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Critical Success Factors of the Survival of Start-Ups with a Radical Innovation

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The purpose of the article is to determine which factors are most important for the success of a startup with a radical innovation in the first three years. First a conceptual model is designed in which three main factors determine the success of growth: the uniqueness of the advantages of the innovation, the startup organization characteristics and the person of the entrepreneur. A survey was setup with startup companies which are not older than fifteen years and which are active in a diversity of segments. A correlation analyses was done based on 75 respondents.

Growth was operationalised in two ways: the growth in turnover and the growth in employment. We found different factors correlating in a different way with the different growth concepts. Both growth in employment and in turnover are positively related to a thorough business plan and more than 75k Euro seed capital. The uniqueness of the advantages of the innovation, customer pro-activeness, multiple founders and a relevant social network have a positive influence on turnover growth but not on employment growth. For turnover growth the uniqueness of the advantages of the innovation and more than 75k Euro initial capital had a high significance. There is a positive relation between employment growth and external advice and investor capital but not with the turnover growth. Only a thorough business plan, external advice, 75k Euro initial capital and using investors capital had a positive significant influence on employment growth. Other conclusions are that depending on the used criterion for growth the significant factors differ and that in general the employment growth is a factor 4 smaller than the turnover growth.

Keywords: *Startup, Radical, Innovation, Entrepreneurship, Success, Growth*

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1. Introduction

Little research is been done, until now, in the matter of the radical innovation by start-ups. De

Jong &Marsili (2006) explain this by the fact that research into patterns of innovation give a dominant role to large firms and are often based on empirical studies which exclude small companies; whereas radical innovation seems to be one of the reasons for some start-ups. In the Netherlands a research after the success of techno starters (Timmermans et al., 2010) states that only 67% of this type of company survives after 5 years. Techno-starters aredefined as new companies based on a technological innovation. Although not all technological innovations are radical innovations, it is clear that the success ratio is at most equal or below the success ratio of techno starters. The goal of the present study is therefore to answer the question: What are the specific success factors that determine the successful radical innovation by a start-up?

After a literature study a selection of the factors that determine the success of a radical innovation and the success of a start-up will be combined in a model, as depicted in figure 1 below, which was tested using a survey.

The article is organized further as follows: section 2 examines the theory and conceptual framework; section 3 data and empirical method; section 4 empirical results and section 5 the conclusions and discussion.

2. The conceptual framework

In this paragraph, we first define the concept of innovation. Our research needs to measure if the innovation is radical, before we can determine the success of the innovation. After defining the radical innovation, we describe the success and fail factors of radical innovations in existing firms, and the success and fail factors of radical innovation. Some research has been done on the critical success factors of radical innovations within established firms, which we will combine with the research on the success of innovative entrepreneurs.

All the identified success factors are combined in a model in paragraph 2.2.

To define innovation, we start with the definition of Schumpeter (in Brem, 2008:6). He defines innovation in five parts. As the introduction of a, until then for the consumer, unknown product or new quality of the product; the introduction of a new production method not earlier seen in the industry; the unlocking of a new market, that until then didn't exist or wasn't used; the usage or creation of new sources for raw materials and intermediate products; introducing a new organization form in the industry. Later Schumpeter added (in Sandberg, 2008:52) that an innovation isn't synonym to an invention. "Inventions are economical not relevant while innovation depicts the idea of economical leadership or a commercial success". In the 60-ties Schmookler (in van der Veen, 2010) added that an invention is a new combination of pre-existing knowledge which satisfies some need. He also stresses that innovations are often demand-induced, not supply-led: without the 'wants' there would not be a problem to solve.

There is also a difference between technology oriented authors (Schilling, 2008; Brem, 2008) defining the innovation from a technological renewal perspective and business orientated authors (Kim &Mauborgne, 2005; Sandberg, 2008; Ostewalder&Pigneur, 2009), who define innovation as new to the business model or market.

The definition for innovation that is used in this article is based on the definition of McFadzean et al. (2005) which combines several approaches. In this view, innovation is a process that delivers added value and newness to an organization, suppliers and customers by the development of new processes, procedures, solutions, products, services, new methods of commercialization and/or business model by a small entrepreneurial or large established firm in an open or closed system.

So an innovation can differ in scope (Schilling, 2008; Cooper in McFadzean et al., 2005:363) and newness (Heany in McFadzean et al., 2005:354); that it can be technological (Schilling, 2008; Brem, 2008) or business orientated (Kim &Mauborgne, 2005; Sandberg, 2008 and Ostewalder&Pigneur, 2009). Additions to the original definition of McFadzean et al.(2005) is that the innovation can happen in an open or closed system (Chesbrough&Crowther, 2006; Herzog, 2007) and by means of three patterns.

These patterns are:

- Schumpeter-Mark I or entrepreneurial pattern: the entrepreneurial activity and creativity of small and new firms;

- Schumpeter Mark II or routinised pattern (de Jong &Marsili, 2006): the formal R&D activity of large and established firms;

- the hybrid form of 'system integration in network model (Rothwell in McFadzean et al., 2005).

The second concept which should be defined is radical innovation. There are several different ways to define radical innovation found in the literature. Some stress the technological newness as characteristic for a radical innovation to distinguish it from a incremental innovation. This technological newness is defined as the possibility of receiving a patent (Schmookler in van der Veen, 2010), the impact of the innovation (Duysters&Schoenmakers, 2010) or the level of new technological knowledge and new knowledge of the market (Brentani et al. in Burgers et al, 2008:56). Others use the effect of the innovation on the market. Then the newness of the innovation is measured through the obsoleteness of other products (Abetti, 2000), The impact on competitive advantages of the firm (O'Connor &DeMartino, 2006) or the emergence of a new knowledge approach towards the market (Schilling, 2008:49). Trauffler&Tschirky (2007) mention that 'technology-push' often is companied by a high degree of newness while 'market-pull' often is companied by regular renewal of a low degree. How companies used radical different business models to change the marketplace is described by Ostewalder&Pigneur (2009) in their book 'Business Model Generation'. The 'blue ocean' strategy (Kim &Mauborgne, 2005) is related and uses radical innovation to escape the bloody competition in a current market, the 'red ocean' by creating an open market space in which the competition is irrelevant. Successful radical strategies build on 'value innovation' by combining innovation with usefulness, process and cost positions. 'Value without innovation' focuses on value creation on a incremental level while 'innovation without value' is purely technology focused or too futuristic market pioneering.

The definition for radical innovation that is used in this article is based on the definition of Abetti (2000) with a number of additions to encapsulate the most common visions found in the literature. A radical innovation is an innovation with a unique and original product , system or business model, that will make other already existing ones

unnecessary or obsolete and has a high uncertainty of success because of the level of newness and obscurity of the needed design effort, technology, knowledge and market.

This definition takes into account that radicalism is accompanied by a high level of uncertainty (Freeman in Jain et al., 2010), newness (Schilling, 2008; Trauffler&Tschirky, 2007), risk (Schilling, 2008), differentness (Schilling, 2008) and market impact (O'Connor &DeMartino, 2006 en Duysters&Schoenmakers, 2010).

Success and fail factors of radical innovation for a startup firm

Several factors are mentioned in the literature that explain the success or failure of a radical innovation. Firstly, the First Mover principle is referred to (Schilling, 2008:88-91). First-movers are companies that initiate the introduction of a new product or service to the marketplace. As first-movers disadvantages Schilling mentions High R&D costs with long payback period, a non existing or under developed distribution channel, lack or immature 'enabling' technologies and supporting products, unclear customer needs and no agreed standards. The latter has the risks that developed standards won't be accepted by the market or that the standards are to far ahead.

Sandberg (2008) remarks that for an innovation to be successful it must satisfy the needs of customers, although it is still unclear who exactly the customers will be. Unfamiliarity causes fear and resistance, the newness of the products encourages to focus on irrational needs, time and effort must be invested to overcome the problems with the interaction with the new product, resistance to acceptance is increased by uncertainty of advantages and risk of using the new product and the appeal of the product can be diminished when the product is still in a pilot phase (see Veryzer in Sandberg, 2008:57).

Since a radical innovation can have a restructuring and reshuffling effect on the existing market (Trauffler&Tschirky, 2007) there will be large resistance by the established order. Trauffler&Tschirky (2007) adds furthermore that current management theory hasn't much understanding about solving the problems of dealing with radical innovation.

A shortlist of the problems when dealing with radical innovations:

- High costs of R&D and long payback period;
- Largely unknown size of market and customer needs;
- Resistance, fear and uncertainty of potential customers;
- Uncertainty how to manage a radical innovation;
- Difficultness of getting feedback by secrecy because of competition threats;
- Non existing distribution channel;
- Non existing 'enabling' technologies and supporting products;
- Not matching existing legislation and current quality norms;
- Defensive behavior of the established order;
- Struggle about the use of standards and agreements upon them.

The critical success factors of radical innovation for a startup firm

Several factors are mentioned as success factors for a starting firm, although these factors are not undisputed. Rauch (2000) and Brem (2008) found that the number of years of working experience is a success factor for a starting firm. Brem (2008) and Nandram&Boemans (2001) found that the willingness to take risks is a success factor. Brem (2008) and Rauch (2000) contradict each other about "being part of a family of entrepreneurs" being a success factor.

Two distinct groups of critical success factors (CSF) were found: organizational and entrepreneurial. This is in compliance with De Mel et al. (2009) who asks if the innovative power of a company is determined by the innovative power of the organization or the innovative power of the owners. On an organizational level, the success is influenced by a thorough business plan (Brem, 2008; Rauch, 2000), a clear strategy/mark analysis/competitor analyses and aggressive competitor strategy (Brem, 2008; Rauch, 2000), the usage of a innovation as a business idea (Brem, 2008; Rauch, 2000), being a member of a formal network (Nandram&Boemans, 2001), having an advisory board (Nan dram &Boemans, 2001) and active marketing (Brem, 2008). On the entrepreneurial level these factors are: the need for achievement (Brem, 2008; Nandram&Boemans, 2001; Rauch, 2000), having locus of control (Brem, 2008; Nandram&Boemans, 2001; Rauch, 2000), the willingness to take risks (Brem, 2008; Rauch, 2000), number of years experience (Rauch, 2000; Brem, 2008), experience as entrepreneur (Rauch, 2000; Brem, 2008), industry specific experience (Rauch, 2000), management experience (Rauch, 2000) and a relevant social network (Nandram&Boemans, 2001; Brem, 2008).

The critical success factors of radical innovations within established firms.

As there is not much empirical research on the success of radical innovations in starting firms, we present an overview of success factors in established firms. In the literature there is a difference over the importance of market-pull versus technology-push. For example, Sandberg (2008) emphasizes customer interaction during the phase of radical innovation development (idea, development and launch) versus Abetti (2000) who stresses the unique advantage and keeping a technological lead. Verganti (2008:443) merges both visions: "As successful technology-push innovation requires a deep understanding of market dynamics, design-driven innovation also implies analyzing user needs, observing them, and exploring new technologies."

Three distinct groups of CSF were found: factors concerning the organizational level, the characteristics of the entrepreneur and the character of the innovation. The important influencers on a organizational level are the process of interaction with the environment and the degree of customer pro-activeness (Sandberg, 2008; Abetti, 2000; Trauffler&Tschirky, 2007), the process of setting up the radical innovation (Brink, 2005; Trauffler&Tschirky, 2007), free communication (Abetti, 2000), methods of acquiring market information (Trauffler&Tschirky, 2007), methods of acquiring market technology developments (Trauffler&Tschirky, 2007), business structure and plan (Brink, 2005; Bacon in Salomo et al., 2007), execution of process & methods (Abetti, 2000; Trauffler&Tschirky, 2007) and being an expert (Abetti, 2000; Brink, 2005).

The important influencers on an entrepreneurial level are having technological skills (Brink, 2005), market insight (Brink, 2005) and being entrepreneurial (Brink, 2005).

The important influence on innovation level is the degree in which the radical innovation offers a unique advantage compared to the existing possibilities (Abetti, 2000).

The success of innovative entrepreneurs.

The identified critical success factors don't differ very much from the factors found when examining the success of entrepreneurs in general. Some factors however are quite specific for innovative entrepreneurs. Two groups of critical factors are identified: organizational and entrepreneurial.

The important influencers on organizational level are a high seed capital (Lasch et al., 2007), a thorough business plan (de Witte, 2008; Syntens website http://www.syntens.nl,2011), market focus / customer involved (Song et al., 2008; Cobbenhagen, 2000), a multidisciplinary and project focused organization (Cobbenhagen, 2000; Syntens website http://www.syntens.nl), marketing and commerce (de Witte, 2008; Cobbenhagen, 2000; Syntens website http://www.syntens.nl), a team of founders (Lasch et al., 2007), using external knowledge (Cobbenhagen, 2000), entering alliances (Duysters& de Man, 2005) and using investors capital (de Witte, 2008).

The important influencers on entrepreneurial level are the willingness to take risks (de Mel et al., 2009), optimism (de Mel et al.,2009), logical mind (de Mel et al., 2009), a higher education (de Mel et al., 2009), multiple earlier jobs (Song et al., 2008; De Mel et al., 2009) and industry experience (Song et al., 2008).

2.2 The model

The success of a radical starter can be explained by three major variables, the unique advantage of the radical innovation, characteristics of the organization and the characteristics of the entrepreneur, as shown in figure 1. All the CSF found in the literature review are grouped into these three categories.

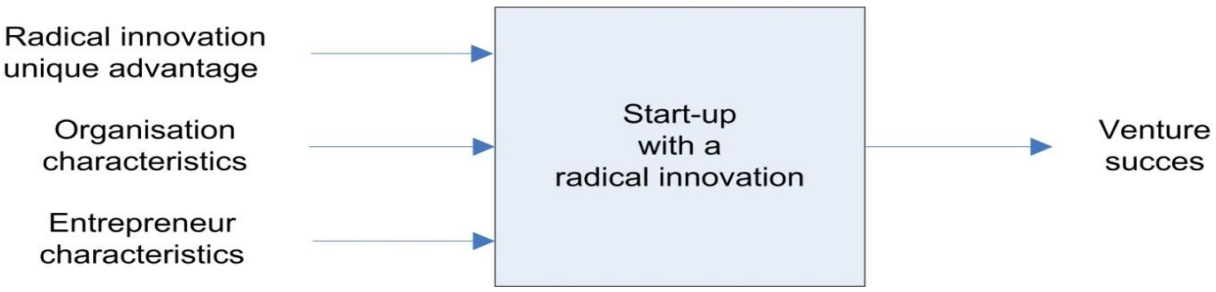

Figure 1. Venture success model for starters with a radical innovation

Since the large number of CSF found in the former paragraph, the CSF list is reviewed critically to make the empirical research feasible.

To do this three criteria are used. Firstly a check which factors are relevant for radical innovating start-ups. Secondly a check is done to see which factors coincide. At last the relevance is determined based on the contribution towards the possibility of problem reduction. Seven factors are deleted because of this selection process. Using innovation as a

business idea (Brem, 2008; Rauch, 2000) because the respondents are all starters around an innovation, multidisciplinary and project directed organization (Cobbenhagen, 2000) which doesn't play a large role in a small firm, forming alliances (Duysters& de Man, 2005) which isn't realistic for a small firm, logical thought ability (de Mel et al.,2009) because it coincides with 'higher education', technical skills (Brink,2005) because it coincides with 'being an expert', having market insight (Brink,2005) because 'good business plan' will lead to it, having entrepreneur spirit (Brink,2005) which exists of the personal traits of entrepreneurs. All the remaining factors are listed in table 4 in appendix 2.

Herein the relations are fixed between the specific characteristics from a radical innovation (A1), the organization (B1 t/m B9), the entrepreneur (C1.1 t/m C2.7) and the ultimate success of the venture expressed in personal growth or turnover (see table 4 in appendix 2). The relations in this model are all positive. The more unique the advantages the radical innovation has the more motivated a consumer will be to overcome initial resistance and negativism. The better the organizations meets the defined CSF (good business plan etc.) the better it will be able to cope with the problems a first mover venture faces. The better the personal traits (need for achievement etc.) and human capital (higher education etc.) aspect of the entrepreneur are conform the CSF mentioned the better he will be able to cope with the problems facing him when radically innovating.

3. Data and empirical method

3.1 Data

For use of this article a clear definition of venture success is needed and calculation method had to be defined. Nandram&Boemans (2001) use the definition of the Dutch Ministry of Economic Affairs that venture success means growth of employment. According to them very fast growers grow with 32% in three year, normal growers with 12% in three year, stable companies have no growth, and a crimper declines with 4,5% or more.

For this article two definitions of venture success are used. Firstly, success is measured as the percentage of employment growth between the first full fiscal year and the third full fiscal year, as used by the Ministry: $WPG = 100\%.(WP\_3 - WP\_1)/WP\_1$ (WPG: Percentage employment growth in 3 years; WP_1: Mean number of employment in the first year (JR_1); WP_3: Mean number of employment in the third year (JR_3)). . However, we think it possible that small and medium enterprises often use an extended network of suppliers and other sme's to outsource activities, so an additional measure of growth is used: the percentage of turnover growth between the first full fiscal year and the third full fiscal year:

$OMG = 100\%.(OM\_3 - OM\_1)/OM\_1$ (OMG: Percentage turnover growth in 3 years
OM_1: Turnover in the first year (JR_1); OM_3: Turnover in the third year (JR_3).

Using both definitions it would make it possible to determine, after the data gathering, if there were differences between the CSF for employment growth or turnover growth.

Because of these measures of growth, we restricted the relevant responses to firms which existed for minimal three years, but not longer than 15 years (as the questionnaire was about the first three years of existence). (See appendix 1 for a description of all the used variables.)

3.2 Empirical method

All variables are operationalised using a questionnaire. In this questionnaire questions were put that could be answered directly (e.g. number of working experience, using seed capital) other questions had to be answered by choosing an option on a 7-points Likert scale (e.g. I like working hard [1] Totally disagree … [7] Totally agree). The questionnaire was put to a number of entrepreneurs using different methods as personal contacts, LinkedIn groups and different entrepreneurial forums. The entrepreneurs had to be based in the Netherlands but could be from any industry. The companies had to be start-ups based on an innovation on product, service, production process or business model. Some of the questions in the questionnaire existed of a single question others were a combination of a number of questions. The questions used to compose these variables are explained in more detail in Table 1 below:

Table 1 Question composition of used variables

Uniqueness of the advantage of the innovation (UVI)

To what degree do you think that your innovation delivers a unique advantage for your customers?
To what degree was confirmed that your innovation offers a unique advantage for your customers?

Customer Pro-activeness (B4)

How (much) did you anticipate on needs of potential users and/or relevant market parties during the idea phase of the innovation?
To what extent did you let potential users and/or relevant market parties participate during the development phase of the innovation?
To what degree have you tried to influence potential users and/or relevant market parties during the launch phase of the innovation?

Willingness to take risks (RSC)

To what degree do you concur with the following statements:
I don't mind taking risks
In order to be successful you need to take risk on a regular base

Degree of radicalness (MRAD)

How high was/is the impact of your innovation on the existing market(s)?
To what degree was/is the knowledge that you used new?
To what degree was/is the product, service, product, process or business model new for the market?
To what degree was/is there a discussion about standards and/or norms?
To what degree was/is it unclear who where the potential customers for your innovation?
To what degree was/is unknown how large the development effort would be for your new product, service, production process or business model?

Some variables that were meant to be composed could not be used, the Cronbach's Alfa was lower then<0.6.These were NFA (Need For Achievement), LOC (Locus of Control),

and POS (Positivism). Some variables were composed of fewer variables then intended. So was RSC (willingness to take risk) composed of 2 questions instead of 4 and MRAD uses 6 questions instead of 7.

4. Results

Description of Respondents

From the entered 125 questionnaires only 75 were valid. Some organizations where to old, some to young, others had not filled in the turnover or employment numbers so the growth percentage couldn't be calculated. No respondents were filtered out because of lack of radicalness, only a few entrepreneurs had a real low degree of radicalness (figure 2 in appendix 3) the mean had quite a high degree of radicalness. Because of statistical restrains it wasn't possible to split the population in low and high radicalness so therefore we used all the respondents.

The youngest participant was born in 1984, the oldest participant was born in 1947. The mean age of the participants was 44.

The top 4 percentage of the type of business the respondents are in consists of 'business services'(57,3%), 'Remaining' (13,3%) , 'Industrial activity' (12,0 %)and 'personal services' (5,3 %).

The geographical focus of the respondents activities shows that 60% focuses only on the Netherlands while 20% have a worldwide focus and 18,7% focuses on Europe.

The oldest companies were started in 1995, the youngest in 2008. The mean starting year was 2004, most of the companies started quite recent, this is good for the validity.

The lowest growth in turnover of the respondents found was a company that actual shrunk with 50%, the highest growth found was 4512,1%, the mean growth in turnover in 3 years was 493,4 %.

The lowest employment growth was established by a company that shrunk with 25%. The largest grower grew with 2720,0%, the mean growth in personal in 3 years was 32,1%.

In figure 2 (Appendix 3) the degree of radicalness can be seen. The minimal score possible was 6 (not radical at all) the maximum score was 42 (extremely radical). As can be seen there is a good nominal distribution. The lowest score was 12 the highest score was 36. Since the mean was 25,12 the group respondents exists of a properly radical innovative group.

Empirical results

With help of statistical software the Cronbach's Alfa where calculated and ultimate the regressions determined. In table 2 an overview is given of all the statistical results. In table 3 the variables mean, standard deviation and correlations can be seen for all measured variables.

In table 2 below, the result of the empirical research is shown. In the right two columns can be found if a factor has a relation with the growth (Yes or No), if the relation was positive or negative (+/-) and how significant the relation was (*, ** and ***). (* *Significant on < 0.2 level; ** Significant on < 0.1 level ; *** Significant op < 0.01 level.*)

Table 2 Results of the validation of the critical success factors

Category	**Critical success factor**	**Venture success (growth)**	
		Turnover	**Employment**
Innovation			
	Unique advantage	Yes *** (+)	No
Organization			
	Thoroughness of the business plan	Yes ** (+)	Yes ** (+)
	Membership of one or more formal networks	No	No
	Usage of external advice and knowledge	No	Yes * (+)
	Proactive customer approach	Yes ** (+)	No
	Structure of the radical innovation process	No	No
	Expertise (technology or other specific)	No	No
	75000 Euro seed capital	Yes *** (+)	Yes * (+)
	Usage of investors capital	No	Yes* (+)
	Multiple owners	Yes ** (+)	No
Entrepreneur			
	Willingness to take risks	No	No
	Years of industry experience	Yes ** (-)	No
	Years of management experience	No	No
	Relevant social network	Yes ** (+)	No
	Higher education	No	No
	Number of previous jobs	Yes ** (-)	No
	Years of working experience	Yes ** (-)	No
	Years of previous entrepreneurs experience	No	No
All			
	Uniqueness of advantage**, Thorough Business plan*, Relevant social network***, Working experience**	Yes (+/+/+/-)	
	Thorough business plan*, Usage investors capital*		Yes (+/+)

In the table 3 below, a variable matrix is shown. In it the mean value of the variables, the standard deviation and the correlation between the variables can be seen.

Table 3 Variable Matrix: variables mean, standard deviation and correlations.

	Variable	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1.	Thoroughness Business plan	3,75	1,96	1,00																				
2.	Member of formal networks	0,56	0,50	0,35	1,00																			
3.	Intensity external advice	3,69	2,37	0,26	0,25	1,00																		
4.	Customer Proactiveness	12,23	4,02	0,20	-0,04	0,25	1,00																	
5.	Degree of structure innovation process	3,51	1,49	0,31	0,12	0,21	0,43	1,00																
6.	Degree of expertise	4,79	1,73	0,04	0,00	0,10	0,12	0,15	1,00															
7.	Application of investors money	0,35	0,48	0,33	0,25	0,15	0,04	0,11	-0,04	1,00														
8.	More then 75000 seed capital	0,25	0,44	0,12	0,08	0,06	0,31	0,09	0,04	0,09	1,00													
9.	Multiple owners	0,51	0,50	0,08	0,09	0,03	0,08	0,14	-0,06	0,16	0,02	1,00												
10	Uniqueness advantage of the innovation	9,77	2,44	0,17	0,02	0,16	0,32	0,34	0,25	0,15	-0,07	0,17	1,00											
11	Willingness to take risk	11,55	1,79	0,29	0,15	0,10	0,23	0,17	0,21	0,11	0,11	-0,06	0,14	1,00										
12	Years of industry-experience	5,52	6,60	-0,14	0,01	0,18	0,12	0,22	0,32	-0,14	-0,03	-0,16	-0,08	0,10	1,00									
13	Years of management experience	5,40	6,56	0,05	0,11	0,05	0,25	0,25	-0,20	-0,03	0,39	-0,15	-0,14	0,03	0,24	1,00								
14	Relevant social network	5,23	1,62	0,05	0,23	0,19	0,25	-0,02	0,11	-0,03	0,13	0,11	-0,01	0,13	0,08	0,06	1,00							
15	Higher education (BSc or higher)	0,83	0,38	0,07	0,09	0,03	0,11	0,01	0,31	0,04	-0,06	0,18	-0,01	0,12	-0,07	-0,27	0,28	1,00						
16	Previous jobs	3,20	2,09	-0,19	-0,07	-0,04	-0,09	-0,07	0,15	0,00	-0,03	-0,14	-0,29	0,04	0,23	0,01	0,14	0,13	1,00					
17	Years of previous working experience	11,47	8,39	-0,08	0,23	-0,03	0,17	0,19	-0,05	-0,18	0,14	-0,24	-0,18	0,19	0,50	0,51	0,13	-0,12	0,51	1,00				
18	Years of earlier entrepreneur experience	2,35	4,77	-0,01	0,02	0,14	0,28	0,12	0,07	0,21	0,18	-0,10	0,11	0,07	0,12	0,39	0,16	-0,19	-0,12	-0,01	1,00			
19	Degree of radicalness	25,12	5,09	-0,02	0,12	0,07	0,36	0,22	0,33	-0,06	0,10	0,06	0,53	0,05	0,02	0,03	0,05	0,06	-0,30	0,00	0,07	1,00		
20	Turnover growth in %	493,37	879,81	0,24	0,01	0,15	0,20	0,01	-0,03	0,24	0,09	0,27	0,36	0,04	-0,21	-0,10	0,22	0,15	-0,21	-0,26	0,05	0,08	1,00	
21	Employment growth in %	132,12	332,70	0,21	0,07	0,18	0,09	0,00	0,09	0,16	0,20	0,09	0,14	0,11	-0,05	0,06	0,12	0,09	-0,02	-0,04	0,12	0,11	0,57	1,00

On the vertical axe the variables are numbered, on the horizontal axe the numbers represent the same variables as on the vertical axe.

With the help of table 3 some extra observations were done. A very high correlation (>0,5) exist between degree of radicalness and uniqueness of advantage of the innovation. This is also true between working- experience, industry-experience, management experience and previous jobs. And also true for turnover growth and personal growth. The percentage of employment growth turned out to be a factor 4 smaller then the turnover growth.

5. Conclusions and discussions

This study tried to expand the existing theory of the success factors of a radical starter. In the other empirical research on success factors of starters, we have seen the importance of specific organisational and entrepreneurial traits. This we combined with the success factors of a radical innovation within an established firm, which added innovation characteristic (unique advantage), organizational traits (customer proactiveness) and confirmed entrepreneurial traits. This we combined further with the success factors found for innovative entrepreneurs in general which added specific organisational (use of seed capital) and entrepreneurial traits (willingness to take risks). All these factors were combined in a model for starters with a radical innovation. This model states that to succeed, there are three relevant factors. The starter has to be an entrepreneur (with specific personal traits and human capital), the organization has to have certain characteristics (business plan, seed capital, etc.) and the innovation has to have some unique advantages for the (potential) customers.

Testing this model through a questionnaire, we see a statistical relevance for each measurement of success. The general findings do support the idea that growth is determined by the uniqueness of the advantage of an innovation, specific organizational characteristics and entrepreneurial traits. The results however are clearer for turnover then for employment growth and not all the factors identified in the existing literature were found statistically significant or positive.

From the outcomes of this study an image of the start-up with the most turnover growth in the first 3 years can be drafted. The start-up exist of a team of founders with not to much working experience and with a relevant social network. There is a thorough business plan that is executed with at least 75.000 euro seed capital. By a pro-active customer approach the start-up is able to bring to the market, successfully, a radical innovation with enough unique advantages (compared to other existing possibilities) to overcome initial customer and market resistance.

This study increases the external validity of the earlier research on the success factors of radical innovation. The results of the case studies by Sandberg (2008), that customer proactivity is important for the radical innovation within existing companies, can now also be applied for radical start-ups. The results of the case studies by Abetti (2000), that the uniqueness of the advantaged of an innovation is important for the success of the radical innovation within existing companies, can now also be applied for radical start-ups.

Another result of this study is the possibility to increase the internal validity of research in the field of radical innovation. The central concept ‘radical innovation’ is redefined in such a way that it can be measured empirically with the help of six distinct characteristics.

Further study should be done to explain why for radical starters personal traits are less important then literature proposes. Secondly to explain why experience has a slightly negative influence on growth instead of what was found in the existing literature. Thirdly a further study should be done to examine the influence of the used ‘measure of success’ on CSF.

Furthermore, it would be interesting to see if the conclusion that success measured in turn over and success measured in employment have different determinants. If this could be confirmed, it will point towards a possible conflict between the individual interests (financial growth) and the interests of policy makers (growth in employment).

References

Abetti, P. A. 2000. Critical Success Factors for radical Technological Innovation: A Five Case Study. *Creativity and Innovation Management, 9*(4), 208-220.

Ansoff, H. I. 1965. *Corporate Strategy*: McGraw-Hill inc.

Brem, A. (2008). *The Boundaries of Innovation and Entrepreneurship*. Wiesbaden: Erlangen-Nürnberg.

Brink, P. v. d. (2005).*Organizational Competencies for Radical Innovation*.Twente: University of Twente Faculty of EEMCS.

Burgers, J. H., Bosch, F. A. J. v. d., &Volberda, H. W. (2008). Why new business development projects fail: Coping with the differences of technological versus market knowledge. *Long Range Planning, 41*, 55-73.

Chesbrough, H., &Crowther, A. K. 2006. Beyond high tech: early adopters of open innovation in other industries. *R&D Management, 36*(3), 229-236.

Cobbenhagen, J. 1999. *Managing Innovation at The Company Level.*KatholiekeUniversiteit Nijmegen, Maastricht.

Cobbenhagen, J. 2000. *Succesvol Innovation: Towards a New Theory for the Management of Small and Medium-sized Enterprises*. Cheltenham: Edward Elgar Publishing Limited.

Duysters, G., & de Man, A.-P. 2005. Collaboration and innovation: a review of the effects of mergers, acquisitions and alliances on innovation. *Technovation, 25*, 1377-1387.

Duysters, G., &Schoenmakers, W. 2010.The technological origins of radical inventions.*Research Policy doi:10.1016/j.respol.2010.05.013*.

Herzog, P. 2007. *Open and Closed Innovation.*UniversitätMünster, Wiesbaden.

Jain, R. K., Triandis, H. C., &Weick, C. W. 2010.Models for Implementing Incremental and Radical Innovations.In *Managing research, development and innovation* (pp. 238-256). Hoboken New Jersey: John Wiley & Sons.

Jong, J. P. J. d., & Marsili, O. 2006. The fruit flies of innovations: A taxonomy of innovative small firms. *Research Policy, 35*, 213-229.

Kim, W. C., &Mauborgne, R. 2005.*Blue Ocean Strategy*. Boston: Harvard Business School Press.

Lasch, F., Le Roy, F., &Yami, S. 2007.Critical growth factors of ICT start-ups.*Management Decision, 45*(1), 62-75.

McFadzean, E., O'Loughlin, A., & Shaw, E. 2005. Corporate entrepreneurship and innovation part 1: the missing link. *European Journal of Innovation, 8*(3), 350-372.

Mel, S. d., McKenzie, D., & Woodruff, C. (2009).*Innovative Firms or Innovative*

*Owners?*Shri Lanka: The World Bank Development Research Group.

Nandram, S. S., &Boemans, M. 2001. *De beste ondernemer: Condities voor ondernemerssucces*. Breukelen: UniversiteitNyenrode.

O'Connor, G. C., &DeMartino, R. 2006.Organizing for Radical Innovation: An Exploratory Study of the Structural Aspects of RI Management Systems in Large Established Firms.*Journal of product innovation management, 23*, 475-497.

Ostewalder, A., &Pigneur, Y. 2009. *Business Model Generatie*. Deventer: Kluwer.

Porter, M. E. 1985. *Competitive advantage : creating and sustaining superior performance*. New York: The Free Press.

Rauch, A. 2000.*Success Factors of Small and Medium Sized Enterprises.*Universiteit van Amsterdam, Amsterdam.

Salomo, S., Weise, J., & Gemünden, H. G. 2007. NPD Planning Activities and Innovation Performance: The Mediating Role of Process management and the Moderating Effect of Product Innovativeness. *The Journal of Product Innovation Management, 24*, 285-302.

Sandberg, B. 2008.*Managing and Marketing Radical Innovations*. Oxon: Routledge.

Schilling, M. A. 2008.*Strategic Management of Technological Innovation* (2 ed.). New York: McGrawHill.

Song, M., Podoynitsyna, K., Bij, H. v. d., &Halman, J. I. M. 2008.Succes Factors in New Ventures: A Meta-analysis. *Journal of product innovation management, 25*, 7-27.

Timmermans, N. G. L., Verhoeven, W. H. J., Hout, R. i. t., & Bakker, K. 2010. *De economische prestaties van technostarters 2008*. Zoetermeer: Economisch Instituut voor het MKB (EIM).

Trauffler, G., & Tschirky, H. P. 2007. *Sustained Innovation Management*. New York: Palgrave MacMillan.

Veen, M. v. d. 2010. Agricultural Innovation: invention and adoption or change and adaptation? *World Archaelogy, 42*(1), 1-12.

Verganti, R. 2008. Design, Meanings, and Radical Innovation: A Metamodel and a Research Agenda. *Journal of product innovation management, 25*, 436-456.

Witte de, N. 2008. *De Gids Startkapitaal*. Breukelen: De Nederlandse Beurs voor Investeringen in Bedrijven en Ondernemingen.

Appendix 1

Variable	Description
JR_1	First year that the company was operational for the whole year, a full fiscal year
JR_3	The year that is two years later than the first year (JR_1)
OM_1	Turnover in the first year (JR_1)
OM_3	Turnover in the third year (JR_3)
WP_1	Mean number of employment in the first year (JR_1)
WP_3	Mean number of employment in the third year (JR_3)
WPG	Percentage employment growth in 3 years
OMG	Percentage turnover growth in 3 years

Variable	Critical success factor that is measured
UVI	Degree in which the innovation has an unique advantage compared to other possibilities
B1	Thoroughness of the business plan (more then 10 A4 and with market analyses)
B2	Membership of one or more formal networks (with membership fee)
B3	Degree of usage of external advice and knowledge
B4	Proactiveness of the customer approach (in the phases idea, development and launch)
B5	Degree of structure of the radical innovation process
B6	Degree of having a technological or other specific expertise
B7	Having more thenEur 75.000 of seed capital
B8	Having used investors capital
NB9	Having multiple owners
NFA	Degree of need for achievement
LOC	Degree of locus of control
RSC	Willingness of taking risks
POS	Degree of optimism
C21	Years of industry experience
C22	Years of management experience
C23	Degree of having a relevant social network
C24	Having a higher education (BSc or higher)
C25	Having multiple earlier jobs
C26	Years of working experience (Rauch en Brem)
C27	Years of experience as an entrepreneur (Rauch en Brem)
MRAD	Degree of radicalness of the innovation

Appendix 2

Table 4. Critical success factors of the radical innovation of a starter

A. Innovation	A1	Degree in which the innovation offers a unique advantage compared to other existing possibilities (Abetti,2000)
B. Organization	B1	Good business plan (Bacon in Salomo et al., 2007; Brink,2000; de Witte, 2008 and website Syntens.nl,2011)
	B2	Formal membership of networks (Nandram&Boemans, 2001)
	B3	Usage of external advice and knowledge (Nandram&Boemans, 2001; Cobbenhagen,2000)
	B4	Proactive customer approach (Cobbenhagen, 2000; Sandberg, 2008; Song et al, 2008; Trauffler&Tschirky,2007)
	B5	Good structured process of radical innovation (Brink, 2000; Trauffler&Tschirky, 2007; Jain et al.,2010; Abetti,2000)
	B6	Technological or other specific expertise (Abetti,2000; Brink, 2005)
	B7	More thenEur 75.000 starting capital (Lasch et al., 2007)
	B8	Using investor capital (De Witte, 2008)
	B9	Multiple founders (Lasch et al.,2007)
C. Entrepreneur	C1	Personal traits
	C11	Need for achievement (Brem, 2008; Nandram&Boemans, 2001; Rauch, 2000)
	C12	Locus of control (Brem, 2008; Nandram & Boemans, 2001; Rauch, 2000)
	C13	Willingness of risk taking (De Mel et al., 2009; Brem,2008; Rauch, 2000)
	C14	Optimism (Nandram & Boemans, 2001; Rauch, 2000; Brem, 2008; de Mel et al.,2009)
	C2	Human Capital
	C21	Industry experience (Rauch,2000; Song et al., 2008)
	C22	Management experience (Rauch, 2000)
	C23	Having a relevant social network (Brem, 2008, Nandram&Boemans, 2001)
	C24	Higher education (de Mel et al.,2009)
	C25	Multiple earlier jobs (Song et al.,2008; de Mel et al.,2009)
	C26	Number of years working experience (Rauch,2000; Brem, 2008)
	C27	Experience as an entrepreneur (Rauch, 2000; Brem, 2008)

Appendix 3

Respondents radicalness

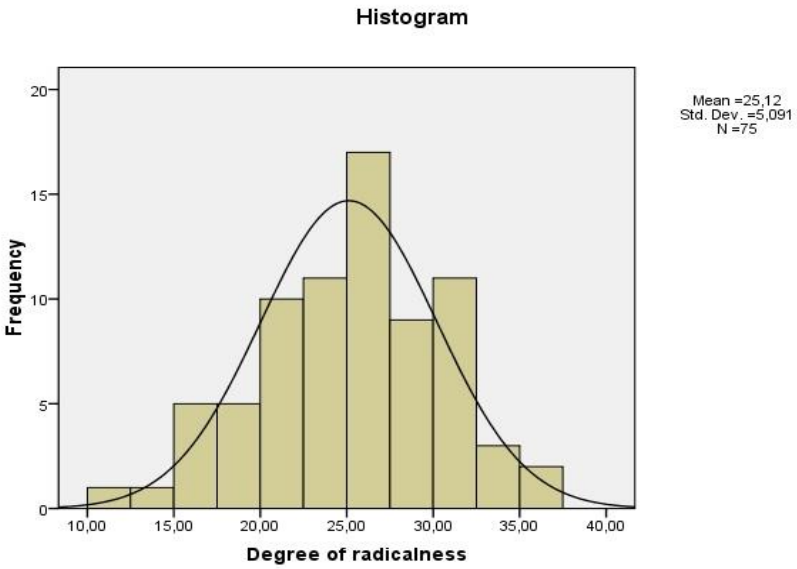

Figure 2 Degree of radicalness