seen as a key enabler of the Israeli success story. Yozma not only made seed and scaling capital available, it also triggered the massive influx of private foreign VC capital, lifting the entire ecosystem dramatically.

When looking at more recent examples though, the direct correlation may not hold. Public sector interventions into the late stage VC funnel in the last decade, both in Hong Kong and in Melbourne, resulted in distorted ecosystem funnels and a generally inefficient capital allocation rather than in overall scaling success. And even in a world leading ecosystem such as Singapore with its abundance of late stage capital, unicorns remain a rare species to this day.

Furthermore, late stage capital in our experience is much less local as opposed to earlier funding rounds with late stage international VCs investing wherever a company meets its expectations for quality and investment thesis and where legal framework conditions are sound.

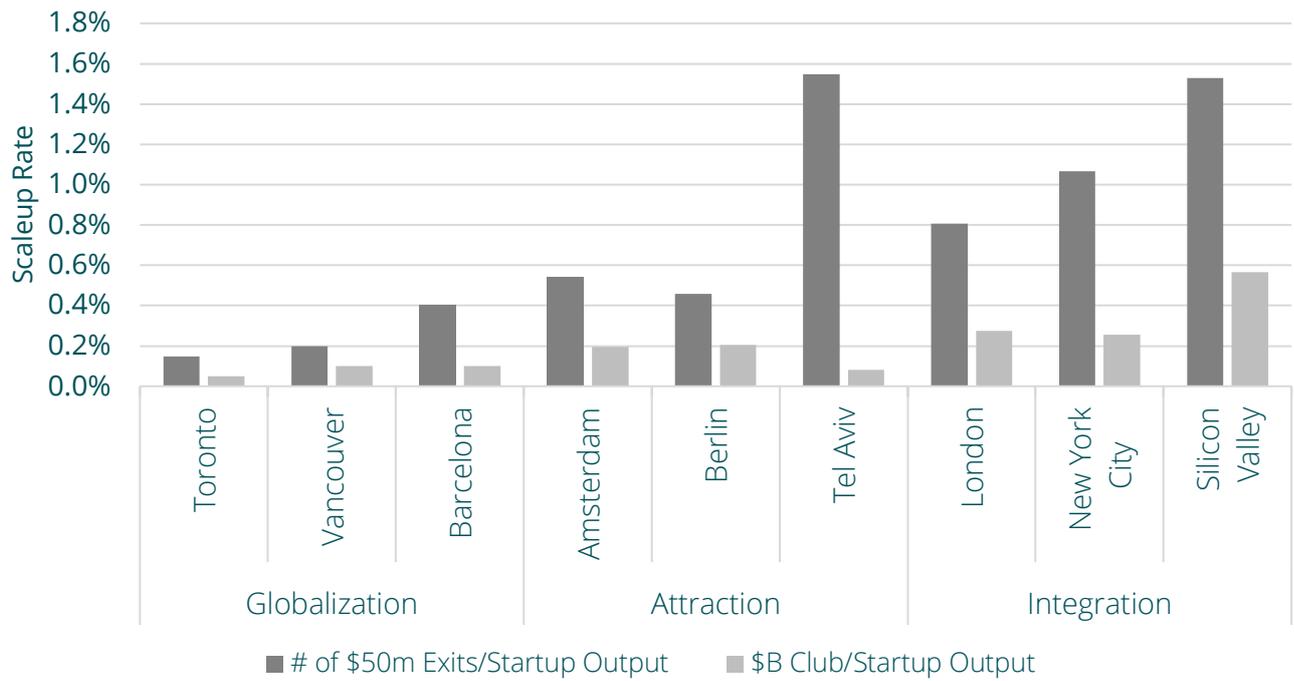
Hypothesis: If it is not the lack of capital only, Rhineland must be missing other success factors. And we have to ask the question if startups are competitive enough, deserving the larger scale investments. We believe at this stage they likely - at least in their majority - are not.



Scaling is the result of a system of success factors

Whilst we do not negate the necessity and impact of the availability of capital for a scaleup segment, data shows that larger ecosystems that combine more resources and startup experience create scaleups at significantly higher rates.

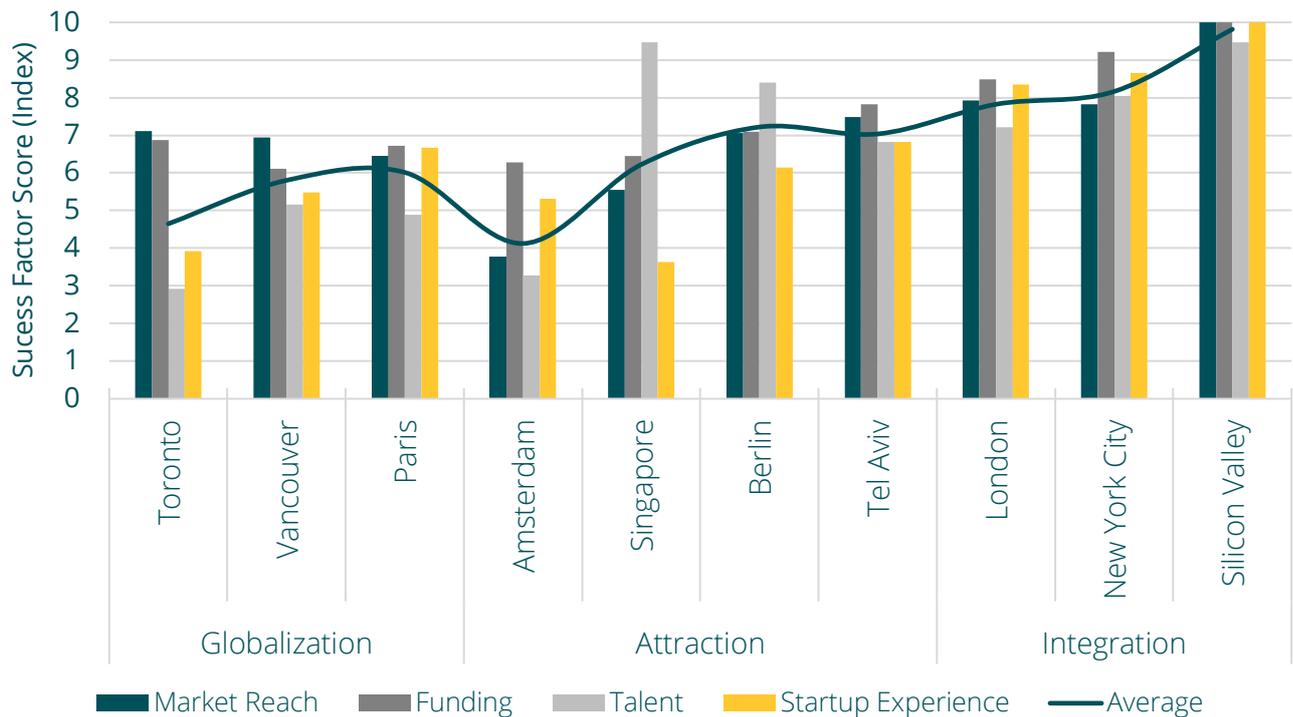
Exhibit 12: Correlation between ecosystem size and scaleup creation



When dissecting the individual success factors, it becomes clear that scaleup success is a system of factors rather than a function of capital alone, with attributes such as Global Market Reach, Access to Talent and Startup / Growth Experience being equally important factors as funding.



Exhibit 13: Scaleup Success is a system of factors



Key Success Factors outside of Funding

Founder DNA, Growth Experience, Global Connectedness and Global Market Reach are key success factors for scaling a business, e.g. with globally well-connected startups growing on average at a factor of 2.1x faster than their local peers¹⁵.

The data analysis shows that Rhineland founders are lacking in most of these scaling factors, e.g.: they are less likely to consider an international market perspective when ideating and building their products and in executing a Global Market strategy right from the start. This is somewhat understandable, given the availability of a large domestic economy locally; however, it significantly slows international expansion in later stages of the company.

The diagram below illustrates the above hypotheses with low values for founders claiming a globally competitive product and with extremely low values for addressing global markets from day one.

During our qualitative interviews we were able to confirm the data insight with many founders stating that they find their first customers locally, develop to their requirements and neither see the need nor have the resource to develop with an international horizon at their earlier stage of development.

¹⁵ Startup Genome, GSER 2019



Exhibit 14: Founders claiming globally leading products

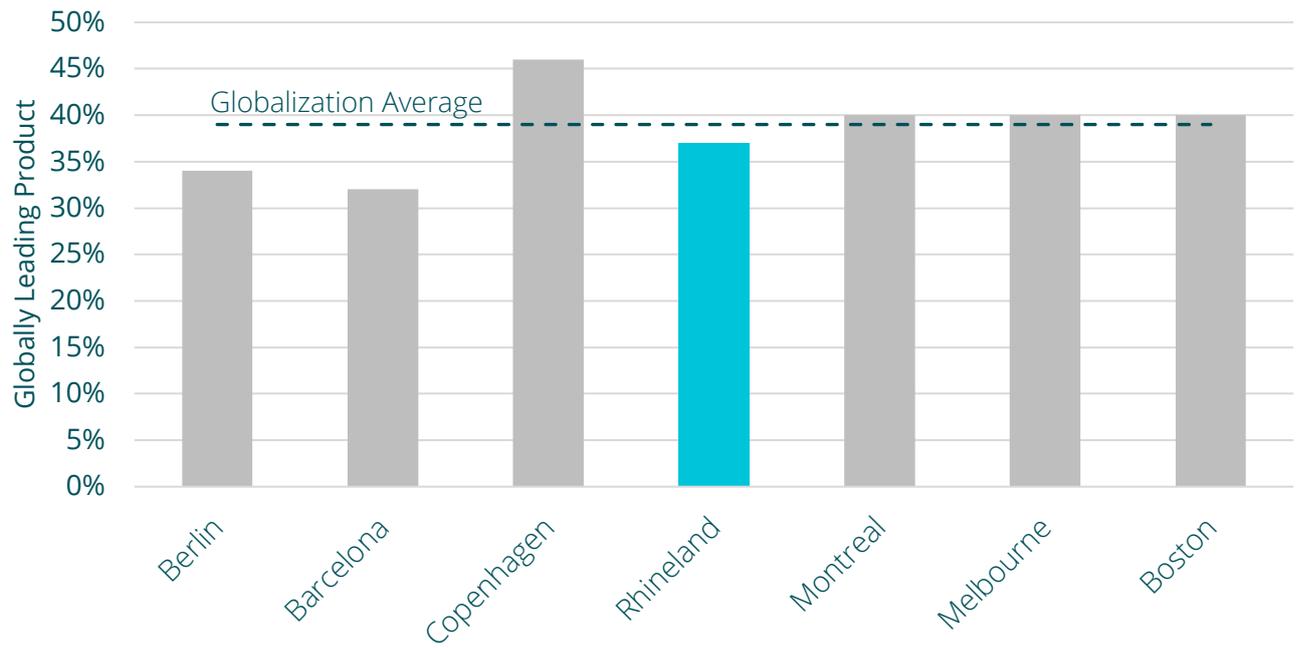


Exhibit 15: Startups Attacking global market immediately

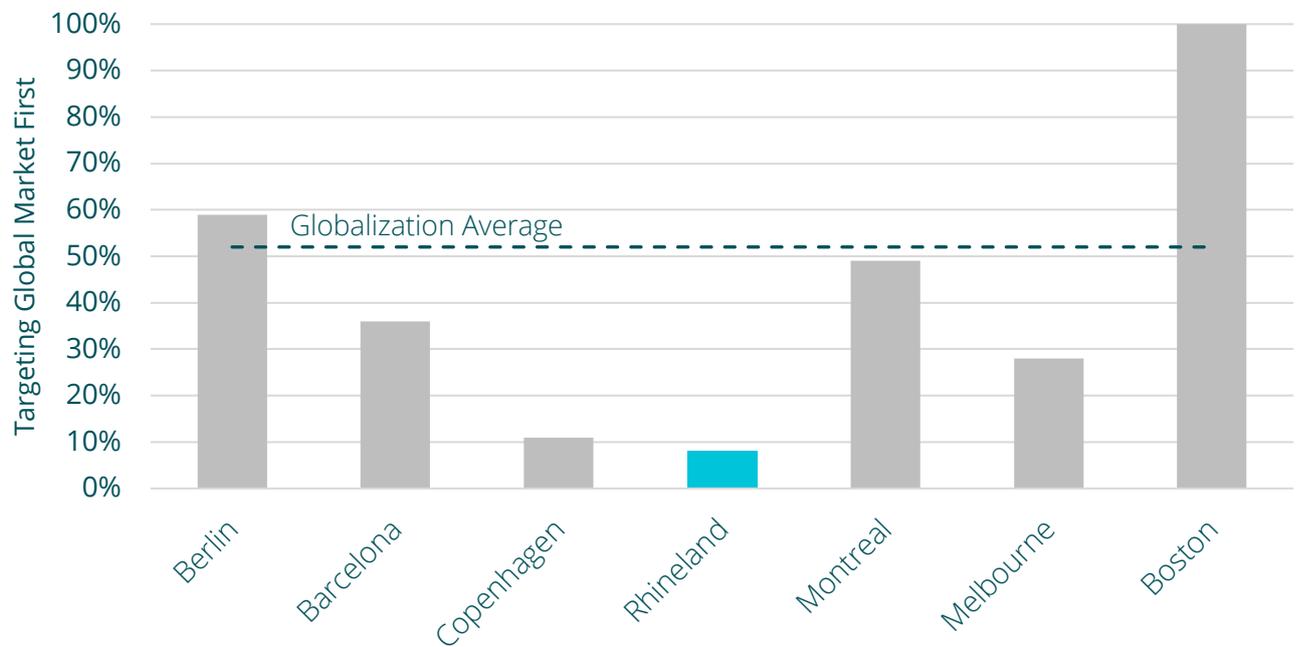
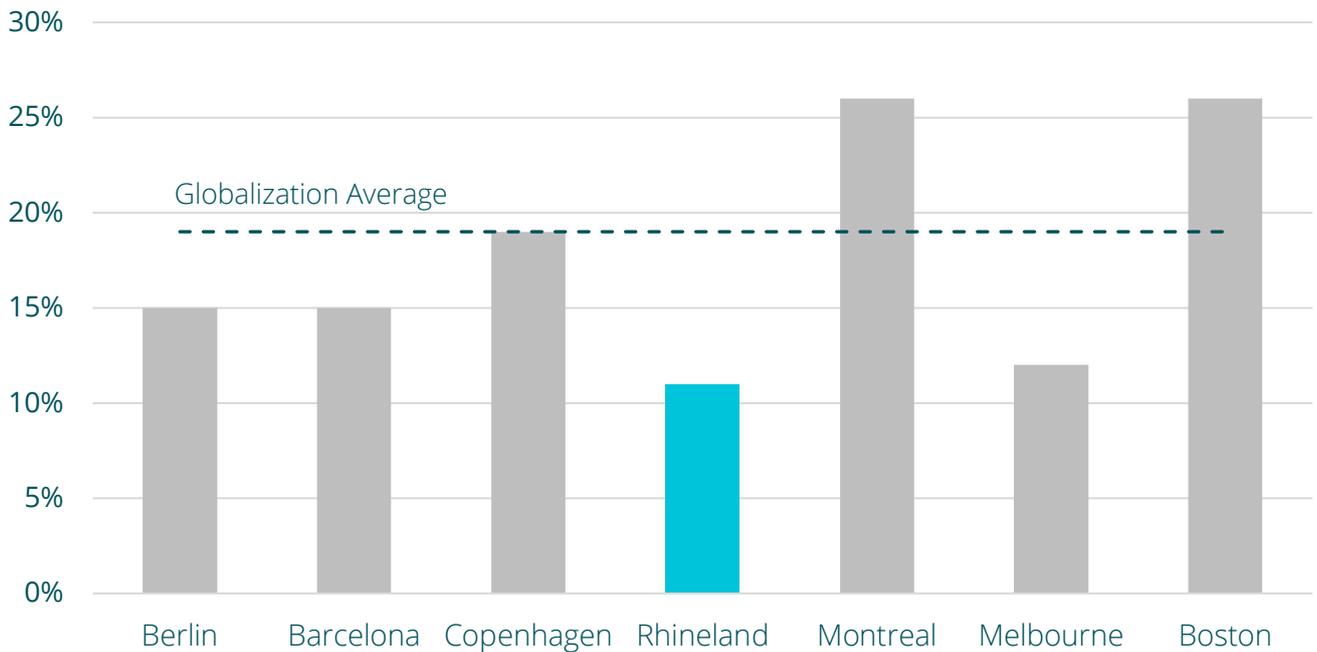




Exhibit 16: Founders with high ambition



The founders ambition and mindset - their DNA - then is reflected in the way they connect, market and sell their products on an international stage with our data again showing low values for the Global Connectedness of founders and their Global Market Reach, the latter indicating in far they are successful in addressing markets outside their domestic environment. Both factors are surprisingly low among local founders: The data shows that the strategy of founders aims to build mostly solid, down-to-earth companies. The aggressive "Unicorn mentality" from San Francisco, Berlin or even Copenhagen is missing. To mention the exception from the norm: Beijing based companies show similar characteristics; however, they scale and show exceptional valuations leveraging the gigantic size of their domestic market; something that is unique to the Chinese market and not replicable, neither in Rhineland nor in other German ecosystems.



Exhibit 17: Global connectedness

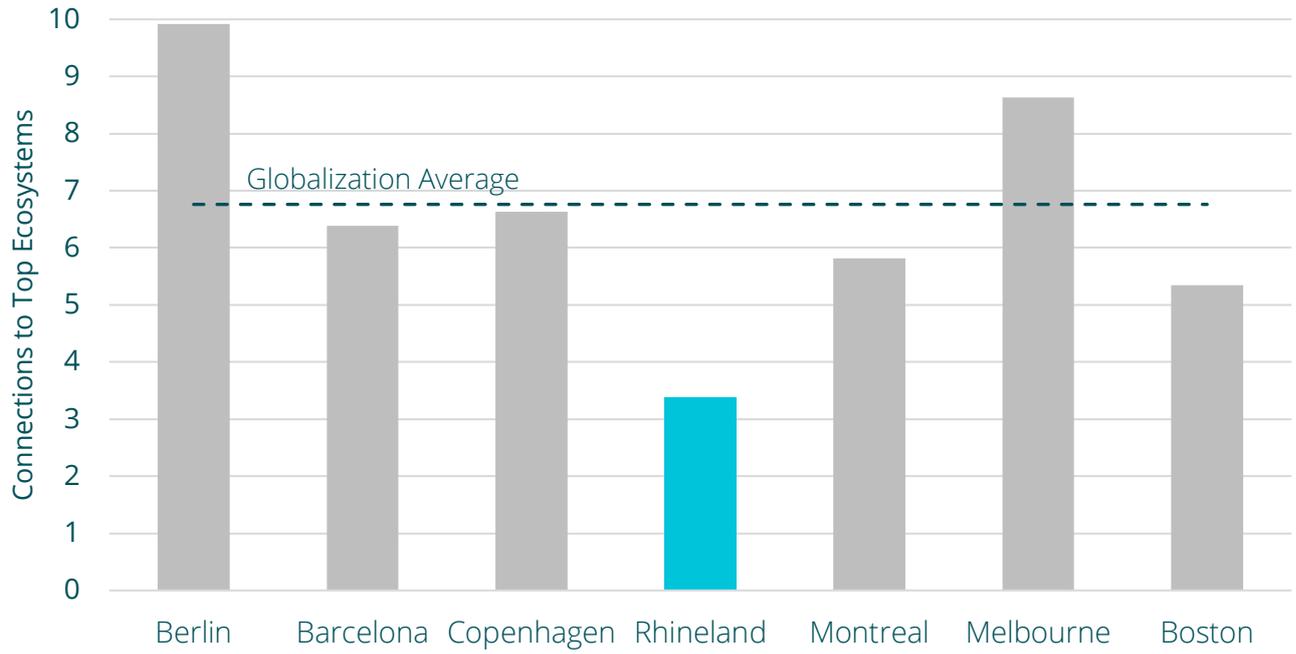
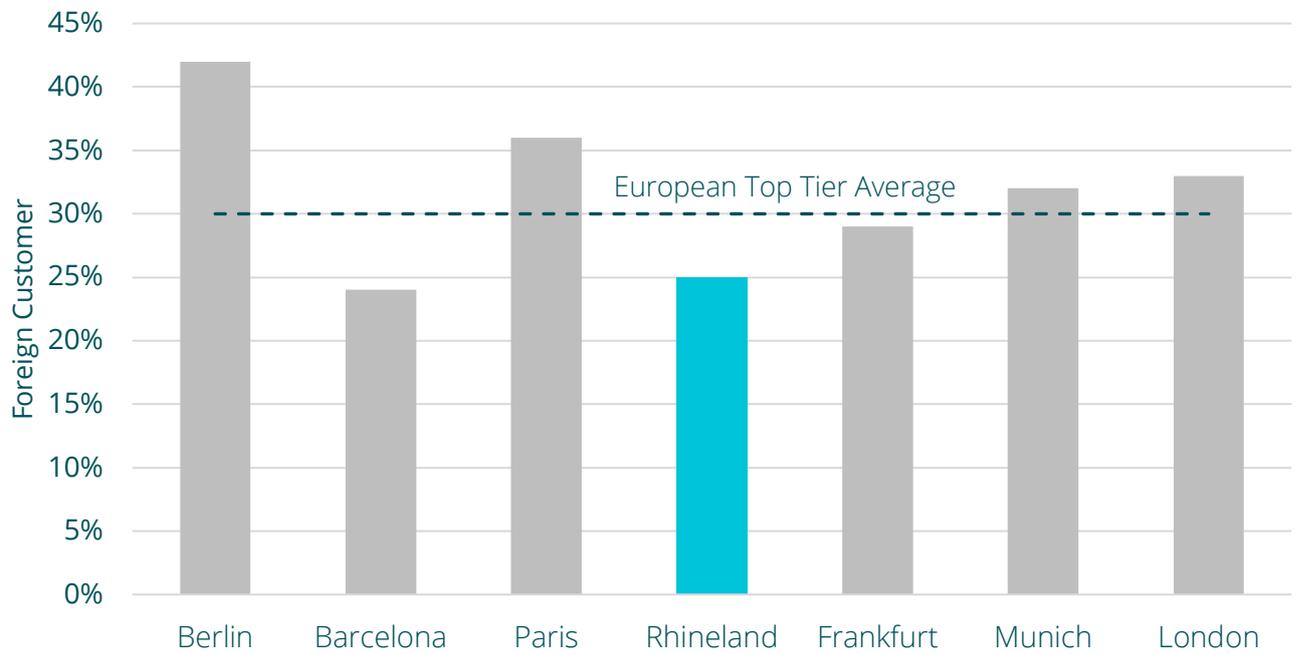


Exhibit 18: Global market reach

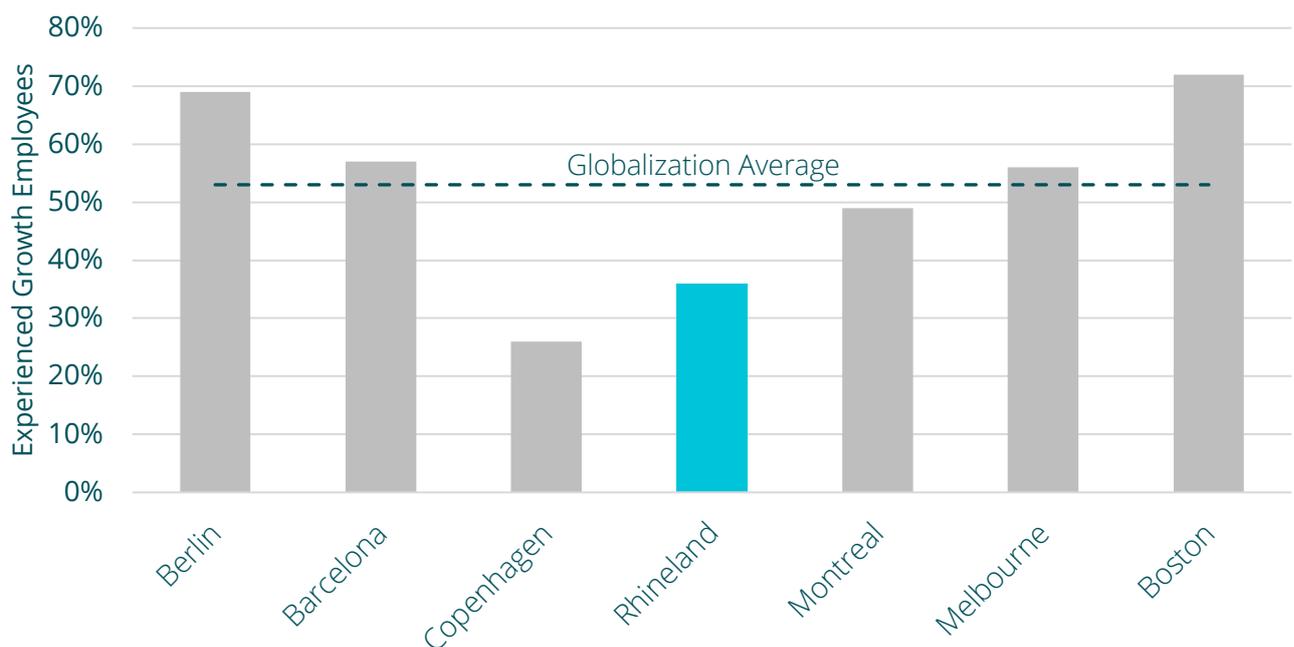




Hypergrowth Experience and Talent

A lack of experienced growth talent likely is contributing to the above-mentioned factors. This could stem from the fact that Rhineland is tech powered by technical innovators and is amplified by a talent gap of experienced management talent that already has gone through the phases of start-and scaleup growth, one or multiple times. Founder mindset and a key talent gap combine in Rhineland, likely significantly impacting its ability to produce more successful scaleup companies.

Exhibit 19: Availability of experienced growth talent



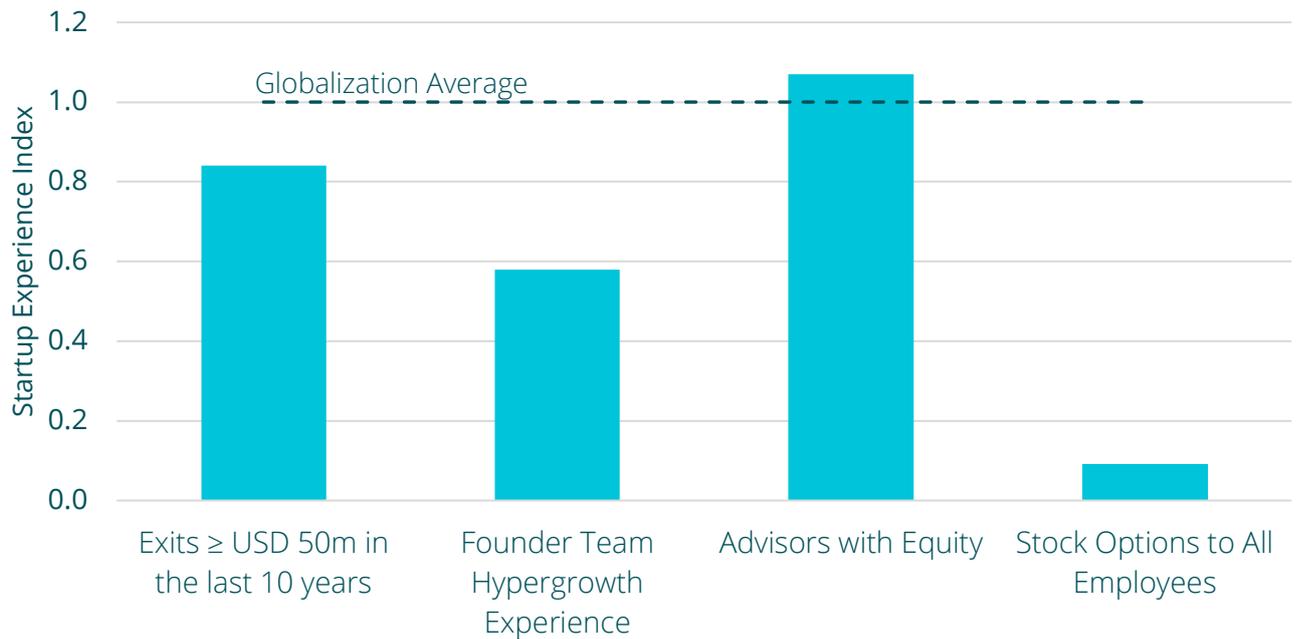
Rhineland has a strong presence of small and medium sized companies and industry. As solid and well-paying employers, they compete with startups for talent. This can be seen in the following graph, which shows that startups in Rhineland score below average in the “Access to Engineering Talent” category. Given the strong presence of universities in the respective field, we assume that this fact is due to corporates positioning themselves as more attractive employers than startups.

Startups in top ecosystems such as Silicon Valley have been able to attract top talent by using stock options as cheap “wage replacement”. Hereby, they compensate potentially lower salaries with the promise of a massive upside should the company succeed.

However, as we can see below, offering a slice of the pie in form of Employee Stock Option Plans or short ESOPS is almost non-existent in the region.



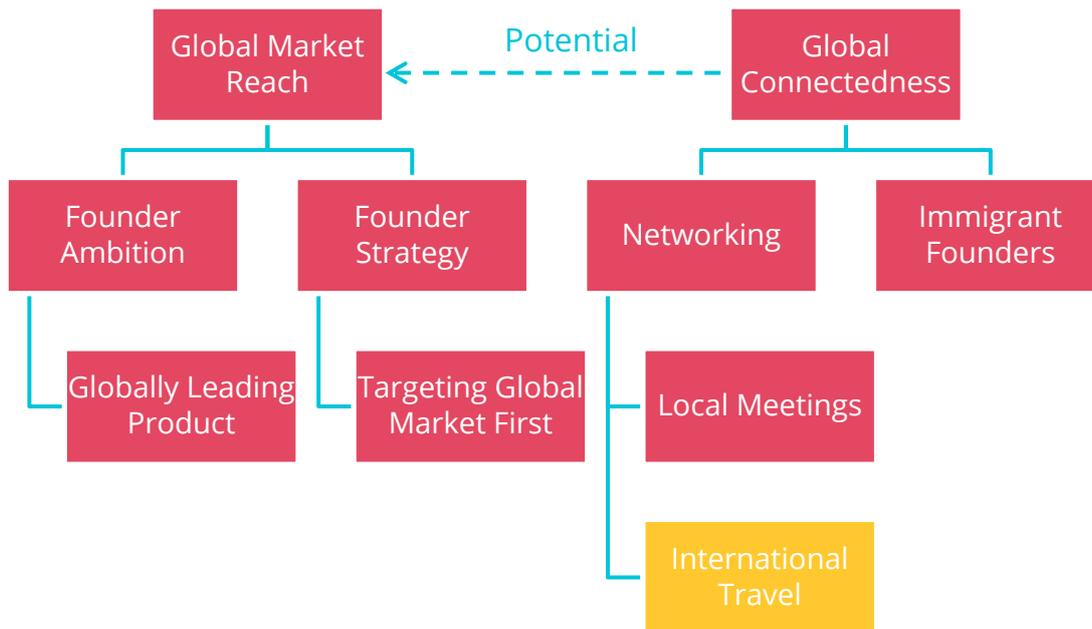
Exhibit 20: Employee Stock Option Plans are almost inexistent



This is due to regulatory hurdles in Germany, which make ESOPS an unattractive tool for highly mobile and sought-after talent. The Federal Association of German Startups is currently working on a large-scale study to illustrate the advantages of ESOPs. They plan to submit the study to German Minister for Economic Affairs and Energy Peter Altmaier before summer 2020 to change regulatory conditions, with the objective of creating an internationally competitive startup environment in Germany- an initiative we support.

4.1 Need for an Elite Scaling Program

Summarizing the above we believe that Rhineland entrepreneurs need assistance in addressing success factors gaps outside of funding if they are to significantly improve on their scaling outcomes. The following slide summarizes the key success factor gaps along the Startup Genome ecosystem success factor model that we believe need addressing.



Rhineland should invest in a scaling program first, with a laser focus on few and highly select startup companies that show true scaling potential. Such a program would seek to create a steadier and more predictable stream of larger valuations and exits. It would address the success factors gaps outside of funding as follows:

Knowledge: Addressing very specific scaling needs and knowledge gaps, for founders and their management teams. These differ considerably from the broader but more basic learning needs in earlier stage companies as founders are confronted with the specific challenges of high growth and of transitioning to a larger company with the need for structure, processes and governance.

Culture: Amplifying the ambition and the desire of founders to stretch ambition and mindset.

Investment: Creating a visible brand that signals high growth potential and high-quality investment opportunities to international investors (and top growth and technical talent as well).

Beyond silos: Sourcing qualified candidates from all cities in Rhineland (or NRW) to achieve quantity and to allow for selection quality and doing so by collaborating closely with existing SSOPs in the cities.

Peers: Small cohorts and their alumni create close and highly connected groups of peer learning and scaling community, amplifying each other's experiences, relationships and success factors.

Focus areas: Ideally the elite program would be differentiated to other international scaling programs, providing a stronger proposition for both mentors and investors. The strong B2B and Deep Tech focus of Rhineland should be reflected in the program selection.

Soft-Landing: Utilization of existing or new soft-landing arrangements with a select number of international markets.



How large should an elite program be?

Our data suggests that in Rhineland 1.11% of all startups transition to scaleups in a five-year time frame, resulting in 10 scaleups or on average two per year. Scenarios 1 and 2 in this study showed that Rhineland might record 16 or even 25 scale ups as part of Vision 2025.

We suggest an elite program cohort size between 5 and 13 companies depending on the scenario chosen (assumption that companies remain with the program for a duration of two years). The below table illustrates program sizing under the 2 scenarios:

Exhibit 21: Elite program sizing and funding requirements under scenario conditions

	Output in 2025	Scaleup rate	Number of scaleups after 5 years	Scaleup production p.a. (4 years till 2025)	Cohort Size per 2 years
Rhineland at current growth rate of 6.29%	900	1.11%	10	2	5
Scenario 1: Rhineland at 10% growth rate	1221	1.30%	16	4	8
Scenario 2: Rhineland at 15% growth rate	1449	1.73%	25	6	13

In the following we introduce a number of programs that have proven to be effective in addressing the scaling gap in their respective ecosystems.

UK: Tech Nation Scaling programs

The United Kingdom has been hugely successful when it comes to creating scale-ups, driving the country's tech advantage. To date, 35% of Europe's tech unicorns (1B\$ valued businesses) have been created in the UK.

Tech Nation is a government backed UK network for entrepreneurs that operates nationwide and seeks to backfill gaps in the ecosystem where private market solutions have failed to emerge.

Since 2015, the organization operates two major scaling programs, Upscale (Mid-Stage) and Future Fifty (late stage), cultivating a steady pipeline of next generation leaders and unicorns.



Prestigious alumni include heavyweights Monzo, Starling Bank, Darktrace, Deliveroo, and Skyscanner. Particularly interesting is the fact that companies regularly return to mentor new cohorts, sharing unique knowledge and world class mentorship, since they likely have undergone similar struggles. The success of the program's alumni attests to the effectiveness of the UK in championing leading tech companies. For example, Upscale alumni challenger bank Monzo has graduated from the program and is now a Future Fifty company, giving back by mentoring others in the cohort. Its success story is phenomenal - it has seen a 2,301% increase in total funding and a 2,122% increase in staff.

Exhibit 22: Late stage vs mid stage funding



Both programs have been conceived as sector agnostic, reflective of the small numbers of companies that reach the ambitious growth criteria. Only recently and on the back of the extraordinary growth of the UK tech ecosystem were extensions introduced for very select sub sectors and somewhat earlier stage companies that today show critical mass, namely FinTech, Cyber and AI.



Example: Tech Nation's Future Fifty

Objective: To accelerate the growth of a highly select group of growth stage digital UK startups, aiming for an exit within a 24 months period (IPO or M&A).

Short description: Future Fifty is a mid to late stage growth program, which unites the UK's most successful tech companies in building a powerful network of highly experienced entrepreneurs. Its key characteristics include:

- Knowledge Transfer: Cohort based groups of founders interact with serial entrepreneurs that have successfully built one or more businesses, transferring unique insights and knowledge. This mentorship component forms the backbone of the program's success. Additional technical topics complement the curriculum, e.g. in regard to specific legal or regulatory challenges.
- Specific topics: International Expansion, Finance and Public Markets, Regulatory, HR
- Peer2Peer learning: The program convenes founders on a regular basis for them to share their challenges and experiences amongst their own peer group. This mechanism is replicated for key management functions, e.g. with CTO, CFO, HR Directors and CMO groups.
- Length: The program spans 24 months, reflective of the time most high growth companies require to get IPO or M&A ready.
- Alumni: Tech Nation facilitates a vibrant Alumni network, again providing the connection between current cohort participants and those "who have done it before".
- Promotion and Brand: Program participants receive significant media opportunities. The program itself has been positioned as a brand that speaks for unique quality to late stage investors all over the globe.
- Talent: The program connects directly with Tech Nation Visa, a scheme that allows the organization to recommend and fast-track foreign talent for TIER-1 VISA.

Selection criteria: Tech Nation facilitates an annual selection process and respective selection jury. The jury consists of serial entrepreneurs and VC partners only. Applicants need to have raised Series B+, generating £5m+, and be growing at a rate of approx. 50% year-on-year.

KPIs:

- Size: 25 companies annually, cohort size 50
- Mentorship: Access to approx. 100 mentors (serial entrepreneurs)
- Population: 127 companies since its launch in 2014
- Funding: 8B GBP in combined funding received
- Exits: 9 IPOs, 30 M&A exits



Toronto Waterloo - with its Lazaridis Institute - offers another globally leading practice for effective scaling programs. Selection criteria are similarly elite as in the London programs; however, there is a much stronger focus on technology companies and Deep Tech solutions. What both programs clearly have in common is a large bench of highly experienced entrepreneurs that act as program mentors.

Example: The Lazaridis Institute, Toronto-Waterloo, Canada

Objective: The Institute combines scholarly research, real-world market analysis, and industry best practices to identify obstacles to global competitiveness and optimize the management of high-growth technology companies.

Short description: The Lazaridis ScaleUp Program helps high-potential, fast-growing Canadian tech companies scale and compete internationally by providing the expert support they need to achieve global success.

The ScaleUp Program includes a series of expert-led, multi-day workshops on Leadership, People Management, Product, Finance, Global Growth and Sales & Marketing. The workshops are accompanied by 12 months of personalized, one-on-one expert mentoring, including Scaling professionals from Adobe, Apple, Eventbrite, Facebook, IBM, LinkedIn, Nest, Salesforce, Shopify, SurveyMonkey, Twitter and Yelp. There is no cost or equity required to participate for selected companies.

Selection criteria: 2 - 20 M in annual revenue, >50% year-on-year growth, funded for fast growth and the potential to become a global category leader. The program is highly selective and admits on average 5% of its applicants.

More than 50 companies have scaled at Lazaridis since its inception in 2015.

The Netherlands offer another best practice example with a special focus on the combination of Social and Economic impact. It also provides an example for a scaling program that is selective in regard to industrial subsectors.



Example: Scaleup Nation, Amsterdam, The Netherlands

Objective: Large societal challenges are equally large entrepreneurial opportunities. But to move the needle in terms of impact, enterprises must scale. ScaleUpNation supports entrepreneurs in mastering the art of scaling.

Short description: With its Runway and Flight programs, Scaleup Nation provides a comprehensive curriculum of Scaleup Skill development in compressed workshop sessions. An additional Board program caters to the increased demand for experienced board members (NEDs) resulting from a growing scaleup segment.

Different to other programs, Scaleup Nation focuses on for-profit but impact scaleups. The current portfolio is reflective of this strategy, addressing 11 of the UN's Sustainable Development Goals. In this regard the addition of an AgTech and New Food program complements the strategic focus.

Selection criteria: are less quantified than in other programs; however, focused on both, social impact as well as economic potential, including characteristics such as significant financial runway and at minimum 15 - 100 full time staff.

KPIs: More than 125 scaleup founders have participated since the program's inception, all with a sector focus in AgTech, Health, Smart Cities or the Circular Economy.

4.1.1 Mentorship - Building Bench Strength

The success of the UK programs relies on their ability to draw upon a larger community of the most experienced serial entrepreneurs in Europe whilst Lazaridis is tapping the best and brightest entrepreneurs and growth executives in North America to deliver its masterclasses. This has not always been the case and in Britain, in its beginnings, program directors had to backfill mentorship by reaching out to the British diaspora and friends, particularly in Silicon Valley. Similarly, in Rhineland we currently don't have the bench strength locally and for similar mechanisms to work effectively we ought to find alternative solutions outside of the region.

A global mentorship network with a strong reliance on effective virtual mentorship could fill the gap - at least temporarily and until local capacity develops - by drawing upon the very best of German entrepreneurs as well as top mentorship talent in the larger global ecosystem hubs.



Mentorship Program - Key Characteristics

Size	10 mentors at minimum, ideally up to 20 to backfill potential gaps or attrition
Type	Serial entrepreneurs with international scaling expertise
Delivery	Strong focus on virtual experiences to allow for global networking
Mentor Attraction	B2B - Deep Tech focus of the cohorts
Mentor compensation	Small equity, e.g. 0.5% to sustain engagement with the program, provided by all cohort participants (pooled equity)

Example: GEN Accelerate

Objective: Training entrepreneurs and enabling entrepreneurship support organizations through a plug-and-play curriculum, virtual platform and structured mentorship.

Short description: GEN Accelerate accelerates the growth of entrepreneurs as they start or scale a company. GEN Accelerates combines a virtual platform with plug-and-play curriculum, structured mentorship and a global network of mentors. For international cohort participants, a virtual platform facilitates the delivery and uptake of a structured curriculum, the guided development of strategic action plans and peer-to-peer learning – so that they are empowered to support today and tomorrow’s entrepreneurs wherever they reside.

GEN Accelerate is part of the Global Entrepreneurship Network (GEN), a non-for-profit organization that operates a platform of projects and programs in 170 countries aimed at making it easier for anyone, anywhere to start and scale a business.

Gen Accelerate offers key modules and processes to provide and facilitate the envisaged Virtual Mentorship Network. Its technical platform and learning content further structures and supports the execution of an elite program. GEN Accelerate would need customization for a Rhineland elite program.



4.1.2 Soft Landing

Most leading ecosystems support the international expansion of their scaleup companies with “soft landing” initiatives, ranging from high level government collaboration agreements to city partnerships to entire teams deployed to support incoming entrepreneurs.

Germany with German Accelerator already offers soft landing support in Silicon Valley and more recently in Singapore. La French Tech operates teams across 22 tech clusters globally, and the British government has introduced entrepreneurship experts as part of their Department for International Trade missions in over 40 countries, facilitating outbound scaleup development as well as attracting inbound startups and investors to the UK ecosystem. Enterprise Singapore’s Global Innovation Alliance (GIA) has established fully-fledged soft-landing programs in 14 countries, most recently adding Chinese cities and London to the network. Keystone teams., e.g. STING in Stockholm and Maria in Helsinki, similarly assist scaleup founders in exploring and connecting with international markets.

All of these programs go beyond the traditional approach of short trade missions or expo participation. They aim at building long term relationships with regional industry and government partners and connect with the local ecosystem, investor scene and even regulators.

We encourage the use of German Accelerator as well as tapping into relationship networks, e.g. in collaboration with AHKs. In addition, we encourage to further build out an international Rhineland (or NRW) network abroad.

Example: GIA Singapore

GIA offers soft landing support for high tech and IP rich scaleup companies from abroad. The program does not intend to entirely relocate scaleups (“stealing”) but rather to convince their management that Singapore is their best choice to scale across the South East Asia Region. Unique to the program is a harsh selection process that only qualifies the very best; combined with the promise of connecting scaleups directly to government and private projects, enabling revenue generation from “day 1”. We believe this model to be an attractive blueprint for discussions with other governments or large municipalities as it goes way beyond traditional trade support or even soft-landing programs.



Building a broader Softlanding network

We enclose a few locations below which are close members of the Startup Genome network and might be open to explore conditions for a Rhineland Softlanding provision.

NYC EDC - New York, USA

TUS Park - Beijing, Shanghai, Nanjing and 27 additional Chinese cities

ITRI Taiwan - Taipei

MDEC Malaysia - Kuala Lumpur

Seoul and Busan Municipalities - South Korea

AB Startups Brazil - Sao Paulo

ADGM - Abu Dhabi

4.2 Attracting Late Stage Capital

4.2.1 The Value of an Elite Brand

The above-mentioned programs with their rigorous selection criteria and state of the art programs have quickly developed into brands in their own rights that signal the quality of their cohort portfolios. Particularly the British programs have worked proactively on this positioning, e.g. by means of intensive PR activity and by showcasing their top companies in international investor conferences and high-profile trade missions. If Rhineland were to adopt an elite scaling program a distinct brand proposition needs developing:

Highly selective and professional, signaling investment quality

Focused on what Rhineland does best: B2B and particularly Deep Tech

Credibility: Including a number of internationally renowned entrepreneurs/mentors.

Internationally visible: targeting international investors in major tech centers, incl. London, NYC, SV and potentially Shanghai, Hong Kong, Singapore and the U.A.E/GCC region.

Scaling up investment rounds

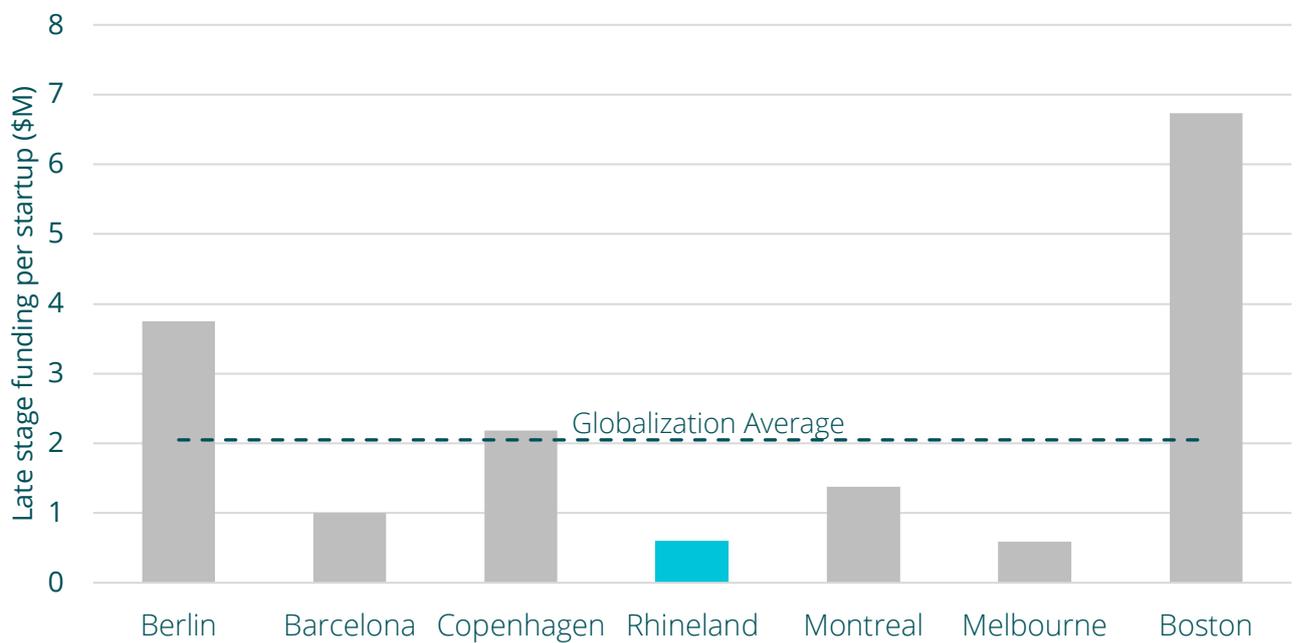
Rhineland's late stage funding rounds remain rare and on average they remain smaller than with its peer groups:



When analyzing Series B+ funding rounds over the last five years, Rhineland companies receive on average **599.3k US\$**. At Globalization Phase average their competitors in other geographies receive **2.05M\$**, 3.7 M US\$ in Berlin and 6.7 M US\$ in Boston¹⁶.

To put these numbers into perspective - and adjusted for salary differences -, a Rhineland late stage funding round would support 4.7 engineers for a period of 2.5 years whilst Globalization Average would allow hiring 13.7 experienced staff. Companies in Berlin or Boston could increase their teams by 23 and 27 staff respectively.

Exhibit 23: Late stage funding per startup¹⁷



A new approach may be necessary to - temporarily - increase the flow of late stage capital.

Vision 2025 Late Stage Funding Scenario

Following our ambitions with the Rhineland 2025 scenarios, late stage funding needs to significantly increase. Below, we explore the need for additional capital until 2025 in regard to our two scenarios:

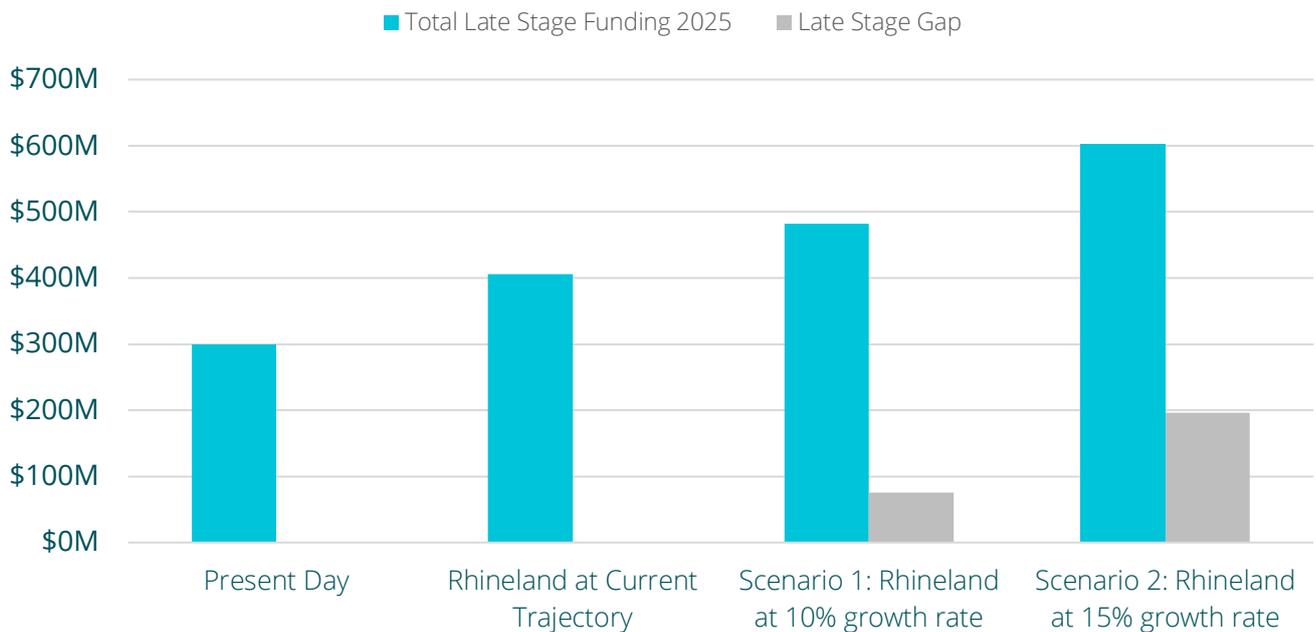
- Scenario 1: Rhineland at 10% 76M\$
- Scenario 2: Rhineland at 15% 196M\$

¹⁶ Please note that funding volumes understate individual rounds as we approximate these numbers based on the total number of startups relative to the total of Series B+ capital deployed. However, the relative gaps evidenced here hold true.

¹⁷ Rounds B and further for 60 months from H2, 2014 to H1, 2019.



Exhibit 24: Total late stage capital required & late stage funding gap for Rhineland (2020 - 2025)



The current activities of VC investors in Rhineland likely will close the funding gap for our most conservative scenario, not the least supported by the upward trend in German VC overall and - importantly - the change in investment patterns towards fewer but larger deal rounds¹⁸. Changing the trajectory though requires a significant influx of new late stage VC capital. With the measures in regard to Scaleup population and quality discussed before we can assume an increase in foreign VC attraction; however, attraction alone likely will not suffice to sustain the significant increase required. Additional intervention is needed, not the least by activating more large-scale traditional investors such as Insurance, Reinsurance and Private Pension Funds to participate.

Key characteristics

Size: 75M\$ to 200M\$ total late stage required

Co-investor or Backstop: Investing with private late stage VCs (GPs)

LPs: Open to and actively encouraging private LPs to join, e.g. Pension Funds, Life Insurers and large Family Offices / HNWIs, both national and foreign

Minimum invest: Eligible for rounds in excess of 10 M\$

Regional "Strings": In Rhineland (or even in elite scaleup program only)

Ratios: Range of 1:4 to 1:1; to be determined

Interest: Capped to provide upside for investors

¹⁸ EY Press Release, 10 January 2019 Berlin



Possible mechanism

Fund of Fund: The government establishes a new or - better - invests into an existing Fund of Fund, (e.g. KfW Capital) that co-invests with VCs (passive investor, acting as an LP). The EIF - ERP and MDD I (and II) in principle are such mechanisms; however, we are under the impression that these instruments target Seed and Series A rather than later stage Series B+ investment. An NRW investment into a fund of funds would need to come with strings attached, e.g. the restriction to invest in Rhineland only or even to use funds only for investments related to our envisaged scaling elite program.

Government guarantees: Large traditional investors (LPs) remain a minority in tech VC, likely resulting from both, a conservative investment culture as well as legal restrictions in regard to risk exposure. Taking this into account, we could envisage a state guarantee for investments made into NRW startups (or the scaleup elite program only) as follows:

- VC selection: Establish a list of validated late stage VCs investing in (with interest in) NRW
- LP selection: Activate LPs (Insurance, Pensions, etc.) to consider a co-investment. Ask LPs to commit a defined sum of investment
- Guarantee: Government or its agency to issue a generic contract that provides a full nominal guarantee on a predetermined amount of investments made.
- Investment Horizon: long term, i.e. 6 - 8 years
- Interest on Principal: modest to leave upside with VC and Institutional Investor, e.g. comparable to the Rate of Return of a government bond.
- Resolution: After the investment period, institutional investors will either
 - exercise their option against the government in case of a loss
 - return the principle plus interest to the government

Taking a lesson from the by now historic example of the Israeli Yozma program, a government intervention with a Fund of Fund may prove a game changer and may well complete other funding programs currently in place jointly with KWF, EIF and NRW Bank.



Example: Yozma, Israel

Objective: Backfilling funding gaps by leveraging public money to attract private investment - and ultimately to change the overly strong dependency of the Israeli tech sector on public funding.

Short description: Between 1993 and 1998, the government offered to provide 40% of the money offered by private investors in combined funds, supporting more than 40 companies. Yozma's approach - bringing foreign investors to Israel by fronting money in a joint fund - led to more than 30 foreign-based venture capital firms setting themselves up in Israel.

The Yozma program was based primarily on developing funds that **combined public and private money** and using these to invest in Israeli startups. Under its central model, the government initiative would provide up to 40% of capital raised by outside investors. This would be bought out at the same value with interest after a maximum of seven years.

In its first three years the Israeli government invested \$100 million in Yozma, establishing ten public/private funds of around \$20 million each. In the years it was running, the financial leverage of YOZMA increased from \$100 million in 1993 to \$250 million by 1996.

The government sold the majority of its investment in Yozma in 1998, having judged the investment sector to be robust enough to run independently. The Yozma group has invested in more than 40 companies, many of which have been made public on the American and European stock exchanges and is widely regarded as one of the few examples of successful government intervention in the VC market.

Conclusion on Scaling

Summing up the above, we can envisage a scaling program for the very best companies sourced from all over the region - approx. 10 p.a. - to receive support with the clearly stated intention of reaching a 100M US\$ valuation or exist within a condensed - 24 months - time period.



Key elements required are

Regional approach: Sourcing the very best from all over the region with Digihubs and other SSOPs feeding the top program

Peer2Peer: Mentorship and Peer2Peer learning principles

Global: Engaging global mentors, virtual or hybrid

Visibility: Strong PR support to put Rhineland on the international map

Funding: Solution that amplifies existing private VC for large Series A, B and C.

Funding in COVID-19 times

The COVID-19 crisis is affecting startup ecosystems and their investors all over the world and with dramatic impact. Recent studies of Startup Genome and others report on significant uncertainty, layoffs, the contraction of follow-on investments and a massive dry up of new funding.

The German Federal Government has implemented a significant capital injection of about 2B EUR into the sector in order to preserve the startup ecosystem and the long-time investments, which national and state governments have been making into the segment.

The world's largest ecosystems, their leaders and politicians are adamant about the need to preserve the results of many years of investment and diligent work, currently put at most substantial risk of evaporating. However, implementation concepts vary significantly as most recently discussed in the Startup Genome webinar on COVID-19 funding policy. Detailed insights have been shared with the NRW Ministry and are available for download [here](#).

A new model has emerged at the Israeli Government since that deserves particular attention as it puts into context government and private investment, the economic value of preserving startup structure and employment and other externalities such as effects on Social Services and Healthcare to name but a few. We describe its key assumptions and mechanics below, provide a simplified example and encourage the NRW government to further explore the implementation mechanisms; in order to maximize an NRW or Federal capital injection into the Rhineland ecosystem.

Key Assumptions

The valuation of startups as a portfolio overall has decreased, due to missing funding rounds, expected longer time to market and inferior negotiation positions for founders.

Foreign investors are likely to freeze their investments abroad or even to entirely pull-out, opening opportunities for local investors to participate in top deals.

Some technologies, e.g. in Healthcare, Logistics, Online Education and others may not be as strongly affected by the crisis, thus are likely currently undervalued.

Alternative traditional; investments are not offering any good prospects as of now.



Private Investors are much more risk averse than a government fund. Co-investments led by existing private investors negate the risk of excessive risk taking.

A government has an entirely different Return on Investment as compared to a Private Investor as it factors in economic externalities irrelevant to a private Angel or VC.

Hypothesis: If the government were to have an investment account, it would create a Rate of Return (ROR) of an order of magnitude higher than what is achievable for any private investor.

Additional Considerations

Public budgets are overstretched, requiring the government to leverage any available \$ to the maximum.

Private investors need reassurance that the liquidity crunch is not going to be as significant as they currently anticipate, thus negating the need for their portfolio firms to aggressively lay off staff. This is time critical.

It is not unreasonable to assume that a government support package would need to provide about 50% of all investment for 2020 to reassure private investors.

This is likely going to exceed the public budget, requiring the government to induce other investors to participate.

4.2.2 Creative Financial instruments - a Hypothetical Scenario

Capital needed: 100M\$ government investment in the equity of the entire tech ecosystem for 5 years

Index: This can (like an index) be split into two parts: the downside risk and a 5-year option on the index. If the index value declines over the next 5 years, the government bears the entire risk and the option expires out of the money. If the index value increases, then the option kicks in.

Leveraging private money: Instead of investing itself, the government would like to imitate the investment process, relying entirely on private investment from institutional investors. This involves providing a full downside protection (taking the same risk on the government) and charging for it from the option payout when it is exercised. There is no high risk to private investors as the principal is guaranteed. Instead they are only asked to forgo the interest on a government 5-year bond and in return to receive a large option on the tech ecosystem. This should ease a positive decision of any investment committee.

Implementing the mechanism:

The government or its implementation agency issues a generic contract that says that every institutional investor satisfying certain conditions can request a full nominal guarantee on a predetermined amount of investments made in the tech ecosystem.



The investor and its investment committee decide on the total investment amount they are about to make and authorize its professionals to directly invest (speed of process)

The declared amount cannot be reduced, otherwise there is a reduction in guarantee, but can be increased.

All new investments under the guarantee must be pari passu with previous investments to avoid Cherry Picking and in the interest of speed.

To practically implement the mechanism the government can

- Become an LP in existing funds
- Create a new co-investment fund with reputable Angels and VCs, investing in all their deals for the next 1 - 1.5 years

Defining the sample model:

Tech Company needs a new investment today:	X
Payment on the investment in 12 months' time:	kX ($k > 1$)
(assuming that it is a quality startup that under normal circumstances would attract Angel or VC capital)	
Government investment into the company:	cX
(c being a share of the total investment that is invested alongside the private investor)	
Private investment into the company:	$(1-c)X$

The investment is spent on retaining people for a period of time

Government avoiding losses in income tax, social & health contrib.	30%
Government savings on avoiding unemployment benefits	Z

For $CX < 0.3X + Z$ the government is **making money** across the ecosystem portfolio instead of being a net investor (implying an infinite ROR).

For $CX > 0.3X + Z$, the government becomes a **net investor** into the ecosystem portfolio with an investment of $(C - 0.3)X - Z$. If the government treats the investment like regular stock and sells in one year's time, its rate of return is $ROR = kCX / ((C - 0.3)X - Z) - 1$.

Example calculation (for one company only)

Investment need to avoid illiquidity / closure:	1M\$
Private Investors max investment appetite:	50% ($C=0.5$)
Yield expectation for the next round:	20% ($k=1.2$)
Staff	10
Avoidance of loss of income tax, social insurance, etc.	30%
Savings on unemployment insurance	150k
Government rate of return: $1.2 * 0.5 / (500 - (1,000 * 0.3) - 0.15) - 1 =$	1,100%
Investor rate of return (k)	20%



5. Deep Tech Clusters to improve on Startup Output

Under the leadership of Minister Pinkwart, North Rhine-Westphalia has declared start-up funding a policy focus. The Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia has launched a number of initiatives, some of which are briefly outlined below.

Since 2018, 1,000 founders have been supported annually by the NRW start-up grant with 1,000 euros a month to ease the risky initial phase. The development of a start-up portal with information about local startups has just been commissioned to the Aachen startup Innoloft.

Digital Innovation Hubs or digihubs are initiatives by Digitale Wirtschaft NRW (DWNRW), an initiative of the State Ministry, and offer resources such as office space, capital, advice and networking opportunities. The 12 hubs, four of them in Rhineland, were founded in September 2016 and also provide a platform to offer established companies access to startups.

Furthermore, Rhineland is an excellent location for science - within the nationwide excellence initiative, NRW has been more successful than most German areas. In addition to the two elite universities University of Bonn and RWTH Aachen, 10 clusters of excellence are currently funded with three to ten million euros each for seven years.

Excellence clusters are interdisciplinary research projects at universities that receive their own funding and in which scientists from various disciplines and institutions work together on a research project.

The following universities were successful:

RWTH Aachen

Rheinische Friedrich-Wilhelms-Universität Bonn

Universität zu Köln

Rheinische Friedrich-Wilhelms-Universität Bonn / Universität zu Köln

Heinrich-Heine-Universität Düsseldorf / Universität zu Köln

RWTH Aachen / Rheinische Friedrich-Wilhelms-Universität Bonn / Universität zu Köln

In the following we outline how Rhineland can create more startups by activating university spin-offs, thereby focusing on the ecosystem's distinctive characteristic as an R&D and economic powerhouse.



Road map:

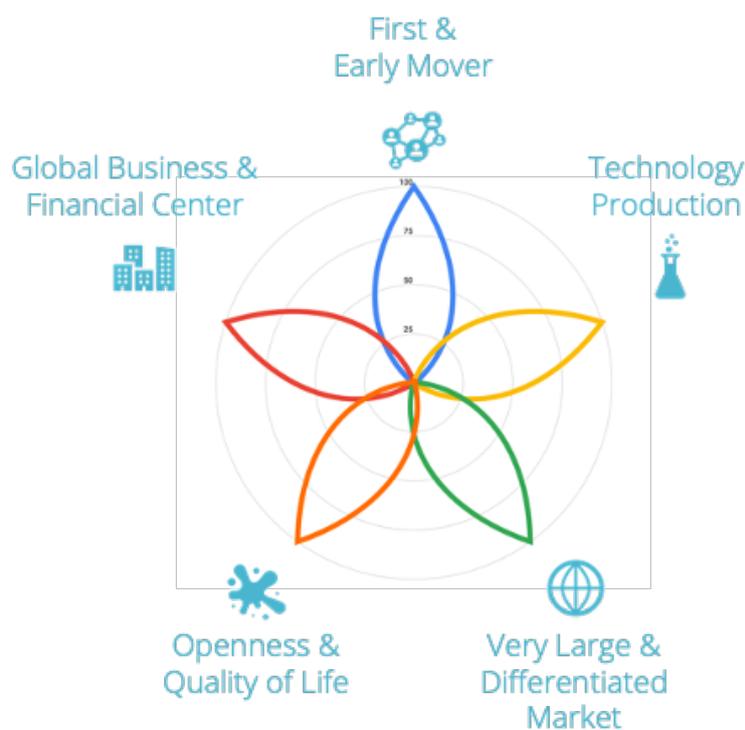
- **Attract a leading program such as Plug & Play or Techstars**
- **Establish innovation partnerships with other tech clusters**
- **Found a Keystone team**
- **Generate demand involving the public sector**

Learn from:

- **Creative Destruction Lab at Business Schools worldwide**
- **EPFL, Switzerland**
- **University of Waterloo, Canada**
- **Robotics in Odensee, Denmark**
- **STING in Stockholm**

Ecosystem Archetypes - charting a future strategy

Different successful ecosystem types have emerged around the world, each with distinct different characteristics. We categorize these into five schematic archetypes with e.g. the initial Founders of Tech (Silicon Valley, Boston, Seattle), Global Business Hubs (New York, London, Singapore), Technology Production/R&D Powerhouses (Tel Aviv, Waterloo, Stockholm), very Large and Differentiated Markets (Beijing, Bangalore) and Cosmopolitan and Creative Centers (Berlin, Barcelona).

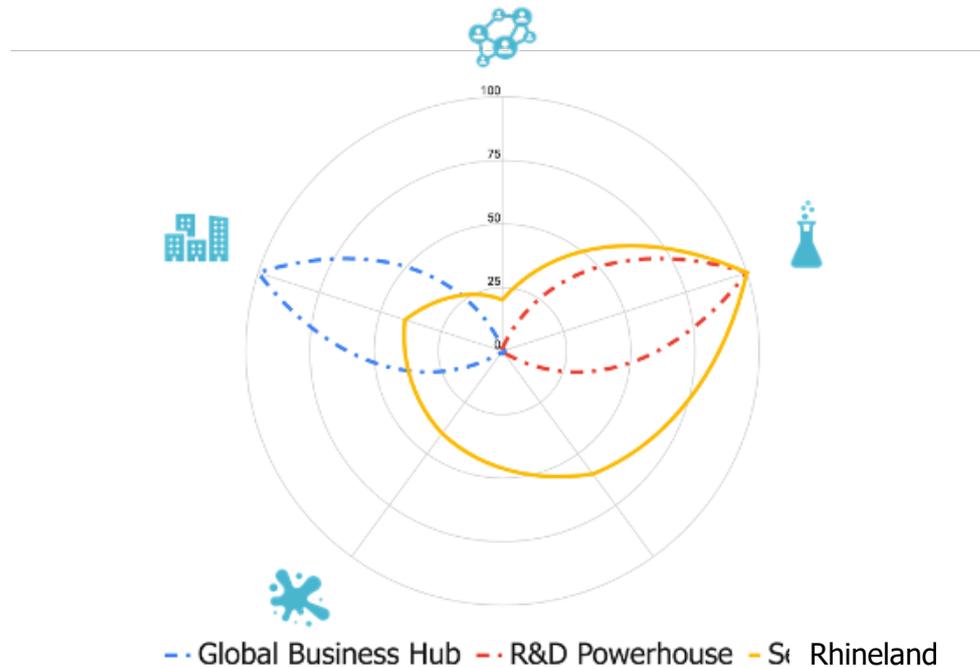


Each of these archetypes is dominated by a primary dimension, has its unique potential and challenges and requires its own approach and distinct strategy for ecosystem development.



For example, copying the success factors of world leading business cities such as NYC to a much less connected, more conservative but highly research focused environment such as Seoul can only be a recipe for failure.

We classify Rhineland predominantly as an **R&D Powerhouse**, given its strong R&D capability and high-tech industries. The region is meeting the pre-conditions for success, e.g. high levels of R&D investment and large pool of STEM and PhD talent.



Successful ecosystems in this category - such as Tel Aviv, Waterloo and to some degree Stockholm - grew through the activation of their local talent, they worked strongly on improving their Global Connectedness and supported their startup companies in building Global Market Reach. In the execution of their ecosystem development strategy they hugely focused on “lab-to-startup” efficiency.

5.1 Accelerating University Spin-Offs

Startups have proven to be the most effective avenue for commercializing the results of R&D processes, largely due to being nimble and able to experiment without the process constraints of a larger organization.

In Rhineland with its B2B and technology focus and academic prowess, University spin-offs - meaning companies that are formed in the R&D labs of universities, led by Research PhDs and



advised by their professors are a critically important factor for the creation of new high-quality companies.

Status Quo - Lab to Startup Performance

In our analysis we seek to quantify how effective an ecosystem is in creating commercial application out of R&D and patents. Highly successful clusters are characterized by strong results in traditional research combined with a high number of companies that are created. To classify and to summarize patent classes we use larger groupings of technology that are relevant throughout the global startup ecosystem world.

Exhibit 25: Knowledge Scores for Rhineland



Rhineland performs well in regard to the traditional Knowledge Scores for several large technology classes.

This positive foundation is not - yet - reflected in our Lab-to-Startup Performance Scores. Here Rhineland shows significant performance deficits, indicating that strong academic research is not yet utilized as effectively as it is in a number of its peer cities and R&D Powerhouse Archetypes. Surprisingly, these deficits are marked in sectors where we would have expected Rhineland to be strong, e.g. in Advanced Manufacturing (RWTH) or in Life Sciences (Excellence Center and digihub Bonn).

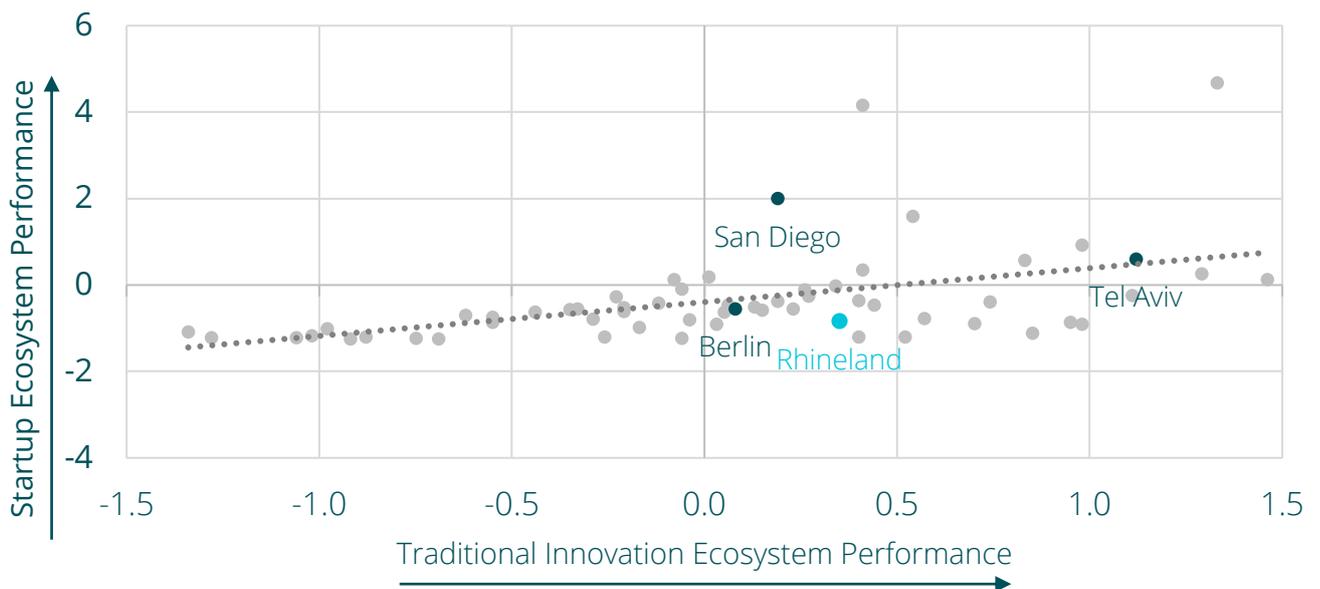


Exhibit 26: Lab-to-Startup Performance Scores



The diagram below shows the prowess of Rhineland’s Life Sciences Research that is directly comparable with knowledge scores in the world’s No 3 Life Sciences Cluster San Diego. At the same time, Rhineland shows a large distance to frontier in regard to the creation of startup companies. San Diego is a comparatively smaller town with only one larger Life Sciences university. Specialization focus and the lighthouse effect of one startup success have made this remarkable development possible.

Exhibit 27: Lab-to Startup Performance Scores Life Sciences





More positively, in Agricultural Technologies (AgTech) and in Cleantech the results show a significantly different picture, possibly already providing the local blueprint for other relevant sectors.

Exhibit 28: Lab-to-Startup Performance Scores AgTech

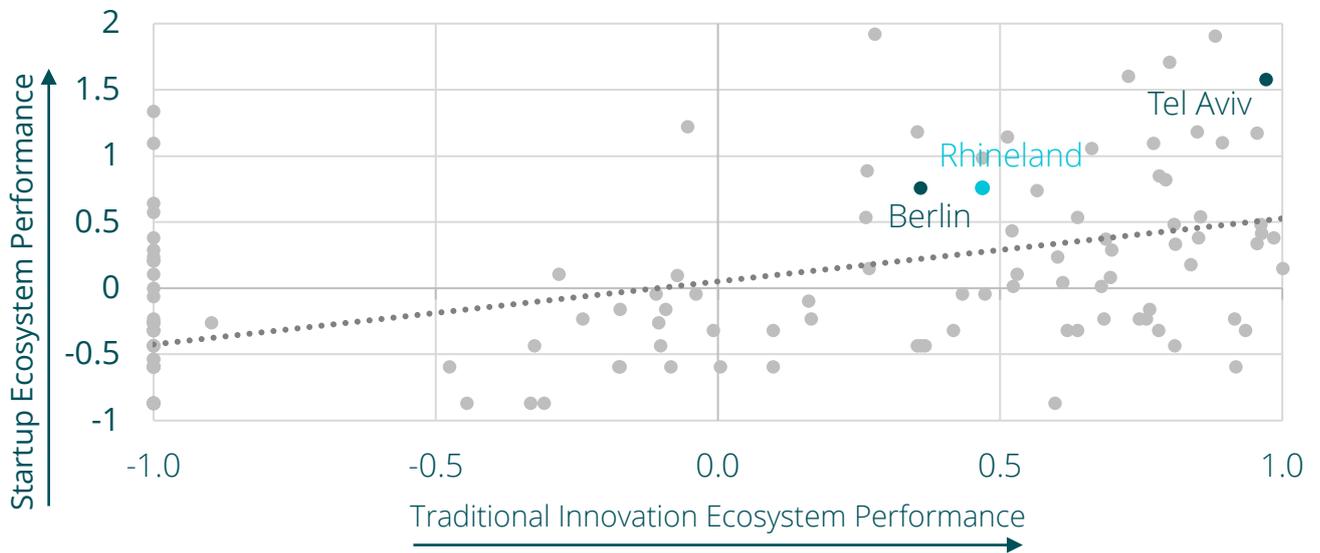
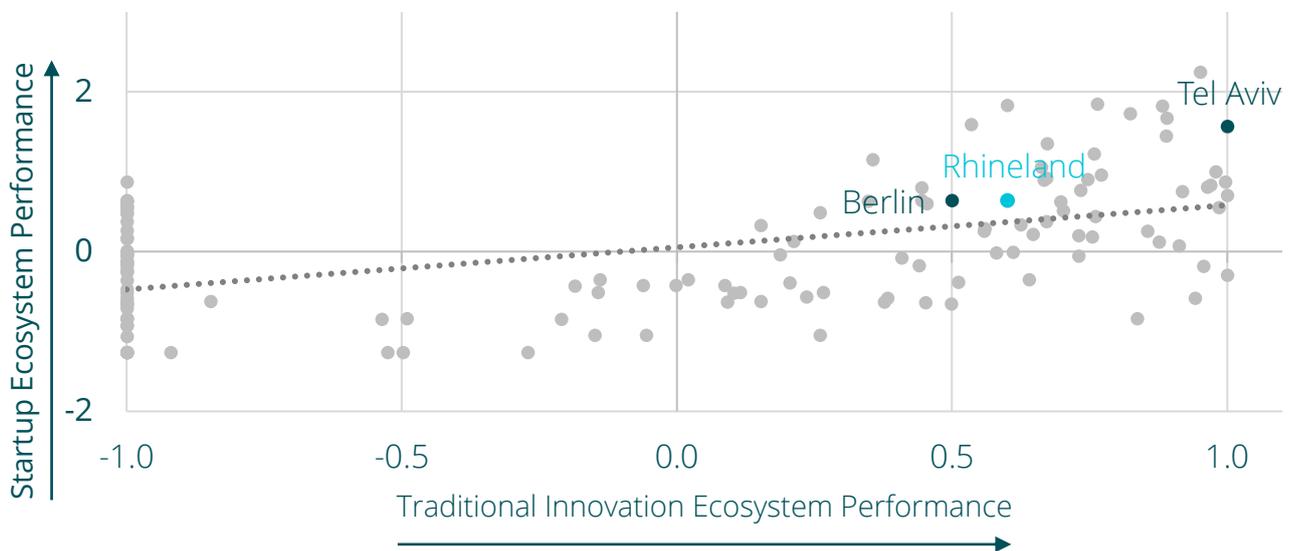


Exhibit 29: Lab-to-Startup Performance Scores Cleantech



If Specialization counts, where to focus?

Michael Porter's theory of Clusters and the New Economics of Competition¹⁹ as well as our density model demonstrate the advantages of specialization and the development of highly dense clusters

¹⁹ M.E. Porter, HBR, Nov/Dec 1998 Issue

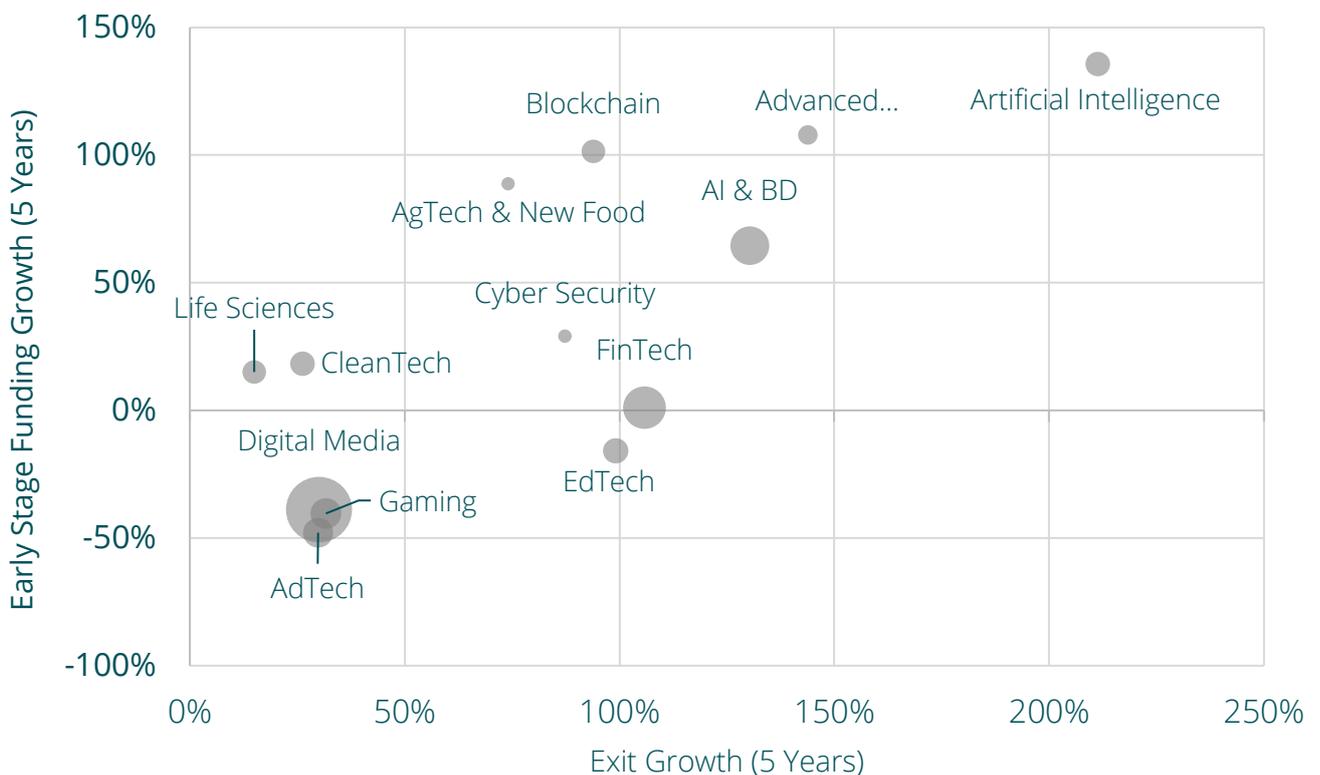


in which industry actors - here research, corporations and entrepreneurs and their financiers - can have collisions, exchange knowledge and collaborate.

A view to the most relevant - in terms of size and growth - technology sub sectors globally shows the potential for Automation and Robotics (AMR) as a large but strongly growing sector, similar to other large groupings such as AI & Big Data and Blockchain; the latter potentially being of interest to Rhineland with its potential to drive efficiency into Supply Chain and Logistics processes (consider a collaboration with the Hessian AI initiative and Tech Quartier's Logistics program).

An interesting sector with strong growth is AgTech & New Food. We believe the sector to be poised for continued growth, given its vast market size (improving the world's largest industry) and fueled by late but strongly increasing investor interest. Based on our 2019 data set, Life Sciences and Cleantech remain smaller and rather stagnant sectors.

Exhibit 30: Startup Sub-Sector Life Cycle 2019



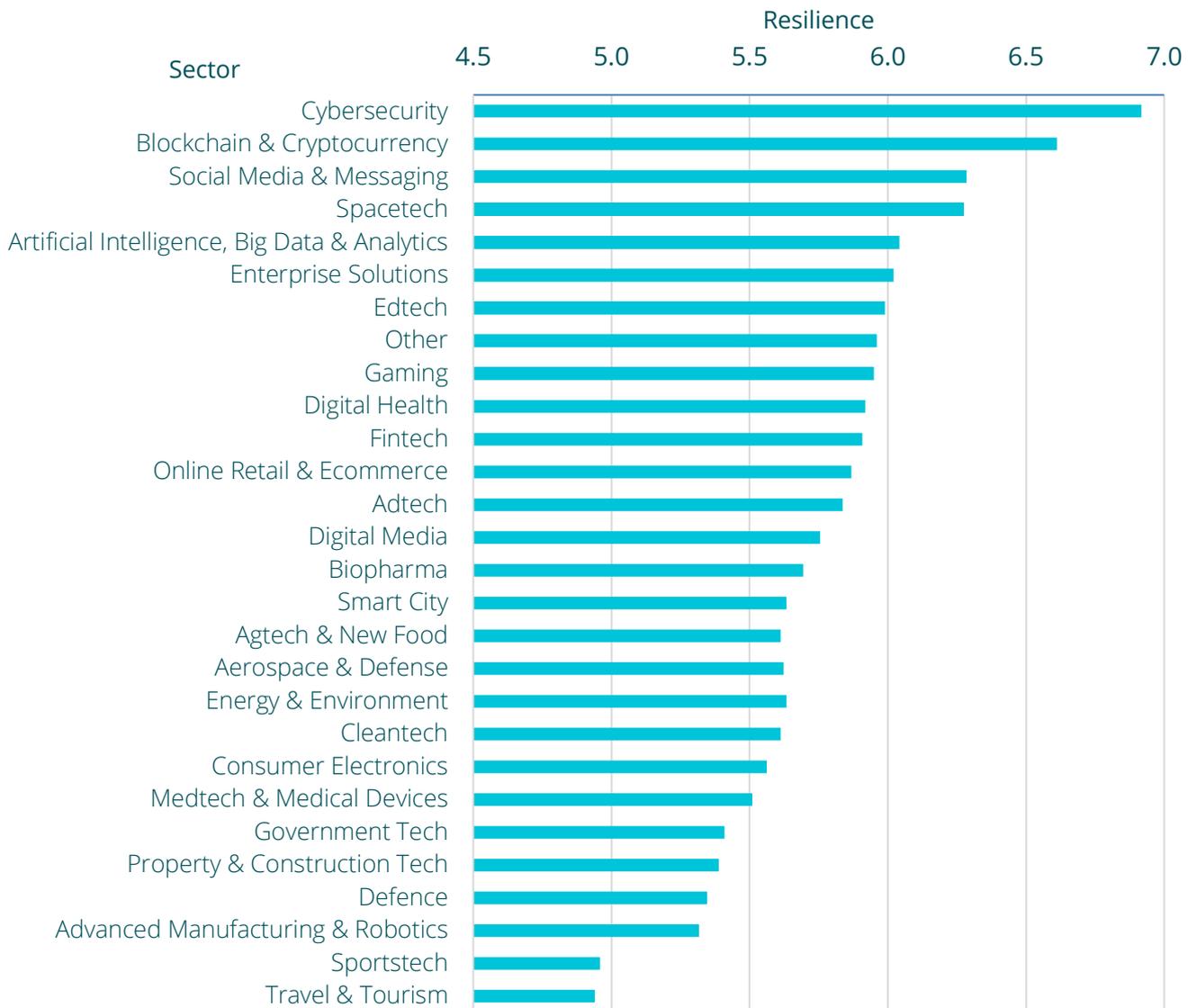
Sector Trends in light of COVID-19

In the context of the current crisis, our most recent data suggest a new lease of life for sectors that directly help mitigating impact, e.g. in Online Education (EdTech), Digital Media, Gaming and Advertising Tech (AdTech) that for the past few years didn't greatly excite new founders and investors. Importantly, Life Sciences and Health Care solutions can be expected to grow



exponentially whilst with a mid-term perspective we also expect a further boost to AMR as industrial manufacturing may well see a further wave of automation, should Social Distancing prevail for a longer period of time. Finally, the crisis has demonstrated the world's reliance on digital services which is already now reflected with Cybersecurity topping the resilience sector charts.

Exhibit 31: SG Startup Resilience by Sector, May 2020



How to improve on Lab-to-Startup Performance - Short term?

Short term solutions can only be successful if they build on existing foundations; in this context existing subsector clusters, existing startups and proven support programs.

Mid-Stage Acceleration: First, mid-stage accelerators that support the fast growth of startups are the most promising solution. Rhineland already has a significant density of local acceleration programs;



however, at the same time, startups remain underfunded, less connected and less able to build international market reach - all factors where the leading global acceleration programs with their international relationships, networks with VCs, sophisticated mentor base and ability to connect with larger corporations undoubtedly have proven to be game changers. Attracting a leading program such as Plug & Play or Techstars can make a huge difference. Today these programs are already located in both Berlin and Munich and globally their acceleration programs cover nearly all the subsectors and technology clusters Rhineland is seeking to develop. Several other high-quality acceleration programs compete globally with the largest brands, frequently with particular strengths in regard to the relevant sub-sectors. Rhineland should invite a number of these programs, i.e. by means of a public RFP.

Partnerships: Secondly, innovation partnerships with other tech clusters nationally or internationally can prove effective in sharing expertise, resource, mentorship and market connectivity, e.g. as demonstrated with the collaboration between Montreal based incubator and accelerator Centech and TU Munich.

Life Sciences: Boston, San Diego

AMR: Odense, Munich, Tel Aviv, Boston

AI & Big Data: Cambridge (UK), Toronto, Montreal, NYC, Boston, San Francisco, Shenzhen, Stockholm

AgTech: Tel Aviv, Amsterdam, St. Louis, Melbourne

Cleantech: San Francisco, Copenhagen, Blyth (UK), Tel Aviv

Provided this is of interest for further exploration, we recommend to investigate potential cluster partnerships within the Startup Genome and GEN Global Networks.

To make an example: The Alternative Flugantriebe Cluster in Aachen may well be interested in collaborating with the combined Techstars - Starbust Accelerator in Los Angeles and the Midlands Aerospace Cluster in the UK.

How to improve on Lab-to-Startup Performance - Medium to long-term?

In order to more fundamentally address Lab-to-Startup performance issues, it is critical to systematically combine all relevant resources, beyond individual university departments, incubators and acceleration environments. Again, the Waterloo Tech Triangle with its Creative Destruction Lab but also examples such as Lausanne's EPFL show a proven path to success.

Critical Success Factors:

Strong academic foundation: A strong university - or ideally a group of universities. Rhineland's excellence clusters provide this foundation.



Connectedness and Integration: All successful excellence clusters we are aware of have early on sought to leave a single university environment - at least in mindset - to better and more openly connect with additional stakeholders, e.g. other R&D Centers, corporations and ecosystem initiatives. NRW's ambitions in Mobility concepts could combine efforts with the Cologne InsurTech cluster to jointly address the technical and the legal barriers in autonomous mobility solutions.

Often the intent to collaborate is reflected even in the physical space they occupy, located in the vicinity but outside of a university campus. Bonn's Life Science Excellency Center and digihub space may become both, the nucleus and the physical center of gravity for Life Sciences in Rhineland, convening participants from all over the region.

Culture and Incentives: Particularly in deep tech, professors play a key role, often as advisors and frequently even as board directors of university spin offs. Universities need to engage in a culture that allows professors for these extracurricular activities and acknowledges their contribution to startup creation.

Seed Stage Funding and Mentorship: Seed stage acceleration programs fill the gap in regard to funding, business mentorship and client relationships. Each of Rhineland's Excellence Clusters should have access to a dedicated Seed Stage Accelerator. These Seed Stage Accelerators may require some government funding to become commercially viable; however, they should seek equal funding from industry partners and Angel Groups operating within the specific technology sector.

Patent and Licensing Issues: Unclear patent and licensing issues hinder successful tech transfer. The cluster should have common standards that define the conditions university spin-off are subject to. The most successful environments in North America frequently waive any licensing requirements altogether for their spin-offs. NRW's initiative to establish a common licensing regime for its Excellence Clusters shows the way for Rhineland²⁰.

Industry and Regulatory Standards: The highly desirable collaboration between startups and corporations can greatly be eased by established standards. Tech Nation's work with the British Standards Institute (BSI) for instance resulted in the development of a highly acclaimed guidance document for Banks and FinTech Startups (PAS 201/2018) and more recently the InsurTech Collaboration Standards (2019). [Downloads here](#). The more formalized FinTech delivery panel goes a step further as it convenes traditional industry players, tech challengers and the regulator on a regular basis in order to level the regulatory playing field between incumbents and new market entrants ([UK Fintech Delivery Panel](#)).

²⁰ Neues Gruenden.NRW



Example: Creative Destruction Lab

Objective: to rapidly scale seed-stage science and technology-based ventures by connecting engineers and scientists ready to commercialize their work with academic and business mentors.

Description: The Creative Destruction Lab is a 9 month, not for profit program that has the objective of commercializing, seed-stage science- and technology-based companies. All CDL programs are tied to a university. Funded at the Rotman School of Management at the University of Toronto, the program has now expanded to collaborations with Business Schools in locations in Oxford, Paris, Atlanta, Vancouver, Calgary, Montreal and Halifax.

CDL turns science into economic impact by assisting ventures transition into high-growth companies. This involves a series of eight-week “sprints,” with those that stagnate not moving forward in the program. Recently, CDL launched a Covid-19 rapid response program to focus on rapidly transforming tech innovations to aid in the current global crisis.

KPIs:

- The 2019 cohort includes 375 ventures across 70 countries, selected from a pool of 2,100 applicants



EPFL Lausanne - center for excellence and innovation

Objective: To ease the creation of university spin-offs and thereby establish Switzerland as a hub for life sciences

Description: The École Polytechnique Fédérale de Lausanne (EPFL) is a research institute and university in Lausanne, Switzerland, that specializes in natural sciences and engineering. Its entrepreneurial ecosystem is strong and the environment international: almost half of the students hail from outside Switzerland; the institute counts more than 120 different nationalities, while 60 per cent of teaching staff are non-Swiss. The university has an innovation park on campus, attracting names like Nestlé, Logitech, Swisscom and Frontiers, the open access publisher. Besides, the university houses more than 350 laboratories and research groups on its main campus.

Besides this infrastructure, EPFL is setting standards when it comes to technology transfer and granting licenses to startups. A license is a contract by which the licensor (here: university) grants the startup the right to use a patent or software in order to develop and commercialize products or services based on these. This means that EPFL by default favors the grant of a license to the start-up, as opposed to the university.

KPIs:

- Since 2000, 293 spin-offs have been created at EPFL, seeing a year on year increase culminating in the incorporation of 23 spin-offs in 2019, only topped by 2018 when 25 new companies were founded.
- EPFL startups raised more than CHF 285M in 2019
- Researchers filed 140 invention disclosures and 95 priority patents in 2019.



University of Waterloo, Champion for entrepreneurship

Objective: to establish the region as entrepreneurial hub.

Description: Waterloo, a small city in Ontario, is internationally famous for its entrepreneurship ecosystem, dubbed as “Silicon Valley North”, with the highest startup density in the world after Silicon Valley. This has largely been attributed to the University of Waterloo.

The Waterloo region was founded in the early 1800's by a group of Mennonites. They settled in Waterloo and brought with them both an entrepreneurial mindset and a “barn building” spirit. In the Mennonite context, this meant that if a neighboring family's barn collapsed or burned down, other members of the Mennonite community would rally and help the family resurrect a new building. This spirit of helping people has become an entrenched value in Waterloo. For example, Professors of various universities decided to combine their efforts in an independent facility where they could collaborate, jointly with startups and companies, thus effectively breaking down silos previously dominating in individual faculties.

At the core of entrepreneurship are IP Rights. In most countries, universities can claim IP rights on technologies developed in their laboratories. Waterloo has taken a decisive stance against this practice early on, following a “creator-owned” IP policy, which grants ownership to the inventor. This is the engine for driving commercialization success of research-based innovations and may be the most entrepreneurial oriented IP policy in North America. At Waterloo, companies can spin out of the university and take their IP with them.

Positive externalities include the attraction of a plethora of resources: Google's Canadian headquarters are not situated in Toronto or in Canada's capital, but in Waterloo.

KPIs:

- The Toronto-Waterloo-Kitchener corridor is home to 17,000 tech companies and 5,200 startups, including names such as Slack, Hootsuite and Element AI
- 18.6% of tech funders in Canada graduated from Waterloo
- 7.4 billion \$+ investments raised by Waterloo entrepreneurs
- Waterloo is the number one Canadian university for unicorns, which means that it is successful in scaling from startups to scaleups and beyond
- According to a study by Deloitte, in 2017/18, Waterloo's operating expenditures alone contributed \$1.52 billion to Canada's GDP.



Denmark / Odense – Robotics

Objective: To accelerate commercialization of Robotics Research and IP through a vibrant Robotics and Hardware startup ecosystem.

Description: The cluster is a collective of robotics companies, educational institutions, and research organizations that share a common thread of having some influence in the small city of Odense (200,000 population), working to build up the robotics industry in the city. The cluster includes about 130 companies, 33% of which are working in the area of collaborative robotics. Companies within the cluster employ more than 3,900 people and have accounted for a combined revenue of €763 million in 2017 (more than 200,000\$ per employee).

The success of the cluster is rooted in the intense collaboration of the 8 regional universities and research centers, the exceptional engagement of few prominent founders and the municipality.

A large-scale incubator helps founders to rapidly develop and test their ideas - without taking any equity or commitment from them - and it also acts as the center of gravity where participants naturally convene.

With its Robotics Funding Matchmaker, the incubator also addresses funding needs, combining Angel Investors with a large private Danish Fund as well as additional government funding. The municipality is strongly supporting the cluster, not the least by building business relationships with larger international business clusters, actively supporting their startups to build Global Connectedness and Market Reach.

Odense today is the leading global center for collaborative robotics and has caught the attraction of international investors, particularly from the Boston Robotics scene.

KPIs:

- 130+ Start- and Scaleup companies
- 2 “Minicorns” well en route to Unicorn status
- 40+ companies highly focused on Collaborative Robotics
- 3,900 employees at 200k Eur average salary
- 8 universities, 40+ Robotics and Hardware focused education programs



5.2 Need for a Keystone team to accelerate Deep Tech Clusters

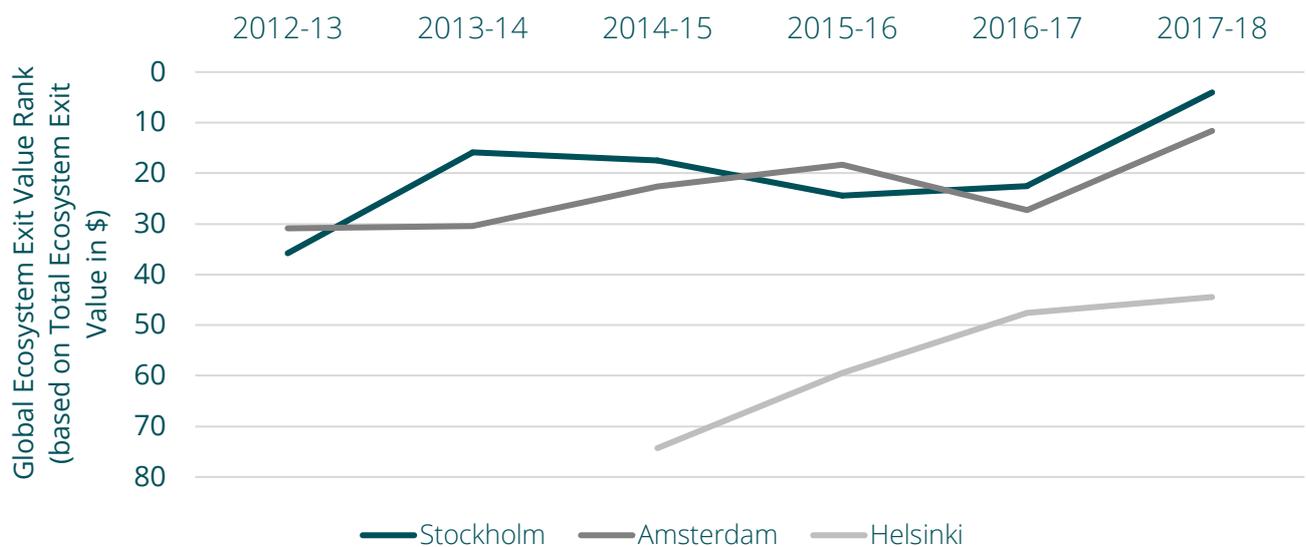
We envisage the aforementioned Excellence Centers to develop into vibrant tech clusters in which open innovation principles are the norm and stakeholders from all relevant backgrounds convene. The theory is evident, the activation though is where science focused environments generally struggle.

Based on some of the fastest growing ecosystems in the past 10 years - including those with a strong Science background such as Stockholm or Waterloo - we have found these cities and clusters to have more or less formal teams - often entrepreneurial, mission driven, fluid in their staffing and community oriented - that accelerate organic growth simply by providing connecting tissue between ecosystem stakeholder and by triggering helpful initiatives wherever success factor gaps in the cluster emerge. We call these groups a Keystone Team.

Ecosystems with Keystone Teams have greatly out-performed others. Prominent examples are those of Sting (Sweden), the integration of Aalto ES, Slush and the City of Helsinki (Finland), and StartupAmsterdam (Netherlands). In all cases, they were led by a public-private collaboration leveraging existing efforts and creating many new initiatives.

The following chart shows the extraordinary rise in the rankings of those cities, overtaking other top-30 startup ecosystems even as they were also growing rapidly. For instance, Stockholm went from an Exit Value ranking of #35 to #8 in the world within 5 years, with its annual exits growing from 10.2B\$ to 32.9B\$.

Exhibit 32: Ranking of Ecosystems led by Keystone Teams





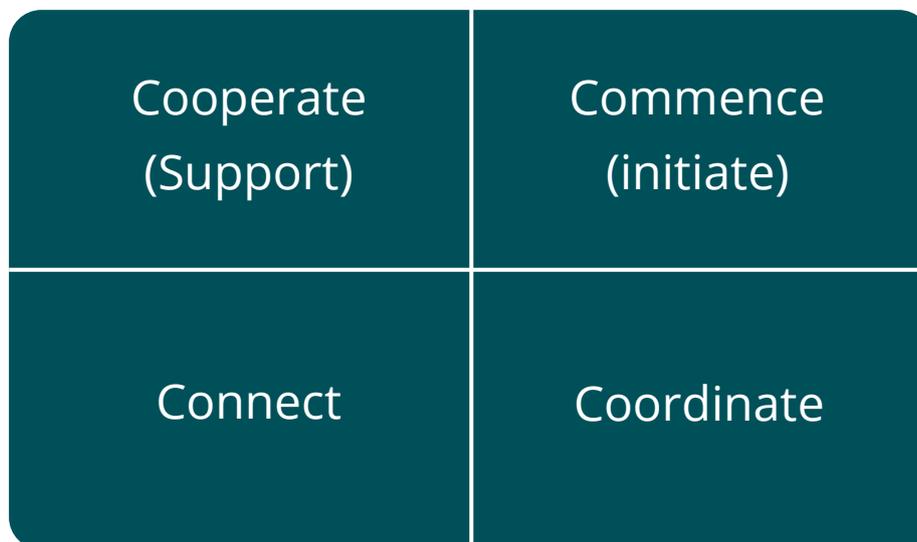
For Rhineland (and NRW) the closest program resembling these keystone teams are the digihub initiatives that today exist in 12 cities in Germany. Many of the objectives - early stage acceleration support, connecting ecosystem and companies, attracting investors and facilitating relationships, strongly resemble the principle keystone concepts:

Tighter Community: Where People Help Each Other: It is a nexus of the ecosystem, creating a higher sense of community: more people sharing knowledge and resources, benefiting more startups. Eventually, most successful organizations (including accelerators, corporations, universities, etc.) and startup leaders connected to the Keystone Team.

Cost-Effective Ecosystem Success, Built from Within: Knowledge and expertise will develop and grow within the ecosystem, since the Keystone Team is made of local leaders who will join, learn and leave room for others who will follow their steps, following this process. Local champions will learn to do everything themselves, at low cost, very much like a startup.

Ripple Effect: Building Leadership and Momentum: The Keystone Team accelerates the rhythm of action and the scale of success of existing programs and events, while also kickstarting initiatives to fill in the gaps. It is a living ecosystem development strategy, which grows stronger by creating a self-sustaining grassroots movement to facilitate startup success.

The “Modus Operandi” takes shape in the 4Cs format:



Recommendation: The principles of Keystone teams are well documented. In addition, the Global Keystone Institute provides a network of knowledge exchange. We suggest select digihubs to tap into this knowledge resource.



Example: Stockholm Innovation & Growth STING

Objective: to contribute to the success of Sweden's future technology companies by helping them to grow and compete internationally.

Description: STING is a public private startup incubator assisting entrepreneurs and innovators from academia, research institutes and the business sector. The focus is on the sectors of ICT, internet/media, cleantech, sustainability, health and life science. STING assisted in developing KISTA Science City in Stockholm and in establishing the Electrion Foundation, representing the public sector as well as corporate Sweden.

Sting includes an incubator, an accelerator, financing, recruitment support, co-working spaces and a large international network.

KPIs:

- Incubated 240+ startups
- 70% survival rate after ten years
- partnered with more than 300 companies
- Its angel investment arm, Propel Capital invested in more than 110 companies since 2014.

5.3 Generating Demand

Ecosystem development typically focuses strongly on the supply side - talent, funding, mentorship - to name but a few. Equally important - but frequently less in focus - is generating demand for innovative and frequently untested new solutions. Israel with the Ministry of Defense and Silicon Valley with US agency DARPA historically were the first to realize and to support the connect between Research and their startup ecosystems, the EU's SME policy clearly foresees significant amounts of public procurement to be allocated to SMEs (incl. startups) and UK Industrial Policy has set out four Grand Challenges addressing massive commercial and societal issues.

Other organizations such as digitalswitzerland have taken an entirely private sector approach and proven successful in engaging their corporate and upper end SMEs in highly structured open innovation programs where common challenges in the digital transformation processes of their members are shared with research facilities and startups, frequently resulting in intense collaboration, joint pilots and commercial partnerships.



To further accelerate the development of vibrant ecosystems around Rhineland's Excellence Clusters, the aspect of systematic and sustained demand generation should not be ignored and the public sector as a first "anchor client" seems advantageous:

Complexity: Challenges are typically complex and create value across broader society, providing engaging challenges to research and ambitious entrepreneurs

Funding: Projects are planned and budgeted for, providing sources of funding for both university and startup engagement

Licensing: The public sector typically seeks to solve a problem and is open to sharing approach and results rather than to exclusively own a solution and licenses as it is the case with the private sector.

Broader Benefits: New approaches in technology and business model thinking can have a significant impact on the quality and the cost of public services, the latter of which traditionally trail the user experience and efficiency of private solutions.

The current crisis only amplifies the role of the public sector in creating demand: Policy makers can play a significant role in mitigating the evaporation of organic customer demand by ramping up efforts to procure in a trade-permissible fashion from innovative domestic companies. Borrowing from the highly lauded U.S. Small Business Innovation Research program (SBIR) and its cousins in Canada, the UK and other jurisdictions, challenge-based innovation procurement provides an immediate means of addressing public needs as well as providing innovative firms with infusions of cash to continue the development of their innovations and technologies.

Successful innovation challenge programs include the US SBIR and Canada's Innovative Solutions Canada (ISC) program that combine challenges, funding and the facilitation of broader innovative collaboration. In Europe, the EU-commission backed Innovation Procurement Brokers program supports participating public agencies in the identification of their needs, and then acts as a broker to connect those needs with startups and SMEs whose capacities are best able to address them; however, the latter is far more removed from addressing the funding question than its North American counterparts.

Today, as startups and SMEs struggle to find sufficient demand to keep their doors open, these approaches stimulating economic activity represent a near-term solution for policy makers in innovation systems worldwide. Whether directed towards the immediate challenges that Covid19 has brought to the fore related to healthcare and social services, or more long-term challenges in public services, no other policy lever offers the ability to address the near-term revenue challenges that will dictate which startups survive this period of economic crisis and come out the other side ready to win.

We recommend for Rhineland to further explore the role that the state and its municipalities can play in creating demand for its most important R&D clusters.



ISC and SBIR which we rate as Global Best Practices are briefly explained in the following.

Innovative Solutions Canada (ISC)

Objective: To trigger the development of technology-based solutions to federal government challenges.

Description: Through the program, companies can receive grant funding to research and develop solutions that overcome these challenges, therefore helping the Canadian government to function better. The three-phase program offers government grants for research (up to \$150,000), development (up to 1M\$) and, if selected, innovators may receive federal procurement contracts.

KPIs:

- 20 public departments regularly committing challenges
- >200 participating startups & SMEs since inception in 2016
- 100 M\$ in annual funding



Small Business Innovation Research (SBIR / US - Federal)

Objective: To support scientific excellence and technological innovation in critical American priorities to build a strong national economy, one business at a time.

Description: The Small Business Innovation Research (SBIR) program encourages domestic SMEs to engage in Federal R&D that has the potential for commercialization. Through a competitive awards-based program, SBIR enables small businesses to explore their technological potential and provides the incentive to profit from its commercialization.

By including qualified small businesses in the nation's R&D, high-tech innovation is stimulated, and the United States gains entrepreneurial spirit as it meets its specific research and development needs.

Funding takes the form of contracts or grants. The recipient projects must have the potential for commercialization and must meet specific U.S. government R&D needs. It provides funding for some of the best early-stage innovation ideas - ideas that, however promising, are still too high risk for private investors, including venture capital firms.

For the purposes of the SBIR program, the term "small business" is defined as a for-profit business with fewer than 500 employees.

SBIR is supplemented with a similar program - SSTTR - that more strongly mandates joint projects with universities and SMEs including by allocating portions of project funding to both partners.

KPIs:

- 11 federal agencies participate under the SBIR umbrella program
- 2.8B\$ in funding are awarded annually
- 50% of fund recipients employ less than 25 people, 30% less than 10



6. Startup Output - Activating the Grass Roots

Road map:

- **Activate graduates by building entrepreneurship skills**
- **Activate experienced workforce through adult education and funding**
- **Increase proportion of female founders through female Angel (groups)**

Learn from:

- **Amsterdam / Rotterdam - Global School for Entrepreneurship (G4SE)**
- **London - Tech Nation Digital Business Academy and Co-op Opportunities**
- **Toronto Waterloo - Co Operative Education (Coop)**
- **Golden Seeds, USA**

6.1 Activating Graduates

Universities are essential in the development of a thriving startup ecosystem, as many exciting startups begin as university spin-offs. The universities in Aachen, Bonn, Köln and Düsseldorf have a joint total of around 160,000 matriculated students in 2020. However, on average, only between 50 and 70 new startups are being founded annually (number of startups in Rhineland total multiplied with CAGR growth rate between 6 – 8%).

The “Gründungsradar” of “Stifterverband für die deutsche Wissenschaft” ranks RWTH Aachen University as the best North Rhine-Westphalian university in 9th place in Germany, when it comes to ease of founding a startup. The other universities rank even lower.

In the UK as a country with a high propensity for tech and creative entrepreneurship - on average - 5% of all graduates elect to create to become an entrepreneur²¹.

When applying the same rate to Rhineland, we see an untapped potential of 8,000 “would be” founders and startup staff. Assuming there are on average 6 staff per startup, this translates into a staggering 1333 startups that could strengthen the Rhineland ecosystem funnel, resulting from graduate activation alone. However, as of today most seem to elect more traditional careers.

²¹ Tech Nation internal research, 2018



In order to further raise interest and awareness amongst students, we recommend entrenching entrepreneurship courses in university curricula. In the following we list a few select examples that we rate as Global Best Practices. These are to be seen in addition to the already existing and vibrant scene of conferences, talks and startup events which we believe to be adequate for the ecosystem.

Amsterdam / Rotterdam - Global School for Entrepreneurship (G4SE)

Objective: Activating a high percentage of students to start a business and to dramatically increase the likelihood of success.

Short description: The school combines classic university degrees (Bachelor and Master studies) with entrepreneurial education. It teaches students to think, decide and act as an expert entrepreneur. Programs are conducted with small groups of diversified students, with a personal approach in an international setting and by connecting students with successful businesspeople and startups. Entrepreneurs and intrapreneurs are welcomed to the in-house incubator from day one and are strongly encouraged to set up their own venture.

At the end of the three year journey, students will not only have gained their bachelor and master's degree, they will also have built a venture and become a global citizen. Additional and shorter modules (GAP year / 90-day entrepreneurship trial) are available for students from other faculties that are seeking to build out their basic knowledge in entrepreneurship. Not all students though choose to create their own venture; some prefer to engage with corporate innovation functions in larger companies, again inspiring a more entrepreneurial minded culture and approach. The school is a spin-off of the Erasmus University of Rotterdam to which it maintains close ties.

KPIs:

- 240 Bachelor Students / 60 Master Students p.a.
- Resulting in 43 new startups resulting from one faculty only.



London - Tech Nation Digital Business Academy and Co-op Opportunities

Objective: To increase the number of startup founders and to reduce the likelihood of failure during set-up and early scaling stages of a new business.

Description: DBA is an online learning platform that delivers essential entrepreneurial skills at speed and low cost for larger learning audiences. A total of 70 course modules create the content for a “Mini MBA”, covering critical foundations of a business, including Strategy, Brand and Communications, Marketing and Sales, Finance, Ideas and Product and HR/People. Successful course finishers also have access to work experiences with startup companies and receive certification. From our point of view the program’s quality is unique as it combines academic rigor (sourced from university partners such as Kings College, UCL - University College London and the Cambridge Judge Business School) with the practical viewpoints and case examples of successful founders - those “who have done it - sourced in collaboration with Founder Centric.

KPIs:

- The program has existed since 2015 and annually attracts approx. 25,000 students
- 20% of all participants start a new business
- 60% of participants see a marked improvement in their career (promotion) and average salary
- The gender mix regularly is at 50/50, helping to rebalance the gender inequality in the UK ecosystem.
- The program has been licensed internationally, e.g. for use in Australia and Southeast Asia.
- Extremely low costs per participant, e.g. in the region of 5 – 10\$ per learner.



Toronto Waterloo - Co Operative Education (Coop)

Objective: To expose students early on to the environment in tech startups and tech companies to promote a career choice in the segment and to practically prepare students for life after graduation.

Description: Co-op students alternate study terms with work terms and graduate with up to 2 years of relevant, paid work experience. This means two years of experience learning how to navigate the hiring process, applying their skills to real-life problems and learning about their career aspirations on the way to graduation.

KPIs:

- 7,100 employers from 60 countries actively recruit from Waterloo graduate pools
- Can \$12,396 average earnings per co-op work term
- 90% of co-op graduates employed

6.2 Activating Experienced Workforce

Many sectors - particularly in Deep Tech and in Financial Markets - need more professional expertise and experienced founders to enable successful startups. This typically requires attracting seasoned professionals to consider a career change at mid-age. The typical Rhineland entrepreneur at a median age of 33 though is younger than what we would expect from the Deep Tech and highly technical environment; for example, this compares to an average founder age of 38 years and with 80% of founders in the Tel Aviv Tech Ecosystem being in the age group 30+.



Exhibit 33: Rhineland's founders relatively younger compared to the Global average

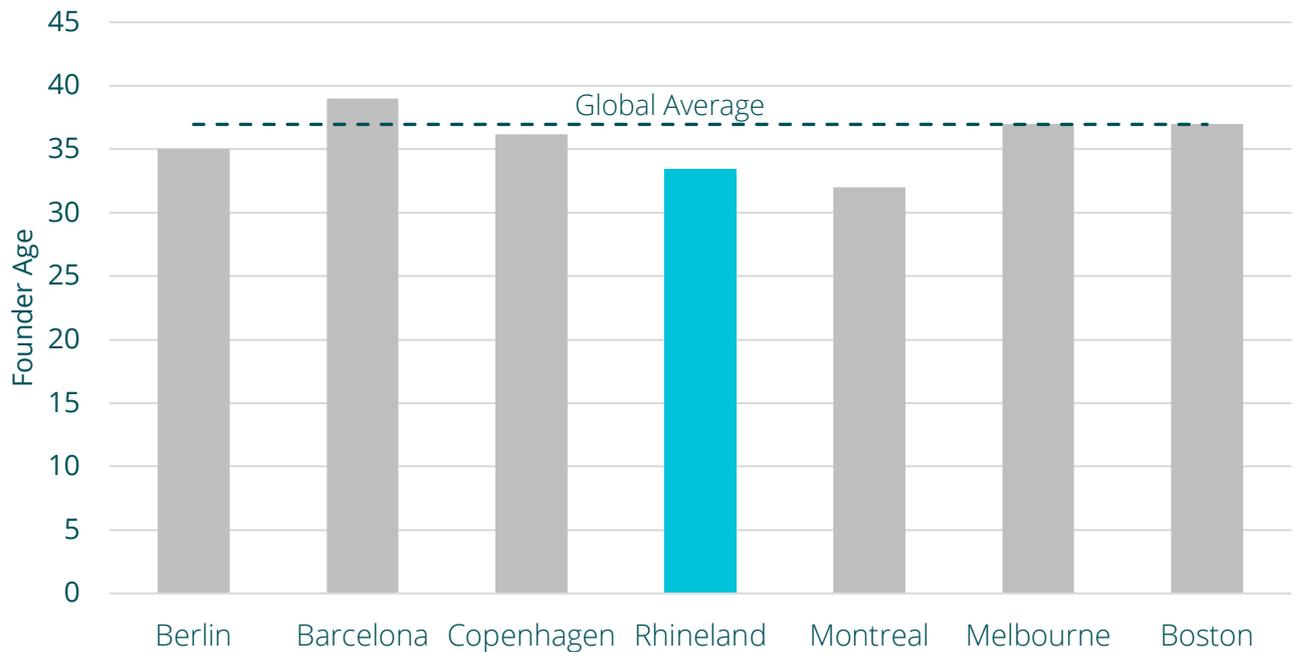
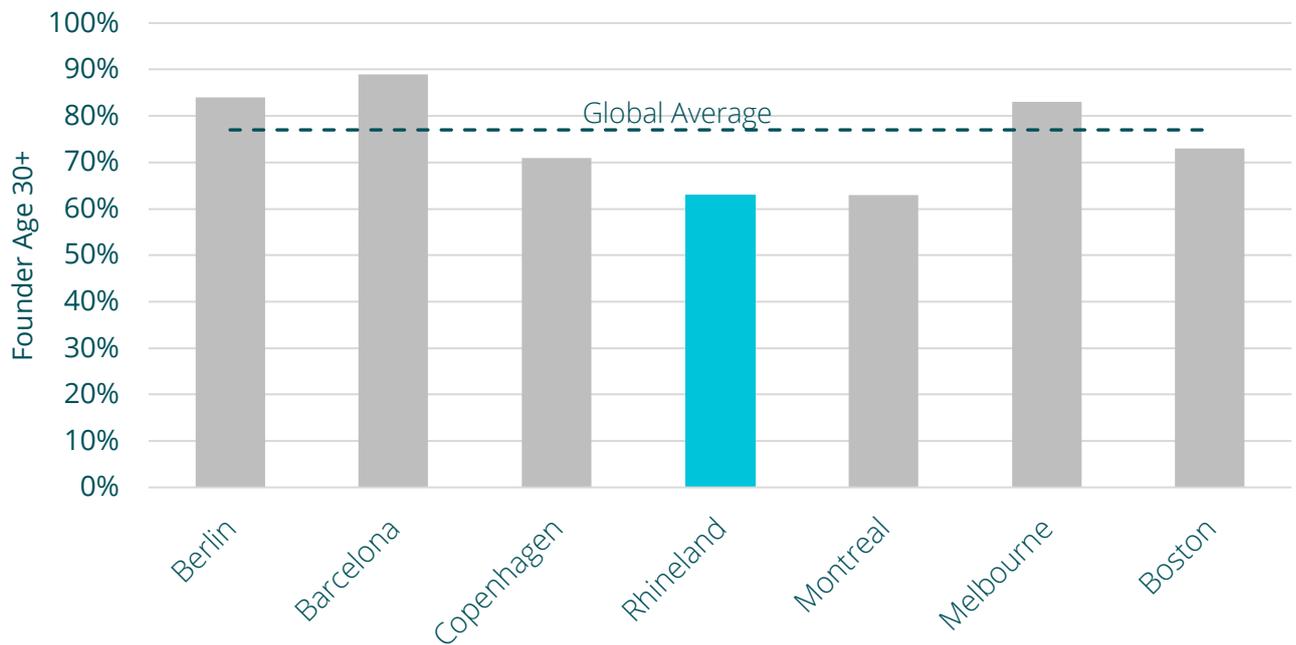


Exhibit 34: Proportion of founders who are aged 30 and over



Entrepreneurship Skills Training: Particularly for the existing workforce, flexible online education offerings are hugely helpful as they allow to backfill skill gaps whilst continuing in employment. Again, in our experience the UK Digital Business Academy is a best practice case as it allows learners to acquire key skills entirely at their own pace and completely online. Many professionals particularly in London's financial services sector already have taken advantage of this offer whilst considering



their FinTech concepts. In addition, we are working on examples that combine a strong focus on online education with few but impactful practice seminars where participants can apply the skills they have acquired online in classroom setting (or live webinars); e.g. recently with the Financial Markets Regulator ADGM in Abu Dhabi.

Funding: Investment needs - particularly in the longer and more complex Deep Tech Development cycles but also the financial commitments of later life - put a larger pressure on external funding. Whilst there are a significant number of instruments in place, none of these instruments seem particularly geared toward the requirements of a high-tech early stage founder as they are largely loan and guarantee based or small in volume (Meistergründung). This may call for active Angel Group involvement, potentially supported by public money and for connecting with the university-based clusters we previously discussed. Our analysis here is based on the instruments offered at Startercenter.NRW.

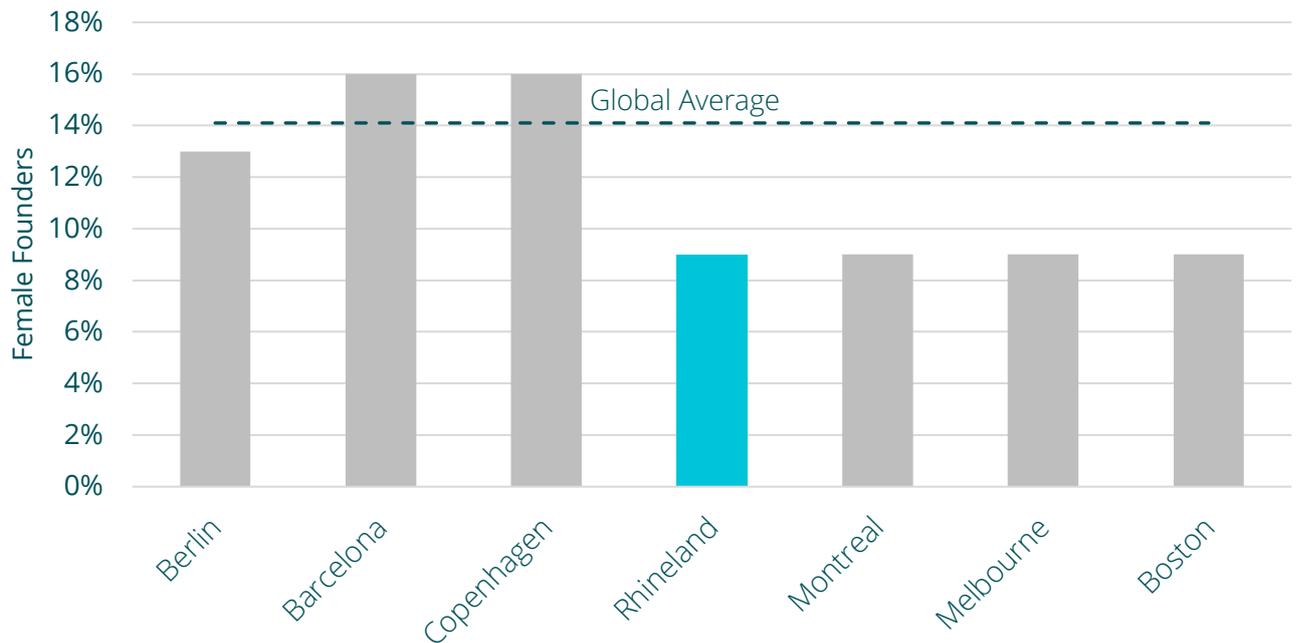
In the United States, 23 million people have already lost their jobs as of May 2020. While the extent of the recession in Germany and its impact on employment cannot be fully determined yet, it is highly likely that many middle management roles might be subject to salary cuts or layoffs. Founding a business, incentivized by corporate career outplacement programs or government programs, might be an attractive choice. Particularly in the deep tech context in Rhineland, the advanced and specialized skill set of mid-level professionals is advantageous. Further, corporate experience and contacts will add value for B2B business ventures. Hence, mid-level professionals which are affected by covid-19 might be an attractive target group for entrepreneurship programs.

6.3 Female Entrepreneurship

As Barack Obama once rightfully stated, you “can’t win the game if you leave half the team on the bench”. While female participation is low in any ecosystem, this seems to be particularly pronounced in Rhineland. The Startup Genome survey showed that only 8% surveyed were female, compared to a global average of almost 15%. Reasons might lie in the focus on STEM related disciplines such as Deep Tech, B2B and Engineering, which traditionally see lower rates of female graduates than others.



Exhibit 35: Rhineland below average level for female founders



Applying the female quota of 8% to the 900 startups in Rhineland, we can deduct that about 72 local startups have a female founder. If this was doubled to 16%, it would yield a total of 144 startups, while a 25% share would result in 225 female founders.

Minister Pinkwart set the ambitious goal of increasing the share of female business owners in the state to 33%. While this number includes businesses which are not categorized as start-ups, it is clear that women are an underrepresented demographic in early stage ventures. Many of these targeted actions involve working at grassroots level, in the early and mid-stages of the education system and will show effects only for the next generation. The initiative below promises much more direct impact.

The role of Female Angel Investors

It requires targeted action to incentivize more women to start their own business, for example by increasing the availability of early stage funding specifically to women.

Early stage venture capital is heavily dominated by men. Women make up just 13 % of decision makers in venture capital in the UK, according to a 2017 report from Diversity VC. This gender disbalance is continued in investments: female founded companies get less than 1% of total UK venture capital, despite the fact that a third of entrepreneurs in the UK are female.

At the same time, there is a clear positive correlation between the presence of female angels and female entrepreneurs: venture capital firms with women partners invest in companies with women



leaders twice as often as VC firms that do not have women partners²². Gender diversity in investors translates into gender diversity in the entrepreneurs in whom they choose to invest.

Hence, the absence of a critical mass of women investors strongly exacerbates the already existing problem of too few female founders: Due to the disproportionately low access to investments, female entrepreneurs are at disadvantage very early on. The problem has been recognized in many ecosystems and we can already see the impact of initiatives we have been involved with, e.g. with Scottish First Ministers drive for Female Investing and the WOMENA network in the GCC region.

It is timely to see that the Business Angels Network Deutschland (BAND) declared the year 2020 the "Women Business Angels Year 2020" and is currently organizing a large-scale initiative to activate female angel investors under the patronage of Federal Minister for Economic Affairs and Energy Peter Altmaier.

²² [Babson College's Diana Project](#)



Example: Angel Group Formation Golden Seeds Program

Objective: Empowering women entrepreneurs and investors by providing a platform for targeted investments in women led companies and by training interested women to become angel investors

Short description: Golden Seeds is a New York-based private equity fund focused on investing in early-stage women-led businesses. Its mission is to change the male dominated investment industry by founding local chapters who establish and train networks of female business angels. This is done through organized angel groups whose members work together to identify investment opportunities, conduct due diligence, monitor the companies' progress and provide support in many other ways. Golden Seeds is one of the largest and most active angel groups in the USA.

Through its knowledge institute, it offers training sessions for interested women to become angel investors. For example, the curriculum for "An Introduction to Angel Investing (101)" includes materials on Risks and Rewards of Angel Investing, The Investment Process, Screening and Due Diligence, Structuring and Valuing the Deal, Term Sheets and Closing.

KPIs:

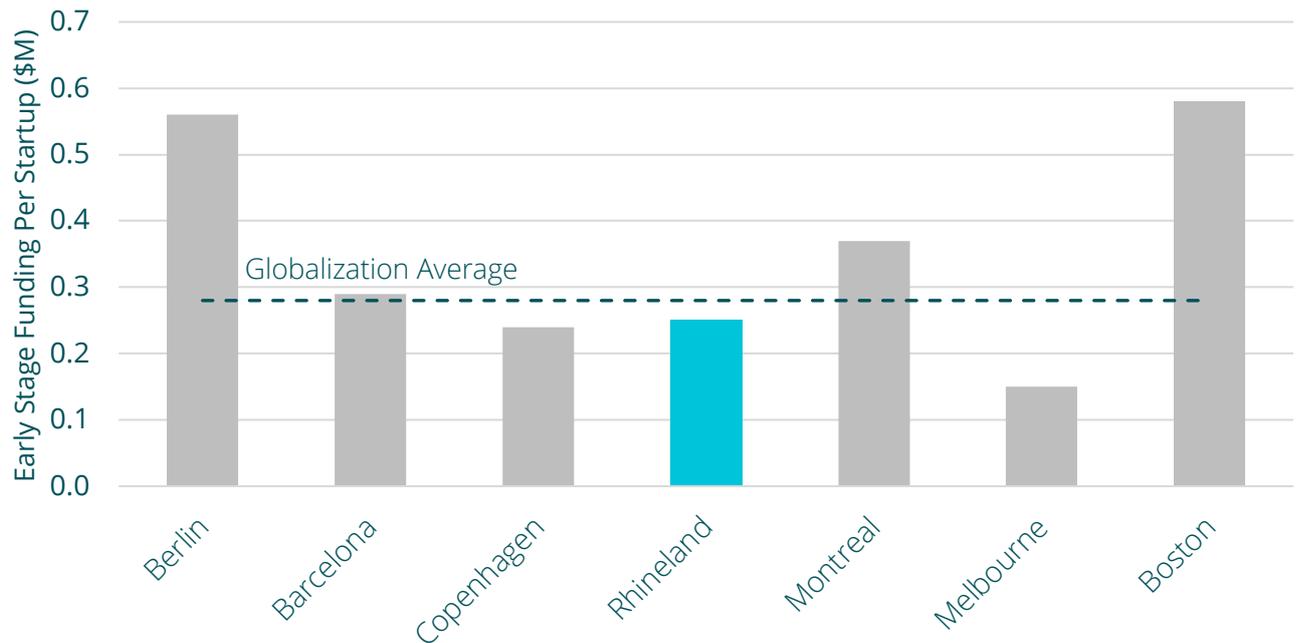
- Over \$120 million invested
- Over 170 companies received funding
- Over 300 members and eight chapters in Arizona, Atlanta, Boston, Dallas, Houston, New Jersey, New York, and Silicon Valley
- Female Angel Groups: USA, Scotland, UAE, Jordan



7. Seed Funding - Addressing the Gap

While there is no doubt that capital is one of the main fuels of ecosystems, data shows that startups in Rhineland are slightly underserved by the capital market. Compared to peers in the Globalization phase, Rhineland is slightly below average when it comes to early Stage Funding per startup²³.

Exhibit 36: Early stage funding Rhineland close to Globalization phase average²⁴



On average, startups receive about 0.25M\$ in early-stage funding, compared to a phase average of 0.28M\$. However, this small funding gap is expected to widen drastically if Rhineland focuses on increasing Startup Output without accelerating funding mechanisms in parallel.

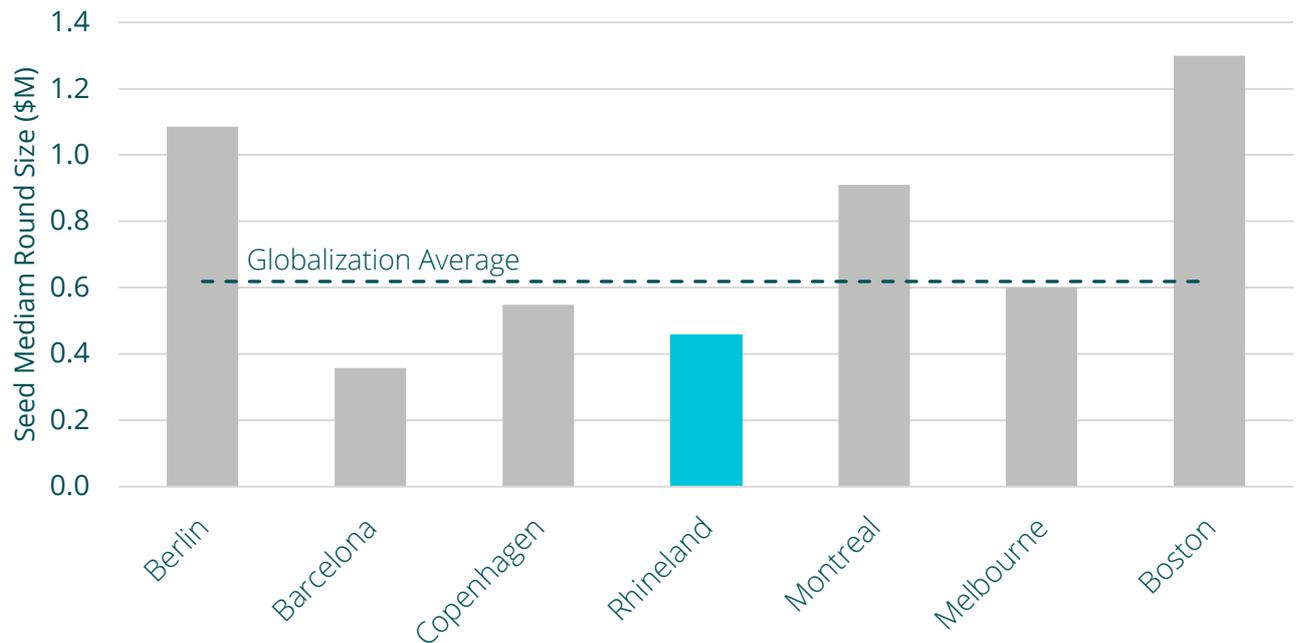
The next graph shows that not only funding per startup, but also seed rounds in Rhineland are significantly smaller than in the phase average. Median round sizes in Globalization phase ecosystems are about 0.62M\$, while startups in Rhineland only obtain a median size of 0.46M\$ per seed round.

²³ Early Stage Funding per startup refers to the total amount invested as Seed and Series A rounds, divided by the number of startups in the ecosystem. Seed rounds include all deals tagged as pre-seed, seed, angel, and Pre-Series A across sources

²⁴ Not based on Startup Genome data – based on Pitchbook, Crunchbase and DealRoom and subject to normal issues with funding data



Exhibit 37: Seed round size in Rhineland is small than Globalization average²⁵



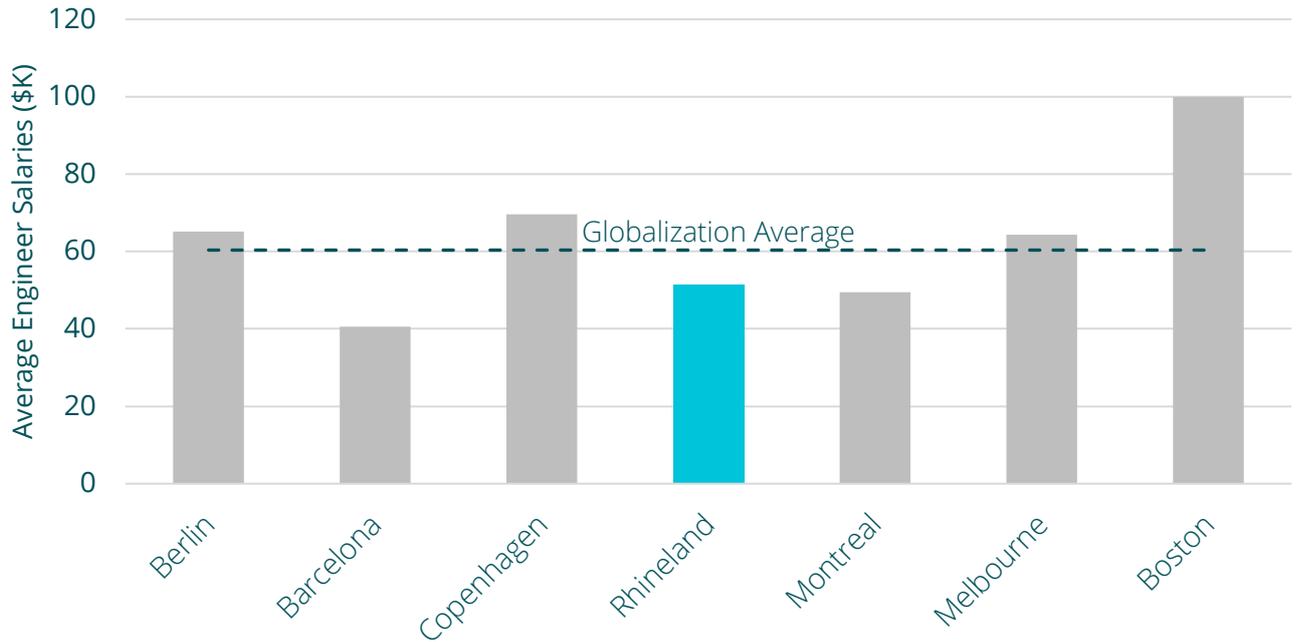
Notably, a cross-ecosystem comparison of seed round sizes must factor in the difference in costs across each ecosystem. Lower costs of talent, especially technical talent, can bridge the gap in lower seed round sizes.

This holds true to some degree in Rhineland, where average software engineer salaries are about ~10,000\$ lower when compared to the Globalization average.

²⁵ Based on Pitchbook, Crunchbase and DealRoom and subject to conventional issues with funding data such as time lags

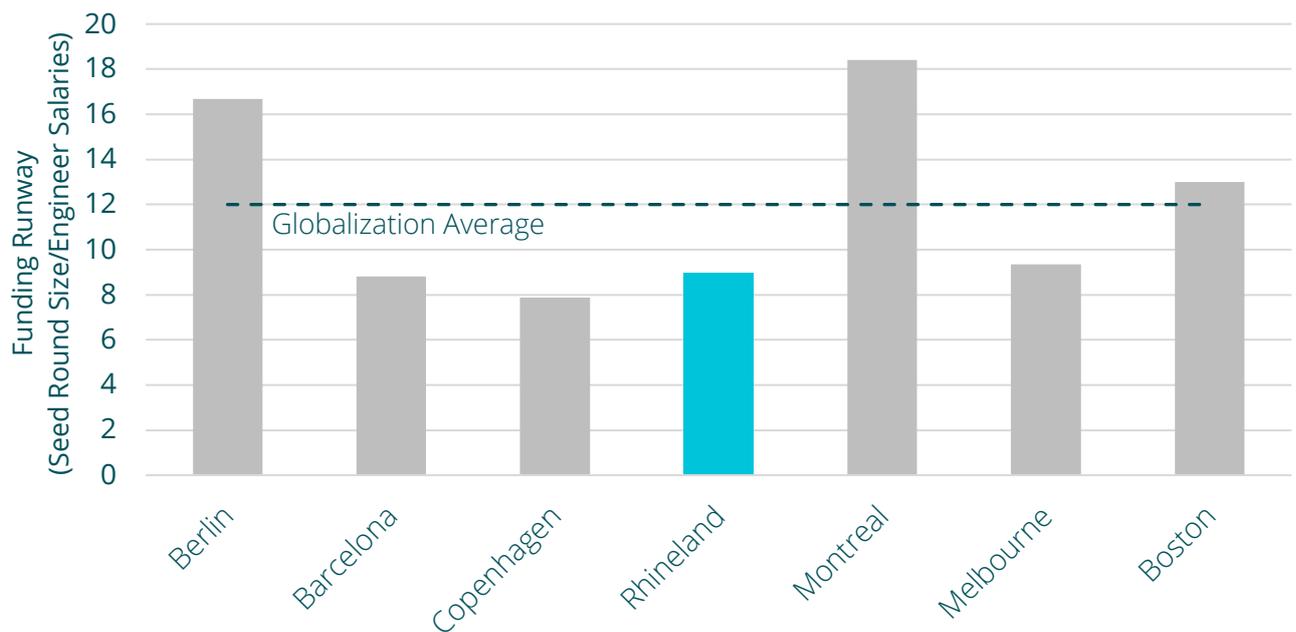


Exhibit 38: Software engineer salaries relatively low, compensate for smaller seed rounds



To analyze seed round sizes in tandem with cost of talent, we calculated the total number of engineers that an average seed round could help hire per year. Even with lower salaries, there remains a gap to Globalization average in Rhineland - and a very pronounced gap to top ecosystems such as Berlin. Smaller seed rounds in the Rhineland ecosystem create barriers to competitiveness for local startups.

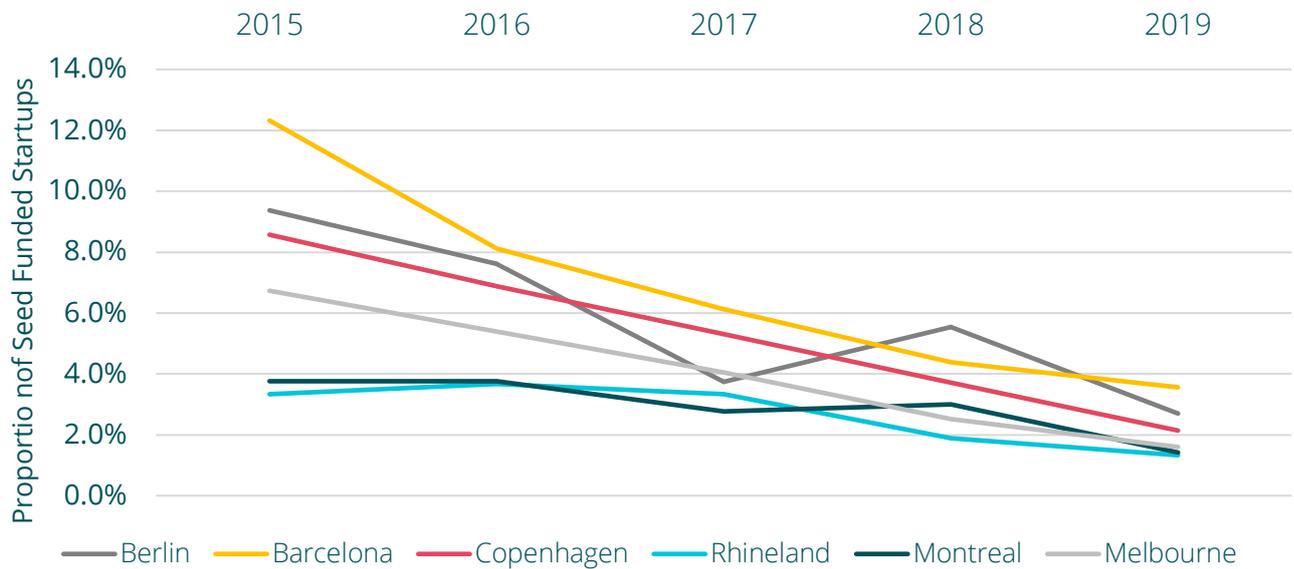
Exhibit 39: In tandem with cost of talent, seed round sizes in Rhineland are relatively smaller





Not only are funding rounds small in size, but there are also not enough startups in Rhineland that receive seed rounds, and which are consequently forced to bootstrap without access to any outside capital.

Exhibit 40: Not enough startups in Rhineland receive seed rounds²⁶



Taking the year 2015 as an example, the graph shows that less than 4% of startups in Rhineland received seed rounds, compared to over 10% in Copenhagen and over 12% in Barcelona, the latter being an exceptional case where the government has acted decisively to improve on early-stage funding.

Why bootstrapping is not ideal

The Startup Genome survey shows that the majority (81.9%) of early stage startups in Rhineland strongly rely on bootstrapping, building and scaling a business without external funding. This is in stark contrast to the Berlin ecosystem where more than 70% of all startups access external capital²⁷.

At the same time, our data also shows that building a business without external funding is not entirely by choice: Only 40% of founders regard bootstrapping as an appropriate funding option. In addition, 23% report that they have received investments from Angels, while a lot more, namely 39% would have preferred this kind of funding.

²⁶ 2018 & 2019 are less reliable because of the 2 to 3-year lag between the closing of seed rounds and capture by global databases

²⁷ Bundesverband Deutscher Startups, 2019 and PwC's Startup Monitor Germany, 2019



Funding limitations typically result in founders aiming for revenue prematurely, having to rely on Minimal Viable Products and less competitive concepts in general, thereby restricting their potential for further access to funding and growth.

Another reason why overreliance on bootstrapping is not conducive is the fact that it disincentivizes potentially talented founders - especially those from lower socio-economic backgrounds - to take the risk of founding a company. It means limited financial runway and time for product development and it restricts founders to hire quality talent.

If we are to create a larger startup funnel - following the scenarios outlined in Chapter 1 - this situation is only to exacerbate. Creating more young companies requires additional pre-seed and seed stage capital, which we quantify in the scenario below.

7.1 Scenario Planning: Capital needed to close the Seed Funding Gap

On its current trajectory, the total amount of seed funding in the Rhineland ecosystem in 2025 is 66.9M\$, assuming the funding per startup stays constant at 54,000\$. Since we however know that there is a significant funding gap, we fill that gap in Scenario 1 and 2 by assuming higher average funding per startup. For both, we use Globalization average funding which is 87,220\$.

In Scenario 1, Rhineland had to close a funding gap of 59.5M\$, while Scenario 2 shows a Funding Gap of 91M\$.

	Number of startups	Seed Funding/Startup	Total Seed Funding in Ecosystem (\$M)	Funding Gap (\$M)
Rhineland	900	\$54,775	\$49.3	
Rhineland at current trajectory	1221	\$54,775	\$66.9	
Scenario 1: Rhineland at 10% growth rate, using Globalization average funding	1449	\$87,220	\$126.4	\$59.5
Scenario 2: Rhineland at 15% growth rate, Globalization average funding	1810	\$87,220	\$157.9	\$91.0

In order to close this funding gap, the following funding instruments seem best positioned to fuel growth in Rhineland:



Gründerstipendium: Financial runway in the ideation and early concept phases (helpful in this context as it helps activating potential founders but not addressing the seed funding gap).

Angel Investors: Angel Investors - ideally organized as Angel Groups or Syndicates are our preferred funding model for early stage funding as they provide funding as well as business mentorship and relationships to potential first clients. In Rhineland today they play a role in regard to funding that is comparable to the rest of Germany.

HTGF: The public-private VC fund (895.5M Eur under management) focuses on investing in early stage companies and providing initial financing up to 500.000 Euros in the form of subordinated convertible loans and acquires 15% of the nominal share of the company. In the majority of cases HTGF invests alongside Angel Investors which only strengthens its already high competency in regard to business mentorship. The large majority of its investment is sourced from the government or government owned institutions such as KfW, however, an impressive list of Corporate VCs (CVC) augment the fund not only with cash but - much more importantly - with a broad relationship network to German corporations.



7.2 Need for Business Angels

Road map:

- **Promote startup investments as attractive asset class to Family Offices and HNIs**
 - **Activate new angels through targeted training**
 - **Encourage the formation of Angel syndicates**
 - **Facilitate deal flow between angel groups and startups**
 - **Drive the Accreditation of Angel Investors**
 - **De-risk and leverage private investments by a public Sidecar Fund**

Learn from:

- **Angel Resource Institute, USA**
- **Global Entrepreneurship Network (GEN): Global Business Angels Network, USA**

Recommendations to activate more Angels

Promote startup investments as attractive asset class to Family Offices and HNIs: The amount of private wealth invested directly into European startups has grown almost five-fold in the period 2014 - 2018, from 1.3 to more than 5B\$ of direct investment into startups as HNWI and Single Family Offices joined the rush for tech in a search for growth assets. In addition, European entrepreneurs have seen record exits and are now reinvesting into the next generation of tech. Similarly, private wealth investment into VC funds has tripled to over 3B\$ with VCs now raising approximately 20% of their funds from private wealth²⁸.

Whilst Rhineland may not yet have a significant population of successfully exited entrepreneurs, it has the highest concentration of large Family Businesses in Germany²⁹.

We believe there to be potential for further activating and integrating Family Offices into Tech Startup Funding and we value the contribution they can make as active investors, business mentors and even as clients in their own right when integrating the services of their investees into their own core businesses.

Activate new angels through targeted training: Angels combine financial investment with expertise and active support. Sound investments require a unique skill set, last but not least to operate efficiently within the respective regulatory environment. In order to increase “smart money” in the

²⁸ Dealroom, 3 Dec 2019

²⁹ Top 500 Germany. Institut für Mittelstandsforschung Mannheim, 2018

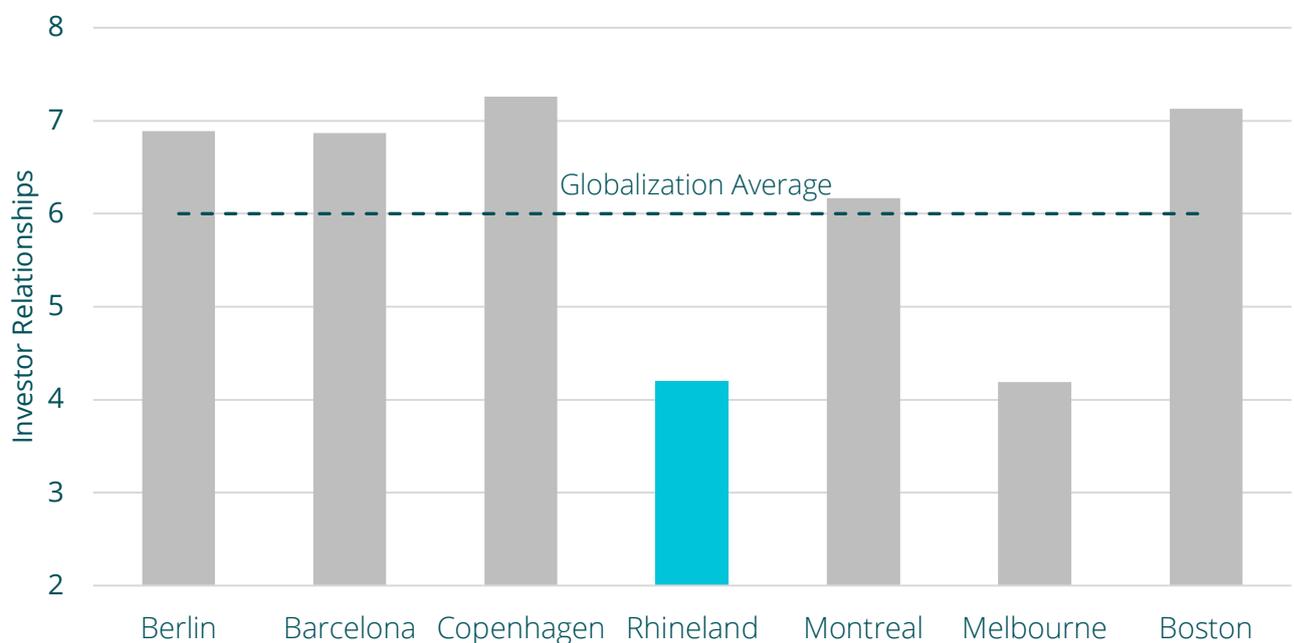


ecosystem, we recommend more targeted training for individuals who would like to become Angel investors. Organizations like the *Business Angels Institute*, which is focused on the DACH region, have set up comprehensive programs with the objective of training (future) angels on financial and legal issues in the pre-investment phase. They further advise on how angels can ideally support their portfolio in the post investment phase.

Encourage the formation of Angel syndicates: Networks of angels not only allow for larger investments, but they also enable risk sharing. The German business angels are dominated by individuals and are not regulated. We strongly suggest that local ecosystem leaders (and keystone teams) more actively engage with Angels and to promote the formation of Angel Groups, e.g. in close collaboration with German [BAND](#).

Facilitate deal flow between angel groups and startups: Finding investment opportunities and selecting the best startups to invest in requires a solid understanding of all the relevant actors in the ecosystem. It is crucial to establish closer connections between angel groups and the region's digihubs and other acceleration platforms in the ecosystem. This could also remedy the relatively low average number of relationships between startups and investors as shown by our data.

Exhibit 41: Investor Relationships



Drive the Accreditation of Angel Investors: We suggest accrediting angel investors to ensure that professional quality and transparency standards are met and maintained over time. Official certification will provide reassurance when Angel Investors and groups seek to leverage their investment capital with passive investors - sidecar fund instruments, as explained below -, working



with either government or other private capital. It will further ease angel group formation as it stipulates trust for potential co-investors.

One example is the UK based [UKBAA Accredited Qualification](#), a quality controlled angel training, which is recognized by the Chartered Institute of Securities and Investment (CISI), and SFEDI, the standards-setting body for Enterprise and Entrepreneurship. In our assessment both go beyond the “Stamp of Approval” offered by BAND. In the DACH region, the *Business Angel Institute* offers the CBA, or Certified Business Angel, which is an ISO-certified accreditation for angel individuals (ISO 17024).

De-risk and leverage private investments by mean of a Sidecar Fund: A sidecar is a financial instrument that helps to enlarge the financial firepower of Angel Groups, resulting in a larger number and larger sized investments being made. The larger funding and broader investment portfolios that the sidecar fund enables also help to de-risk Angel Investors, providing for more sustained operations of the Angel Groups.

Sidecars are hence passive funds that are sourced from both, government and private capital, and that invest alongside the decisions taken by Angel Groups.

At the Globalization phase of startup ecosystem development, private investors will find financial results to be volatile and more difficult to achieve than in more mature tech clusters. We thus believe government funding to be required to increase interest of potential angel investors.

A Sidecar Fund provides liquidity for angel groups and enables them to further “stretch” their own money across not only a broader portfolio of pre-seed stage companies but also into the larger funding rounds frequently required by seed stage companies, e.g. those exiting from the envisaged accelerator program(s). The Sidecar Fund allows the angel group to invest in more startups but also to write larger checks, on average and to the highest potential startups.

The Sidecar Fund supports the group in increasing its deal flow (as startups follow where the most money is) and accelerating the accumulation of investment experience. A Sidecar Fund also enables private individuals and organizations that seek to invest in startups without taking a commitment in the management of the portfolio (passive investors or LPs).

One existing sidecar mechanism can be found within the European Angels Fund (EAF), an initiative by EIF. It co-invests into startups alongside Angel investors, matching private investors. We suggest building on and expand this mechanism by a sidecar which is focused on startups in Rhineland.



Quantifying the Sidecar -Investment needed

The scenarios presented earlier in this study showed that Rhineland needs an additional 59.5M\$ in order to catch up to Globalization phase levels of seed investment, while also increasing the startup output growth rate to 10%.

We recommend a Sidecar Fund covering 50% of Angel Investment, assuming 25% stems from government and 25% from other sources.

	Funding Gap (\$M)	50% Angels (\$M)	25% Sidecar Public (\$M)	25% Sidecar Private (\$M)
Scenario 1: Rhineland at 10% growth rate, using Globalization average funding	\$59.5	\$29.8	\$14.9	\$14.9
Scenario 2: Rhineland at 15% growth rate, using Globalization average funding	\$91.0	\$45.5	\$22.8	\$22.8

As per Scenario 1 in the model above, a sidecar of 29.8M\$ for the time period 2020-2025 to be adequate for Rhineland with funding equally being provided by government sources (14.9M\$) and private investment (14.9M\$), the latter being HNIs and Family Offices with in interest in the asset class but not being actively involved in the management of the portfolio.

The returns on government capital should be capped to provide greater upside potential for private Sidecar Fund investors, knowing the first several years are very difficult and negative returns are not abnormal, all the more in the to be expected post crisis environment. Supporting the ROI of trailblazing investors increases the probability of their longer-term engagement—rather than seeing them give up after a few failed investments and never to return.

This could complement the existing Germany wide INVEST Program, comprising a purchase grant and an exit grant. The purchase grant is a non-reimbursable grant, which provides business angels with a grant of 20% of their investment, given certain conditions such as investment size between 10,000€ and 500,000 and a maximum grant per year per investor of 100,000€. In addition, the Exit grant is 25% of the profit of a sale of shares, which were previously supported by the INVEST Purchase Grant.

This differs from our recommendation in the way that the government does not recuperate any investment gains - the grant is lost even if the angel investment successfully exits.



Introduce tools and processes to increase angel investment efficiency: This could range from cooperation with platforms such as 1000 Angels, which help investors source deals, to exploration of more advanced software such as CapLink. The latter streamlines the process of a business transaction, for example by offering deal rooms where both sides of the transaction are able to share information. Other effective tools include YouNoodle and the GEN Accelerates software platform.

Example: Angel Resource Institute

Objective: To provide education for investors and increase the number of angel networks

Short description: The Angel Resource Institute (ARI) is a United States-based nonprofit organization that carries out research and education activities related to the field of angel investing. It focuses on delivering top-notch education on proven best practices in angel investing to both entrepreneurs and investors, as well as delivering the most robust data trends in angel investing.

Key activities include:

- **Advocacy:** ARI champions Angel Investment and attracts new investors to its programs
- **Angel University:** Competency development for individuals
- **Angel Group Formation:** Mentorship and support for the formation of highly functional Angel Groups, incl. training for Angel Group Managers
- **Angel Accreditation:** A semi-formal accreditation that assist to credentialize Angels (and Groups) with potential passive investors
- **Dealflow:** Evaluating partners and structuring networks to enable sustained deal flow
- **Investment Readiness Coaching:** Practical advice for SSOP leaders, enabling them to advice their startups on getting investor and pitch ready

KPIs:

- Angel University and Angel Group Formation projects in 30+ countries globally
- Lead consultant on World Bank projects
- Leading authority and creator of the de facto standard book on Angel Investment



Example: Global Business Angels Network by GEN

Objective: to develop angel investor capacity and increase access to early stage capital

Short description: The Global Business Angels Network (GBAN) is a global community of business angel networks and organizations coordinated by the Global Entrepreneurship Network (GEN). It is an inclusive global community of early-stage investor networks seeking to increase access to early-stage capital by developing angel investor capacity in burgeoning entrepreneurship ecosystems.

Directed by leading angel investor networks around the world, GBAN mentors new national investor networks, provides training and support to improve investor capacity, amplifies the angel “voice” to regulatory issue discussions, advances policies removing barriers to investors and facilitates cross-border investing.

KPIs:

GBAN provides a platform of projects and programs in 170 countries aimed at making it easier for anyone, anywhere to start and scale a business or to invest.

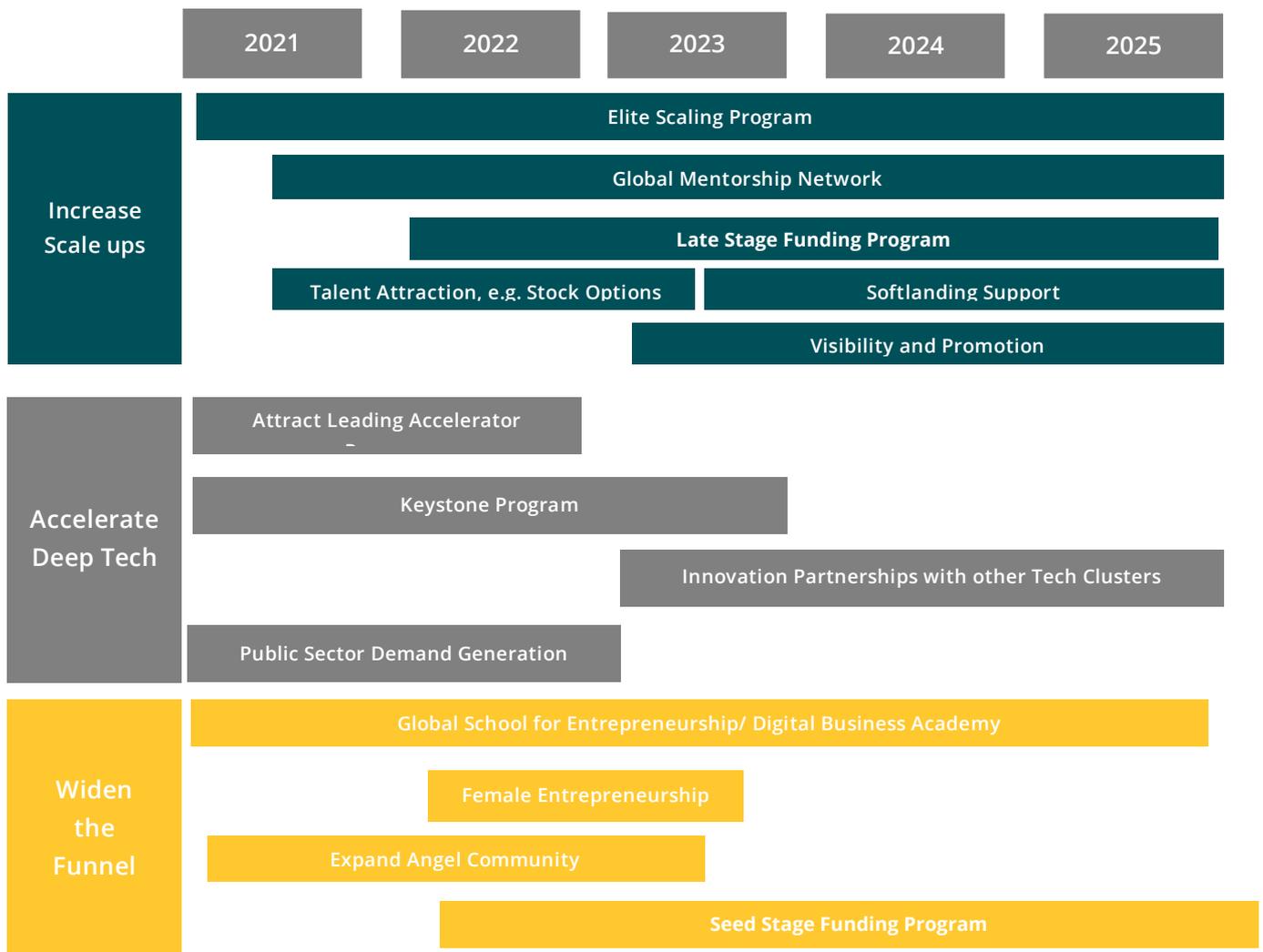


8. Roadmap

In order to reach the objectives outlined by Vision 2025, we suggest to time stagger the implementation of initiatives as outlined below.

To reiterate:

- We suggest prioritizing the Rhineland Elite program first in order to create a “pull effect” across the ecosystem.
- To accelerate Deep Tech with a focus on Excellence Clusters, we believe an international accelerator program to be a short-term fix, the latter to be further supported with the development of keystone team capability at the digihubs, innovation partnerships with international R&D and Ecosystem clusters such as Waterloo. Demand generation – i.e. challenges – should be introduced early on, particularly in light of private sector demand drying up during and post crisis.
- For Grassroots activation we only seek to address few existing gaps, e.g. an online entrepreneurship bootcamp, female investors and – importantly – the further increase in Seed Funding. The latter applies to Grassroots as well to accelerate Deep Tech.





9. Budget Outline

Scenario 1 (in M\$)

	Top Elite Program	Uni Acceleration		Grass Roots
Total Funding Required	\$75.9			\$59.5
of which State Funding Required	\$37.9			\$14.9

Program Costing	Top Elite Program		Uni Acceleration		Grass Roots	
	p.a.	Vision 2025 Total	p.a.	Vision 2025 Total	p.a.	Vision 2025 Total
Elite Scaling Program	\$0,3	\$1,2				
Global Mentorship Network	\$0,2	\$0,8				
Soft Landing Support	\$0,4	\$1,4				
Selective Talent Attraction	\$0,3	\$1,0				
Visibility / Promotion	\$0,2	\$0,8				
Keystone			\$1,0	\$4,0		
International Accelerator			\$0,3	\$1,2		
G4SE / DBA					\$0,3	\$1,0
Angel Program Operate					\$0,3	\$1,2
Female Angel Invest Operate					\$0,2	\$0,6

	Top Elite Program	Uni Acceleration		Grass Roots	
Total Program Operate Cost	\$5,2		\$5,2		\$2,8
Total Funding Required	\$76,0				\$59,5
State Funding Required	\$38,0				\$14,9
TOTAL NRW BUDGET	\$43,2		\$5,2		\$17,7

Grand Total	\$66.1M
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10. Methodology

The Startup Genome quantitative data infrastructure includes data on over 1.27 million companies, 250+ ecosystems, and survey data from more than 10,000 startup executives across the globe -- the Voice of Entrepreneurs.

Below is a description of the main datasets that make up this data science infrastructure:

- Startup Genome proprietary data:
 - Interview of 100+ Experts
 - 2017-2019 Startup Ecosystem Survey with more than 10,000 participants per year
 - 2020 COVID-19 Founder Survey with more than 2,000 participants
 - 2020 COVID-19 Knowledge Base with more 200 articles on policies actions taken all over the world
- Crunchbase: global dataset on funding, exits, and locations of startups and investors
- Orb Intelligence: global dataset on company information
- PitchBook: private capital market data provider
- Dealroom: global dataset on funding, exits, and locations of startups and investors
- Local partners (accelerators, incubators, startup hubs, investors):
 - list of startups
 - list of local exits and funding events

10.1 Data Sources

Primary Data Sources

- Startup Genome LLC (2017-2020). StartupGenome.com Database
- PitchBook (2018-2020), a private capital market data provider Database
- Crunchbase (2017-2020). Crunchbase.com Database
- CB Insights (2019-2020). Cbinsights.com Database
- Dealroom.co BV. (2017-2020). Dealroom.co Database
- Orb Intelligence Inc. (2017-2020). orb-intelligence.com Database

Secondary Data Sources

- Forbes 2000
- Github API
- International IP Index
- Meetup.com



- OECD, R&D Spending

Other sources from Life Sciences Rankings

- Salaries data from Glassdoor, Salary.com, and PayScale
- Shanghai Rankings
- Techboard
- Times Higher Education Rankings
- Top 800 R&D Hospitals, Webometrics
- USPTO
- WIPO
- World Bank, Ease of Doing Business

10.2 Key Concepts and Definitions

10.2.1 Key Concepts

Ecosystem Lifecycle Factors

Combined with some of measures from our Success Factor Model (discussed below), Ecosystem Lifecycle Factors measure different dimensions of a startup ecosystem. These allows us to determine the phase of development in which the ecosystem is in -- Activation, Globalization, Attraction, or Integration.

- Ecosystem Size: Ecosystem size or Startup Output refers to the number of technology startups that exist within that ecosystem
- Resource Attraction: captures the extent to which entrepreneurs move to an ecosystem to start a startup and how many startups relocate to an ecosystem. Increasing Resource Attraction at the national and global levels is an important determinant of an ecosystem's growth rate
- Startup Leakage: measures the percentage of startups that, in our global survey, reported leaving a certain ecosystem. A low score on Startup Leakage indicates that few startups have left that ecosystem in favor of another one
- Triggers: Triggers are the externally impressive exits and high startup valuations that spark a sharp increase in Resource Attraction, driving the growth of an ecosystem and its evolution to the next phase of the Lifecycle

Ecosystem Success Factors Model

Our principal analytical tool, this measures different dimensions of what supports the performance of local startups. We look at multiple factors for our rankings: one measuring actual performance, with other Success Factors associated with performance, each comprised of sub-factors and



metrics. These factors are highlighted in our Ranking Methodology section, as well as in each rankings section.

- Performance: A combination of leading, lagging, and current indicators that capture economic outcomes in a startup ecosystem
- Funding: The level and growth of early-stage funding, looking at both access and quality.
- Market Reach: Measures early-stage startup access to customers allowing them to scale and “Go-Global.”
- Connectedness: Measures how connectedness within the ecosystem and the supporting infrastructure
- Resource Attraction: The gravitational pull of an ecosystem in drawing in entrepreneurs and startups from elsewhere
- Startup Experience: The depth and diversity of the pool of prior startup experience in an ecosystem
- Talent: Measures the accessibility, quality, and cost of software engineering expertise.
- Founder: success factors related to the startup founder, under his or her control, or internal to the startup as opposed to external (a function of the ecosystem)
 - Founder DNA: The background, experience, ambition, and motivation of local founders
 - Founder Go-Global Strategy: measures whether a startup is going global from the outset or first targets its local market, and whether its customer acquisition team is located, targeted, and skilled to succeed
 - Founder with High Ambition: Founders who expressed all of the following attributes: Total Addressable Market of 30B\$ or more; developing a globally-new, or one of the globally-leading or niche products; and the mission to change the world, get rich or create a great product
 - Founders with Experience in Sub-Sector: founders who considered their graduate or postgraduate degree to be directly relevant to their startup
- Local Connectedness: A multi-variable assessment of the local community, including sense of community, relationships, and collisions between founders, investors, and experts
 - Sense of Community Index: a sub-factor of Local Connectedness capturing the degree to which founders informally receive help from investors, experts, and fellow founders
 - Number of Relationships Between Founders: number of quality relationships between local founders, where they know each other and can call upon the other for help “this week”



10.2.2 Glossary

Key Definitions

Startup

A technology-enabled business that is less than 10 years old. Steve Blank defines a startup as a “temporary organization in search for a repeatable and scalable business model.” We use this definition to look across sectors and sub-sectors, including software, hardware, health, energy, and others, and we use these parameters for data collection purposes.

Startup Ecosystem

A shared pool of resources, generally located within a 60-mile (100-kilometer) radius around a center point in a given region, with a few exceptions based on local reality. Resources typically include policymakers, accelerators, incubators, coworking spaces, educational institutions, and funding groups.

Ecosystem Value

A measure of economic impact, calculated as the value of exits and startup valuations over 2017, 2018, and the first half of 2019

Total Early Stage Funding

Total Seed and Series A funding in tech startups in 2017, 2018, and first half of 2019

Software Engineer Salary

Average software engineer salary (lower is better): from Glassdoor, Salary.com, and PayScale; as well as local sources when applicable

Median Series A

Median of Series A rounds in tech startups in the ecosystem for a 2.5 year time period (2017, 2018, and first half of 2019)

Median Seed

Median of Seed rounds in tech startups in the ecosystem for a 2.5 year time period (2017, 2018, and first half of 2019)

Sector and Sub-Sector Definitions



Below is our definition for each startup Sub-Sector analyzed here. Note that sub-sectors are not mutually exclusive nor comprehensive — some startups are in sub-sectors we did not consider.

In addition, at least from patents, the data shows a clear tech convergence. Technology like AI software are increasingly inter-related, and we would expect a similar convergence overtime for Startup Sub-Sectors.

For more detail, including in our machine learning classification of sub-sectors, please see our Startup Classification sub-section in this Methodology. For more coverage on each sub-sector, please see their respective sections in the report.

Advertising Tech (Adtech)

Advertising Tech captures different types of analytics and digital tools used in the context of advertising and marketing. Extensive and complex systems are used to direct, convey, or monitor advertising to target audiences of any size and scale.

Advanced Manufacturing & Robotics

Advanced Manufacturing involves smart technology to improve traditional manufacturing of products and/or processes. Robotics is the science and technology of robots, their design, manufacture, and application.

Agriculture Tech (Agtech)

Agriculture Tech captures the use of technology in agriculture, horticulture, and aquaculture with the aim of improving yield, efficiency, and profitability through information monitoring and analysis of weather, pests, and soil and air temperature.

Artificial Intelligence, Big Data & Analytics

AI, Big Data & Analytics refers to an area of technology devoted to extracting meaning from large sets of raw data, e.g. often including simulations of intelligent behavior in computers.

Blockchain

Blockchain is a decentralized data storage method secured by cryptography. Cryptocurrencies are one of many innovations utilizing the blockchain. Companies building their product/architecture on top of this decentralized and encrypted technology are defined as blockchain companies.

Cleantech

Cleantech consists of sustainable solutions in the fields of Energy, Water, Transportation, Agriculture, and Manufacturing that include advanced materials, smart grids, water treatment, efficient energy storage, and distributed energy systems.



Construction and Property Tech

Construction Technology refers to technology that can improve the construction processes and methods including productivity gains, cost savings, improved safety, shorter lead times and maximised resources etc. Property tech refers to the technology that helps organizations and individuals research, buy, sell, rent, lease and manage real estate. Methods include searching for property, listing available properties, setting up viewing dates and finalizing the lease agreements and deals.

Consumer Electronics or Home Electronics (includes Wearables, Smart Devices)

Consumer Electronics or Home Electronics are electronic or digital equipment intended for everyday use, including smart devices used for entertainment, communications, and home-office activities as well as other wearables.

Cybersecurity

Cybersecurity is the body of technologies, processes, and practices designed to protect networks, computers, programs, and data from attack, damage, or unauthorized access.

Education Tech (Edtech)

Education Technology refers to an area of technology devoted to the development and application of tools (including software, hardware, and processes) intended to redesign traditional products and services in education.

Fintech

Fintech aims to improve existing processes, products, and services in the Financial Services industry (including insurance) via software and modern technology.

Gaming

Gaming involves the development, marketing, and monetization of video games and gambling machines, as well as associated services.

Government Tech (Govtech)

Govtech is the infrastructure of technology that the governments and government institutions use to provide specific services to its citizens with the aim of improving public service. This technology enables the government to effectively operate in a way that increases transparency and maximises public welfare and involvement.

Life Sciences

Life Sciences is the sector concerned with diagnosing, treating, and managing diseases and conditions. This includes startups in Biotech, Pharma, and Medtech (also referred to as medical devices).



Authored by:

Stephan Küster

Head of Ecosystem Development
stephan@startupgenome.com

Patricia Russ

Senior Consultant
patricia@startupgenome.com