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START-UP or START-APP

Why Breakthrough Start-Ups often fail

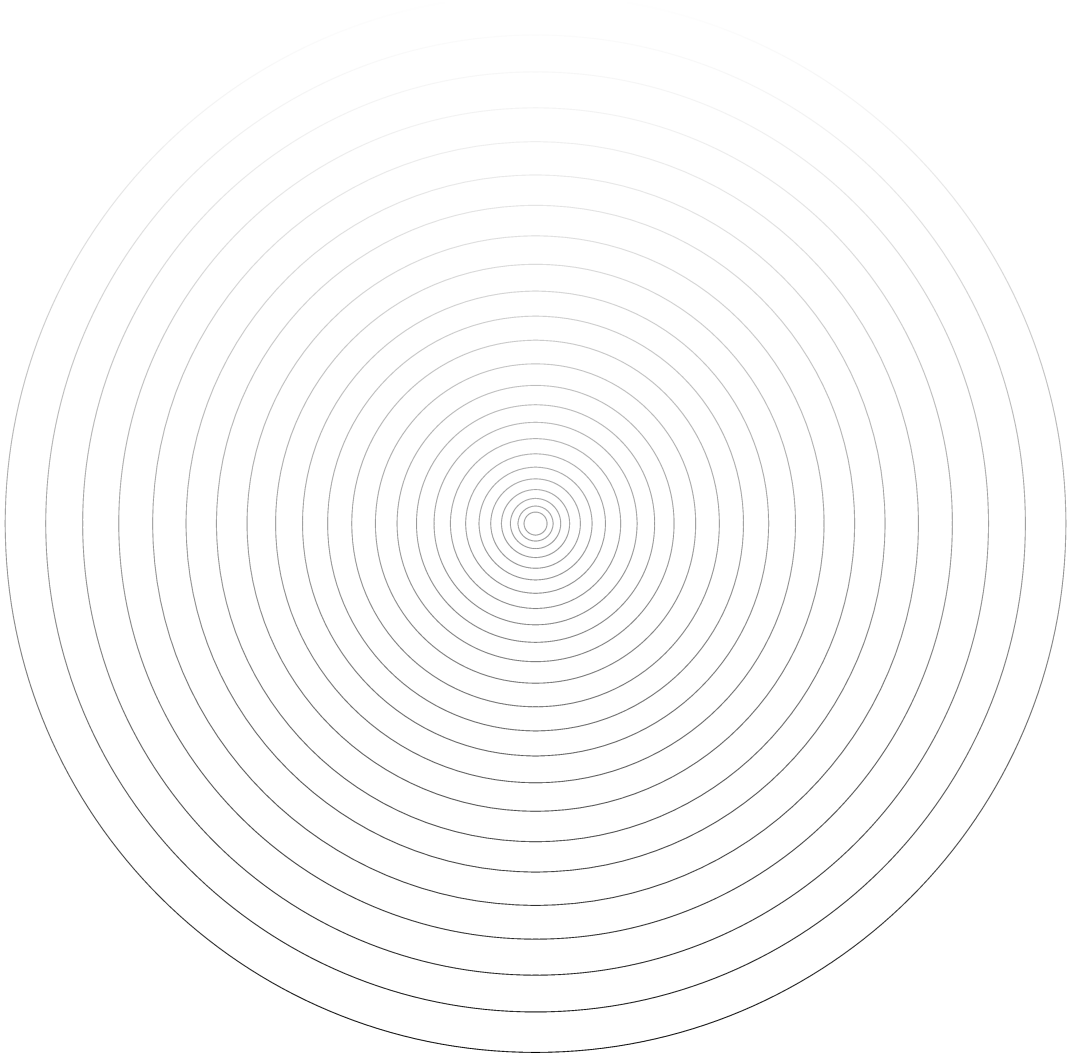
With case studies from the Dutch Brainport Eindhoven

CONTENTS

	Preface	7
	Introduction and reading guide	13
1	**Start-ups**	25
1.1	Definitions	26
1.2	Number of start-ups	29
1.3	EU-classification of companies	30
2	**Innovation**	33
2.1	Introduction	34
2.2	The stages of innovation	35
2.3	The model of Anderson and Tushman	38
2.4	Where breakthroughs come from	51
2.5	An enhanced innovation model	57
2.6	Evaluation	62
3	**Breakthrough or Incremental Innovation: With which do we engage?**	73
3.1	Introduction	74
3.2	The innovation goal of a company	74
3.3	Active versus reactive attitude towards innovation	76
3.4	Start-ups and innovation	87
3.5	Openness, hospitality, reciprocity, and complementarity	96
4	**Business strategies and financial models for breakthrough start-ups**	103
4.1	Introduction	104
4.2	Go for the ultimate product in 'one jump'	107
4.3	Go for the proven principle prototype, tell the story, 'hype it' and sell	109
4.4	Go slower for the ultimate product via intermediate products	113
4.5	Evaluation	116
5	**Heritage**	119
5.1	Introduction	120
5.2	Company heritage	124
5.3	Regional heritage	130
5.4	Enrichment of heritage	133
5.5	Coping with cultural differences	144
6	**The role of the state in innovation**	147
6.1	Government involvement	148
6.2	The state as venture capitalist	155
6.3	ROI for the state	196
6.4	Perseverance in economic downtimes	202
7	**Networks, campuses, and projects**	219
7.1	Introduction	220
7.2	Sector and local based networks, and intra-network collaboration	223
7.3	Campuses	233
7.4	Open innovation projects	234
7.5	Improving ecosystem's effectiveness regarding start-ups	251

8	**Field labs, demonstration projects, and launching customerships**	261
8.1	Introduction	262
8.2	Characteristics of highly innovative products	264
8.3	Field labs, demonstration projects and launching customerships	272
9	**Case studies**	281
9.1	Introduction	282
9.2	Rose	283
9.3	Smit Ovens	289
9.4	QTIS/e and Xeltis	293
9.5	All Green Vehicles	297
9.6.	Drivetrain Innovations	301
9.7	Blubrake	305
9.8	Closing remarks	309
10	**Epilogue**	311
10.1.	Validity of this book	312
10.2	The increasing importance of start-ups	313
10.3	Developments regarding start-ups' financial strategies	317
10.4	New ways of funding	319
10.5	Room for improvement	320
10.6	Opportunities of Horizon Europe	323
10.7	Finally	335
	Amenability	327
	Acknowledgement	328
11	**Appendices**	331
11.1	The Brainport Region Eindhoven	332
11.2	'Hidden Champions'	335
11.3	The history and heritage of the Brainport region	338
11.4	The enrichment of the heritage and economic structure of the Brainport region	349
11.5	The six dimensions of Hofstede	354
11.6	Realignment of Brainport's strategic agenda	355
11.7	Brainport's investigation into SME's experience regarding European schemes	359
11.8	The introduction and launch of new consumer products	362
11.9	The government debt	364
11.10	Programmes and projects	379
	Bibliography	384
	List of figures	392
	List of tables	393
	List of boxes	393
	Index	394

Preface



In April 2015 we still had enough money to carry on for two more months, negotiations regarding a bridging loan were again stretched for time and would not be successful in the short term. Time for crisis consultation!
In 2013 we had started Rose with the help from a healthcare insurance company as a financial and strategic partner – Rose was a start-up with the mission to develop and market care robots. We only had enough money for two years, so from the start, we worked on getting the second round of funding (*Series B financing*[1]) arranged. This quest for capital, which absorbed a great deal of our time and energy, had not been successful so far and we concluded that it never would be, not in time. In the shareholders meeting of April 29, the management team and shareholders agreed that it was no use to carry on this way. Therefore, we saw no other option than to terminate Rose from June 1st.
From then on, it all went very quickly. On April 30th, we dismissed the staff and informed our business partners; on June 1st, the staff had left, prototypes were donated to befriended development partners, any inventory was sold, and the offices were then empty. For the rest of 2015, I found myself busy dealing with any contracts, remaining financial matters and the dissolution of Rose. In early 2016, Rose was deregistered from the Chamber of Commerce records. A promising adventure that started in 2009 had ended.

At first, I was shaken – in the months after this, angry – and what remained in the end, was astonishment and disappointment. How had it been possible that a spinoff from the University of Technology Eindhoven, staffed by excellent scientists, smart young engineers and experienced management, supported by a renowned healthcare insurance company, located in a high-tech region and working on solutions for one of the greatest challenges of today – care for an ageing population –, had not managed to survive? How could we have been so wrong in our assumptions and judgment?
Rose was not on its own, it worked in an innovation environment (*ecosystem*[2]), so there were also questions: Had we worked with the ecosystem optimally? Also, had this system itself provided appropriate support? Moreover, if we, the system or both had not done this, then what would be any recommendations for improvement?
Rose, in the end, found itself financially locked-in. The funding from investors and *public schemes* – i.e. subsidy programmes –, on which it depended, did not arrive in time. In times when private capital is hard to get, government subsidies become more important for *breakthrough start-ups*[3]. However, we experienced that finding your way in the subsidy system and actually acquiring funding is very difficult, especially for overloaded start-up entrepreneurs. Moreover, we found that such schemes are quite unreliable and an inconsistent source of financing. This raises the question as to what roles the state and governmental institutions exactly play towards stimulating innovation, and how should these be actually improved to provide adequate and more reliable support.

It is more productive to search and analyse to find answers to questions, than to stay angry and disappointed. So, I decided to try to find the primary and underlying causes for our failure and to distil *lessons learned* from this, to do it better next time and to advise (young) entrepreneurs to do better.
I thought about the crucial occurrences regarding our case, read about other cases, discussed matters again with some colleagues and partners we had been working with, and I immersed myself in innovation theories in order to find out what had gone wrong. However, most of all, I reflected on personal experiences gathered during the project; a project which started with drafting a roadmap for service robots.
In this book, I have laid down the results of this quest and analysis.

Start-ups are popular, there is a lively discourse about their importance for the social-economic tissue of regions, and many books and papers have been written on the subject. So, why add yet another book to the many that already exist? The main reason for this is that most literature only mentions the successes of start-ups. However, the literature does not mention the failures. I believe that we can especially learn from the flops, particularly if we hear about these flops from the entrepreneurs themselves. I believe the inside experience and analysis from the practitioner will add something valuable to the discussion. In this book, I try to give an answer to the comprehensive question that hides in the book's subtitle: *'Why Breakthrough Start-Ups often fail.'* I do this mainly from my experience as co-founder and director of Rose, and from the point of view of a critical observer and consultant. However, to get the complete picture, it was necessary to transcend my work on start-ups and utilise experiences from other roles I have fulfilled in my career. Reflecting my personal experiences on the applicable theory is **the** recurring theme in this book. The ones who argue that because of this approach *(n=1)*, the answers express an opinion rather than provide the truth based on broad research, are right to a certain extent. However, on the other hand: 'is practising one's profession not just like working in a laboratory where experiments constantly take place, which in turn prove or reject theories, hypotheses, and assumptions?'
In order to present the matter from different perspectives, I have incorporated the views and comments of professional practitioners working on different positions in the innovation arena (Acknowledgement). To mitigate the risk of giving only 'an opinion', I, moreover, have linked my experiences and observations to theoretical frameworks and insights from innovation and business science. My discussions with Prof Dr Frank Go[4] and Dr Ad Breukel[5] on, in particular, the *innovation cycle* and the concepts of *heritage* and *hospitality,* have been very enlightening in connecting the dots.
In my quest for answers, I have put the specific innovation model of start-ups in the broader perspective of innovation as a whole. This means that I have positioned the innovation undertaken by start-ups, in particular, breakthrough

start-ups, in its relation to the activities and contributions of the other actors in the arena: universities, knowledge institutes, large companies and other SMEs[6]. My personal experiences from (open) innovation and R&D projects as a research engineer, project manager, director and as an *interim manager*[7] in innovative industries, have helped do this. The analysis applies to innovation in general and gives an application to the Netherlands, more in particular to the Brainport Region Eindhoven[8], which I also alternately will indicate as *Brainport Eindhoven* or simply as *Brainport*.

First of all, the book deals with the challenges and pitfalls that tech start-ups – in particular the break-through start-ups – encounter within the very early years of their existence. It also deals with the innovation process as a whole, the different stages of the innovation cycle, ecosystems, *open innovation*[9] (Chesbrough, 2003), the particular role different actors play and the interaction between the players. Altogether, I believe that this work provides a holistic view and insight, which makes it useful to a variety of stakeholders in the system, but which is also interesting to outsiders. The following groups of readers will find (parts of) this work of particular interest:

1 In the first place, the book is meant for start-up entrepreneurs, to help them understand better their position within the innovation cycle and their interaction with other actors and stakeholders in the network; a network they need for bridging the difficult period between proof-of-principle and first operational income (the valley of death);

2 Secondly, the many graduate and doctorate students who are thinking about starting their own company based on their graduation work but lack entrepreneurial experience. They form a special group within start-up entrepreneurs. I especially want to give them a helping hand. I believe that the experience and advice laid down in these pages are worthwhile to this group, in particular to those who are embarking on a tech or breakthrough start-up;

3 To any students of *Industrial Engineering* and *Business Administration* in their final year, the book provides background and insight into the practices of their profession. I, therefore, hope that the book will be used in lectures on innovation and entrepreneurship and courses to support entrepreneurial graduates. As parts of the book may require too much background knowledge for these students, the build-up has been chosen as such that they may skip these. The chapters may be read as separate parts;

4 Investors and governments are the fourth target group. As investors and boosters of innovation, they are crucial for the success of start-ups. I

therefore sincerely hope that they will take note of my experiences and observations and will take them into account in their plans, assessments, and decisions;

5 Incumbent companies – which could contribute more to a fertile climate for tech and breakthrough start-ups – will also find information on the needs of start-ups but moreover, information regarding the benefits which cooperation with start-ups may bring;

6 To researchers, the book reflects the experiences of a practitioner regarding the innovation theory. Also, to those among them who want to deepen their knowledge and contribute to the debate, the book offers context as to the *Brainport Region Eindhoven* (appendices 11.1, 11.3, 11.4, 11.6 and 11.7) and entrances to independent source research;

7 Also, finally, this book is meant for the interested layman (male/female). Although they may be an experienced reader, they may have some difficulty with the business administration language and context. However, I am confident that after having read the introduction and with the help of the footnotes, they easily will manage to understand the book and its message.

Although usefulness and business are essential for continuity, innovation especially is still interesting and fun to work on. It is learning about new things and pushing technical and personal borders. Though the main subject is *lessons learned,* I have tried to bring that fun aspect across too.

I hope that I have made you curious as to what follows and that you are eager to proceed. I hope that your curiosity will be satisfied and, not least important, that you will enjoy reading this book.

Henk Zeegers
Veldhoven, January 2020

1.1 Definitions

Depending from which perspective you look, there are several definitions of *Start-Up* in circulation. Financial institutions, for instance, place, a bit one-sided, much emphasis on growth strategy and scalability. The economic bureau of ING bank describes a start-up as *'an organisation looking for a globally scalable business model.'* (Jongkind, 2015). However, this definition fits not only starting companies but also any existing one with a global growth strategy. So, the definition at least needs the addition that it concerns only new organisations. Then, in my opinion, the definition still covers too many companies and does not precisely pinpoint the companies we have in mind here. This, however, is important because the precise nature of a starting company always proves to be decisive for its chances and challenges, and in the end its success or failure. So, if we want to follow and study these companies, we need to have a precise definition.

What are the distinguishing characteristics of a start-up? Also, are all start-ups the same or is there variation among them? Also, if there is variation – what then are the different challenges and opportunities of these variations? These are all critical questions that require answers.

In my definition, start-ups differ from other new companies in the newness of the business model or of the technology they are founded on. Start-ups utilise new business models or new technologies or both. Moreover, in the context of this book, the new technologies are *cutting-edge,* hereby meaning the latest and most advanced. Those new companies that do not utilise new business models or technologies – which is most of all new companies – merely copy existing companies. Many new (chain) stores, trading companies, building companies, suppliers, commodity manufacturers and consultancies are examples of this category. I call them *copycats* (Fig. 1.1).

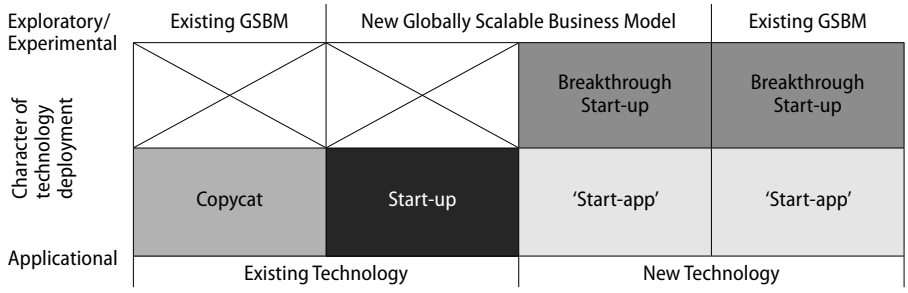


Fig. 1.1 New companies with a Globally Scalable Business Model (GSBM) in the technology-business model diagram

Apart from newness, a prerequisite for being a start-up is to strive for global scalability. In other words: start-ups apply *Globally Scalable Business Models (GSBMs).* So, in my definition, a start-up is: *'A new organisation, based on a new globally*

A serious problem here however is that the government's support is not consistent and sustainable (section 6.4: Perseverance in economic downtimes). As a result of changes in the political landscape, changing societal priorities, sudden austerity measures or the work of lobbyists, it often happens that governments suddenly quit or reduce the support for a certain technology or sector, which results in the failure of new products that are under development. Examples are green technologies and complex products for public care and health. Therefore, start-up entrepreneurs should investigate the risks of an unexpected abortion of the support beforehand. They can do this by assessing the size, duration, and chances of success of the schemes currently in force, and by evaluating the expected political climate with respect to their subject by the time current schemes are finished.

Because of all the complications and dependencies, the approach described in this section remains risky for tech and breakthrough start-ups. The confidence of private investors and consistent government support is essential for the success of this financial model. If investors and countries lose their patience or interest and 'pull the plug', then all effort and investment (public and private) is lost. A recent high-profile example of this is the bankruptcy of Mapper Lithography in December 2018 (Houtekamer, 2018) (NRC e. o., 2018-12.28). A bankruptcy is often *finally fatal* for the start-up (or scale-up in Mapper's case) because it is hard to get the momentum back in a project once it has been discontinued and the key people have left the company.
To conclude, we may say, that, although the road to a completely new product in 'one jump' is accessible for start-ups, it is exceedingly difficult and only a few succeed.

4.3 Go for the proven principle prototype, tell the story, 'hype it' and sell

This strategy is aimed at mitigating the risk of financial lock-in, by selling the start-up to a large incumbent company as soon as certain *technology readiness levels (TRL[91])* are achieved. TRL6 is an often used level for innovations breakthrough start-ups work on: TRL6 is the *prototype demonstration* in a relevant environment. Preferably this achievement should be accompanied by positive market feedback and publicity. The achievement of certain TRLs marks points on the *value creation chain* where the value of the innovation, or the development in progress, has changed significantly. Besides prototypes, also, finishing a proof of principle study, type approval, readiness for manufacturing, and first products from production, are such points. We call these *value inflexion points[92]*. In the pharmaceutical industry, finishing the animal toxicity study and successful human testing are well-known value inflexion points.
Professional investors and venture capitalists steer on value steps. It is their business model to 'step' into and out enterprises at beforehand strategically

defined value inflexion points, with the intention to 'cash' the value which has been built-up between entry and exit.
In Fig. 4.1, the value creation during the R&D phases is visualised; at any value plateau the sale of the value proposition is possible. The sales price is higher the more value has been built up.

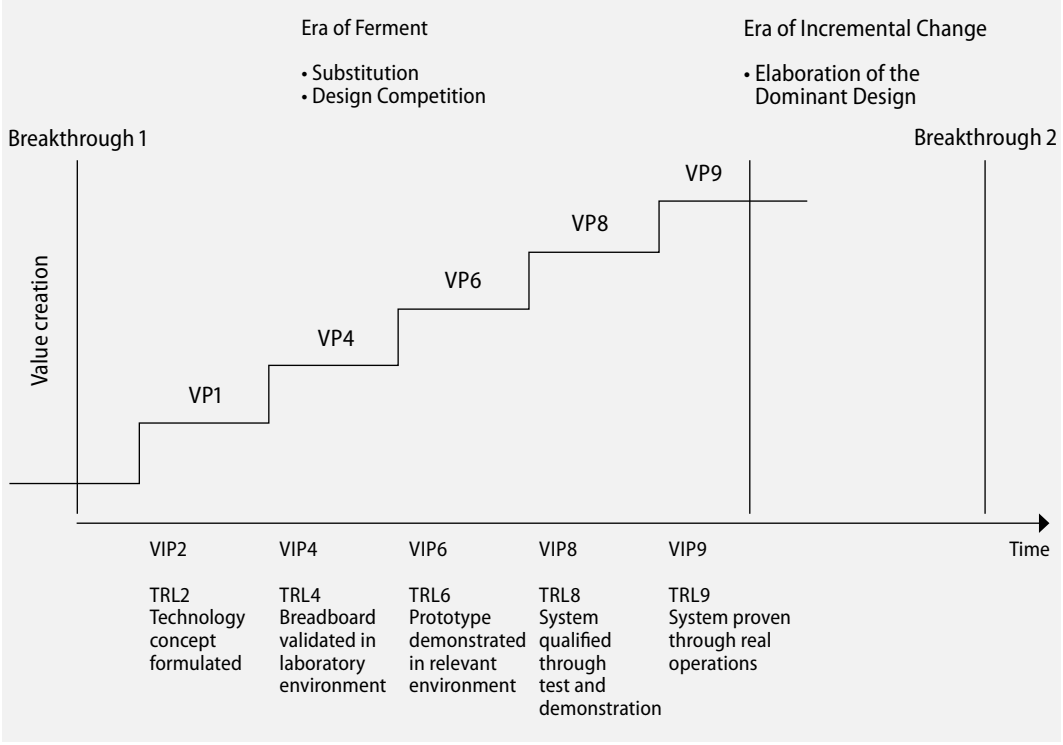


Fig. 4.1 TRLs and value plateaus in the value creation chain

So, tangible results are key in this strategy: they draw the attention of incumbent companies and may trigger a takeover. A good deal provides the start-up with a solid base in terms of resources as well as skills, which enables the rapid finalisation of the development, the roll out the product and the scale-up of the enterprise.
A positive, not intended, effect of this strategy is that the tangible intermediate results may be so convincing that investors, who refused participation before, are still enticed to invest in the start-up. This would still enable the independent development of the ultimate product. If this happens, and no other advantages of a take-over are in play, the take-over route can be abandoned. Although it is not the main objective of this strategy, why not utilise the opportunity?
So, if we assume TRL6 as a logical point in the development to sell the value proposition (which equals the start-up), this strategy focuses on the design,

build and demonstration of a (preferably patented) prototype. Furthermore the attention must be on the narrative and communication, creating the momentum ('hype'), and selling the company at the right time.
For the trustworthiness of the proposition, it is immensely useful to have the prototype independently evaluated by a renowned knowledge institute. Many inventors leave this behind: the reasons for this are not always clear. I remember that years ago I advised a company who had invented an advanced inlet-valve for internal combustion engines, that would, according to the company's own measurements, increase the efficiency of the engine by 25%. Although it was evidently important for raising capital, the company was very reluctant to have the design evaluated by an independent third party: I still do not know why. Several years later, the same happened. I then was involved in a start-up that invented a continuous variable transmission for bikes that would increase comfort and efficiency enormously, and again I met a dismissive attitude regarding the involvement of third parties. Whether it is the fear to reveal the 'trick' or simply (the wrong kind of) frugality, I do not know, but, anyway, some entrepreneurs do not seem to understand the importance of independent evidence to convince investors. A trustworthy report and a strong patent show that the prototype works, and that the IP is defendable, two especially important aspects for an investor.
To carry out the strategy successfully, a plan must be in place that ensures that, from the moment the enterprise is started, predefined, tangible and convincing TRLs are achieved which, moreover, draw the attention of the *outside world* and the larger players in the industry. The company, from the beginning, has to also have a good narrative to communicate, 'packed' in an attractive and appealing presentation.
In order to have several options in the negotiation process, preferably more than one party should be interested in the start-up. Whether this is possible, will depend on the potential of the offering, but partly it is beyond the control of the entrepreneur and his advisers – for instance, oligopolistic sectors only have few players to deal with.

For the start-up entrepreneur, the take-over is an exciting and complex process which takes a lot of time, attention, and energy. Therefore, they should ensure adequate internal support as well as external advice from specialists and experienced entrepreneurs. Because th e negotiations distract any attention from the ongoing operations, it is necessary that the entrepreneur delegates his operational tasks to other management team members during the process.
In a takeover deal, timing and approach are crucial for the start-up entrepreneur because he would like to get a reasonable share of the 'cake'. It happens too often, that the ones who had the idea and put in the hard work and effort, are not the ones who profit!

strength and health of a country. In Europe, certainly the prerequisite that all countries must comply with the same rules (of the Stability and Growth Pact), although they are quite different, has forced the social-economic strong countries into a straitjacket which restricts their movement more than desirable. Former European commissioner Frits Bolkenstein says: 'The fundamental problem of the *European Monetary Union* (EMU)[155] is that it both assumes a *one size fits all* and also strives for this.' (Bolkenstein, 2016)[156].
Although the Stability Pact is a questionable measure for healthy economies, all members of the EA comply with the limits of the pact. Box 6.6 shows the consequences of the EA rules for the deficit and government debt. However, by living by these limits, strong member states restrict themselves and cannot follow a policy that would be best for them to fight recessions and strengthen their economy.

Box 6.6 The evolvement of the government debt

The evolvement of the government debt is a function of the budget balance, the economic growth plus inflation, and the financial transactions. In appendix 11.9 the mathematical model is derived and worked out which describes this function. The model enables for instance the simulations of the impact of additional investments in innovation on the Dutch government debt, which is discussed in 6.4.3. The model shows that (if the positive and negative financial transactions on average are in balance) the relative Government Debt (γ) converges to approximately the ratio of relative Budget Deficit (β) over Growth-plus-Inflation Rate (α); In formula form: $\gamma=\frac{\beta}{\alpha}$. Regarding the Euro Area (EA), this for example means that if countries would allow the maximally allowed deficit of 3% from the Stability Pact, they can only keep the debt below the 60% limit if the growth plus inflation is at least 5%. However, 5% is a high growth-plus-inflation rate which not often is achieved; therefore the deficit must in practice be (much) lower than 3% on average in order to keep the debt below 60%.
For any new combination of α and β it takes time before an equilibrium of the government debt γ is reached. Depending on the magnitude of the changes of $\frac{\beta}{\alpha}$, this time may be considerable. If in times of crisis the $\frac{\beta}{\alpha}$ ratio is high, γ will move towards an (unacceptable) high value, however, this will not be reached if the ratio is timely reduced again. This is the reason Prof van Duijn sees no harm in temporary high deficits during crisis as he states at the beginning of section 6.4.2. The high Dutch deficits in times of crisis have never caused an unacceptable high debt in the long run because, each time a recession or crisis was over, the government returned to balanced budgets, surpluses or low budget deficits. In this way, the $\frac{\beta}{\alpha}$ ratio was, on average, kept at a rather low value and, hence, the government debts in the past were even much lower than the 60% which nowadays is enforced by the Stability Pact.

An interesting question is what the consequences for the government debt would have been if governments would have been more flexible regarding deficits caused by expenditures concerning important structural areas of the economy and society. In appendix 11.9 the answer to this question has been worked out for the Netherlands. Simulations show that substantial investments in innovation during the crisis would have had only a modest impact on the government debt at the end of this crisis (2017). An additional yearly investment of 0.3% of GDP in innovation in the period 2009-2015 would have ranked the Netherlands amongst the best in class countries worldwide regarding public expenditure on R&D (Korea: 1.05% of GDP) and would have considerably increased the Dutch innovation power. The investment involved would have resulted in an increase of the government debt of 1.7% by the end of 2017 (Fig. 11.16).
An increase of the budgets for Education, Science, Infrastructure and Economic Structure Reinforcement by 5% (approx. 2.3 billion euro annually) during this period, on top of the additional investment for innovation, would have required an increase of the deficit of an extra 0.36%. The total increase of the deficit of 0.66% would have resulted in an increase of the government debt of 3.8% by the end of 2017 (Fig. 11.17).
With view on the prosperous recovery of the world economy after the crisis and the opportunities this offered, it is most likely that this additional investment in these essential pillars of the economy and society would have turned out to be an excellent investment.

However, following a policy of anti-cyclical investment is not unconditional. In first place, following Keynesian economy policies has two sides: to be able to spend during economic lows, financial buffers must be created during economic highs. These buffers are necessary to absorb the first and most serious shocks when the economy gets in a recession. Euro group chairman Dijsselbloem brings this forward (Dijsselbloem, 2018) and, at this point, we can only agree with him.
Admittedly, creating buffers did not happen enough during the economic boom that preceded the crisis. This restrained the financial manoeuvring space of most European countries when the crisis broke out, and certainly in the course hereof.
Besides the condition that the state should be in fundamentally good economic shape and have enough financial buffers, spending itself should be bound to strict rules.
Firstly, the innovations, in which the nation invests, should have been selected with well understood mechanisms in the way we have discussed before to ensure their relevance.
Secondly, public-private cooperation should be symbiotic.
Furthermore, the third condition is that governmental agencies closely monitor the innovation projects, and, if necessary, correct these, to ensure the quality of the results.

Summarising, investments in innovations at the cost of higher deficits can be justified in my opinion, if the following conditions are fulfilled:

1 The government has formulated an articulated vision on the upcoming GPTs and on the areas of (future) economic importance for the state;
2 The government has clearly determined the GPTs and projects it should invest in and has carefully selected the partners with whom the objectives can be best achieved. This first requires appropriate selection mechanisms for technologies, projects and partners; in other words: it requires appropriate *picking the winners methodologies* which are accepted by the stakeholders whose collaboration is required. However, most of all it requires politicians who have the guts and vision, who take responsibility and risk, and can convey the underlying narrative to the public and get this behind their plans;
3 Public agencies and civil servants monitor and, if necessary, correct innovation processes to ensure the value of the results for the society. This should not be done in the bureaucratic manner, which is practised today, but in an entrepreneurial way, focussed at tangible, useable end-results;
4 Public-private cooperation is symbiotic, which means that both the cost **and** the profits are shared;
5 Finally, that politicians themselves take responsibility for the results of the major innovation programmes. Again, not bureaucratically but pragmatically.

Especially in difficult economic times, when resources are scarce, independent public *top down* selection mechanisms may collide with private *bottom up* demands. However, this must not scare off, on the contrary: 'there is no shine without friction.' Differences of opinion are worthy as they provoke discussion and debate which leads to better outcomes. In any case, discussions should, as much as possible, be conducted based on facts and evidence. For the consequences of not doing so, I refer to the case of the Dutch gaming industry we have discussed in 6.2.3.
Designing and applying national innovation policies is not easy, especially because there are many different opinions about the role of the state and the ability of the state to control economic processes. Decision making in democracies is truly complex – restrictions opposed by super layers of governance, such as the rules of the European Monetary Union (EMU), make policy making on national level even more complex. Moreover, it is also true that public monitoring and control of projects is not perfect. However, all these arguments do not justify refraining from investments in the important public domains in economic downtimes. Because of the defects, many believe that entrepreneurship and industry policy by countries is a bad idea and therefore they prefer low deficits to investments. They would rather turn to austerities and thereby take for granted that

implementation require interaction with the market and, sometimes, the society and governments. Field labs, Demonstration projects and Launching Customerships are instruments to shape and facilitate this interaction: Field labs in the phase of pre-development for the optimisation of product concepts and specifications; Demonstration projects for showing and testing new technologies/products and sensing their reception by the market and the public; finally, Launching Customerships for the finalisation of the co-creation process and starting commercialisation.

8.3 Field labs, demonstration projects, and launching customerships

Field labs, Demonstration projects and Launching customerships are indispensable tools for the development and introduction of new products. In the previous section we have discussed the diverse new products and have connected these to the most appropriate instruments to use.

Private parties (like OEMs, suppliers, providers, operators, customer boards and associations, end-users, and researchers) are all, depending on their role, involved in one or more of these instruments – Governments, on the other hand, in practice, mostly play a role in demonstration projects, and act as launching customers of public goods and services. In field labs, they are normally involved as co-funders, either of a separate field lab or of a more comprehensive R&D project in which field labs are embedded.

From a perspective of efficiency, it is sensible that governments go beyond the backing of 'hard' R&D and commit themselves more to the three additional instruments. By 'going this extra mile', countries increase substantially the chances of success of implementation of innovations and, as a beneficial by-product, they increase the chances of the return on their investments in these innovations.

In the following section, I deal with each instrument in more detail. For this, I first illustrate the instrument by an example, then delve into its characteristics and benefits, and finally make some closing remarks.

8.3.1 Field labs

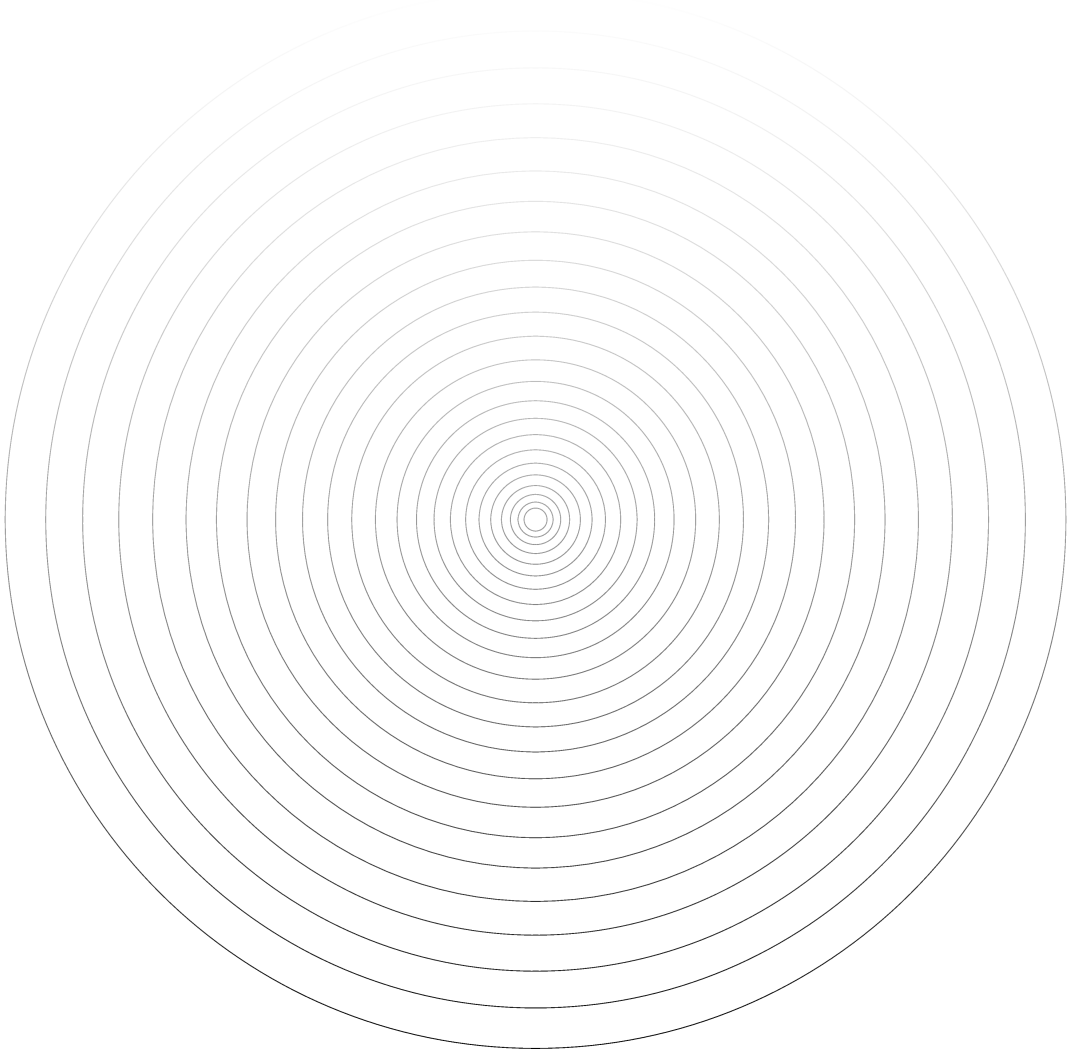
Robot Rose is a care robot designed to be operated (at least initially) by a distant professional in a care centre, giving care to elderly or physically limited people who are either living at home or in elderly and nursing homes. Care robots will, for a considerable number of years, not be personally owned but owned by care organisations who provide *robot-assisted-care as a service*. Insurance companies or *social security funds* mostly reimburse the cost of robot assisted care within a legal framework. Not only is the robot an advanced product, its implementation, operation and embedding into the allocation and financial reimbursement systems make it an even more complex product to implement.

The care robot is by many seen as a *challenger* because it is supposed to substitute human care and displaces human care givers. However, this is not the case: for the near future, robots **cannot** replace human care because their performance is too limited – in the long term, they **will not** displace people as we, at least in the West, will face a huge shortage of care givers in the coming thirty years due to demographic trends. Therefore, we, as a society, need care robots in addition to the available human care givers, in order to cope with the challenges of an aging society (chapter 6).
As so many different players are involved, the development and introduction of a care robot can only be successful if it is a co-creation of manufacturer, customer, and end-user. Moreover, the other stakeholders of the care system should remain constantly attached to the development. Therefore we, as team Rose, deployed several fields labs for our second and third prototype. In these field labs we researched the scientific, technical, psychological, and financial

Box 8.2 Field labs for tele operated care robots

A good example of a field lab, for establishing specifications and testing the effects of complex new technologies in existing infrastructures, is the co-development of a care robot by start-up company Rose and care providers Zuidzorg and Thebe from the Brainport region in 2014/2015: a project co-funded by care insurance company CZ. The robot technology was only in the early development phase and therefore the emphasis of the field labs was on confirming the precise requirements and specifications, and on the joint development of the robot systems, and care concepts and processes that need to be in place in order to implement robots in elderly homes and at elderly living at home. Simultaneously a similar field lab was executed in cooperation with care organisation Siza, from the Arnhem region, who provides care to physically limited people.
The robots were designed to provide assistance at Activities of Daily Life (ADL) such as: getting dressed, preparing meals, picking up things from the floor, answering the doorbell, etc. The robot technology and system design used in both subprojects is quite similar. It consists of a robot (the slave) at the clients' location that is controlled by an operator from a distant cockpit (the master). In fact, the robot is the 'extended arm' of a care giver who is available 24/7 in a distant care centre.
We found that the demands of the two types of clients show both similarities and differences. The ADL tasks for which they ask support, are for a great deal the same. Surprisingly, both elderly and physically limited people have no aversion at all from advanced assistive technology. Both appreciate and value the technology because it gives them more independence. They do not need to wait for a care giver to come: distant support is immediately available. But we also found differences regarding requirements and demand. Physically limited young people with good cognitive skills like to operate the robot themselves and they like to help other people with

9 Case studies



9.1 Introduction

In the previous chapters we have discussed the nature of the different types of new companies – for which I have subdivided these into: Copycats, Start-ups, 'Start-apps' and Breakthrough Start-ups – and I have explained why not all new companies are start-ups. We have also come across the Scale-up, a company who has successfully completed the start-up phase and has entered the growth stage. To get there, some of them had to pass the 'valley of death'.
All these companies have diverse characteristics and must follow different strategies to be successful. We have found that the Breakthrough Start-up is probably in the most tricky situation as its chances of successful research, and subsequent successful product development, are low due to the early risky phase of the innovation cycle they are in. Moreover, the early phase implies a large *distance to market*. Both uncertainty and market distance deter investors and therefore the chances of financial lock-in are considerable for breakthrough start-ups.

In the course of the book we have discussed the content and essence of the concept of innovation, and followed the elements which are decisive for the success of new companies, in particular start-ups and breakthrough start-ups. These are: the need for a fit between company character and innovation type (breakthrough or incremental innovation), timing and market distance, access to funding and knowledge, and hospitality and heritage.
After, I have explained the importance of networks, campuses and projects, and the supportive function of field labs, demonstration projects and launching customerships for smoothening the development and implementation of new products. In chapter 4, we have moreover studied the business strategies and financial models which breakthrough start-ups may follow to avoid financial lock-in.
All together we have come across most of the elements which start-ups, and to a lesser extent scale-ups, encounter on their journey, and have discussed the concepts and instruments whose understanding and application helps deal with these.

In this chapter we will study, based on six case studies from different sectors, to what extent the themes we have discussed affect in practice the course of events at start-ups and scale-ups. Four case companies are from Brainport Eindhoven, one from an adjacent region (Tilburg area), and one concerns a company from Milan, Italy. Four are university spin-offs – two breakthrough and two tech start-ups – and two companies were in the transition to the scale-up phase. In terms of independent survival or take-over by (larger) incumbents, three companies have been successful (so far), three were not.
The first company we analyse is breakthrough start-up Rose who was active in Robot Assisted Health Care. The company developed and marketed care robots. Rose was a spin-off from the Eindhoven University of Technology. As

my experiences with Rose have prompted me to author this book, I have paid more attention to this case than to the others.
The second case concerns Smit Ovens who were in the business of production equipment for solar cell manufacturing. It is the only company from the machinery business, the others develop and/or produce end-products or components/systems for end-products. Smit Ovens was in the scale-up phase[204].
The third company is QTIS/e who have developed a biodegradable heart valve prosthesis. QTIS/e is a breakthrough start-up and a spin-off from the Eindhoven University of Technology.
Number four is All Green Vehicles (AGV), who, in the scale-up phase, worked at the forefront of the electric vehicle industry. It converted conventional commercial vehicles into electrically driven.
Then comes Drivetrain Innovations (DTI), a tech start-up and a spin-off from the Eindhoven University of Technology, active in advanced drivetrain technology.
Finally, we study Blubrake, a spin-off from Politecnico di Milano. Blubrake is a tech start-up who develops and produces anti blocking systems (ABS) for electric bikes.

In the cases I first describe the company and explain the course of events, then we analyse its success or failure, and finally we try to learn valuable lessons from each case.

9.2 Rose

Based on my own experience

9.2.1 The company

Rose, a spin-off of the university of technology Eindhoven, had to close its doors in June 2015 because it had not been able to attract capital in a second Series A financing to continue the development of its tele-operated care robot and the services connected to this. Up to the day it quit, some 3.5 million euros had been invested in the project: 1.6 million of this were grants from the Dutch state and the European Union. Besides the financial investment, thousands of hours of private time had been invested by the Rose team.
What was left of Rose was its heritage in the form of prototypes, knowledge, network, and scientific papers. The prototypes and knowledge were bequeathed to educational institutes, care providers and some small companies with whom Rose had worked constructively in the previous six years.

Enterprise Rose started in 2009 as an 'open innovation' project of a consortium of ten partners representing the complete development/supply chain, supplemented with universities, care organisations (as customers) and end-users. The project – named Teleoperated Service Robot (TSR) – was supported by the Dutch 'Pieken in de Delta' scheme with a subsidy of 1.45 million euro. Based