

Sustainable Venturing – Sustainable Entrepreneurship

Creative construction as an answer to the megatrends of sustainability

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1 Introduction

A range of sustainable technologies have come into existence the last 30 years. Many huge corporations today are creating turnover by selling wind turbines, solar thermal equipment or car sharing services to their customers. Many politicians are proud that they fostered the creation of large sustainable markets by introducing specific regulation like the German Renewable Energy Sources Act. Hundreds of thousands of employees are working in the sector supplying technologies for renewable energy, energy efficiency or sustainable water.

But where did it all begin? Which events were the starting points for the development of sustainable technologies as we know them today? And more specifically: Who were the people who got the whole thing going?

Going back in history we find that the German Renewable Energy Sources Act was enacted because there already were promising techniques for exploiting renewable energy sources. In the case of wind turbines, these had been developed by a group of green start-ups, most of which had started up from scratch between 1975 and 1984. The only exception had been MAN, a huge machinery and lorry manufacturer who made its exit from the wind sector in 1989, just one year before the real market growth began. In many other sectors, the development was quite similar.

The following paper was written in order to look into the past, the time before the growth of the sustainable technologies sector began. Growth begins when the principal function of a new technology is demonstrated to be successful and a market begins to evolve. The paper will focus on the phase of the first tests and the first green start-ups involved.

The target group for the paper is environmental and economic policy. The paper tries to make clear why and where sustainable technologies had their origin. The objective is to point out that the instruments which are needed to make sustainable markets grow are not the same as those that are necessary to start them up. At the very beginning of a completely new technical idea, market regulation will not help. Research funding might help, but often the first sketches or plans of a technology central for future sustainable development would never have convinced the selection committee for a research proposal. Furthermore, entrepreneurship policy is often used to focus on start-ups in established sectors. The combination of technology innovation with start-up creation is sometimes more than economic policy and support can handle. Even more so if established powerful actors are not interested in new types of competition.

But why are we writing the paper? The reason is our belief that many more radical innovations are necessary to achieve sustainable development and many of these might need non-mainstream people and non-mainstream technological ideas. And they need non-mainstream entrepreneurship policy.

2 The Challenge

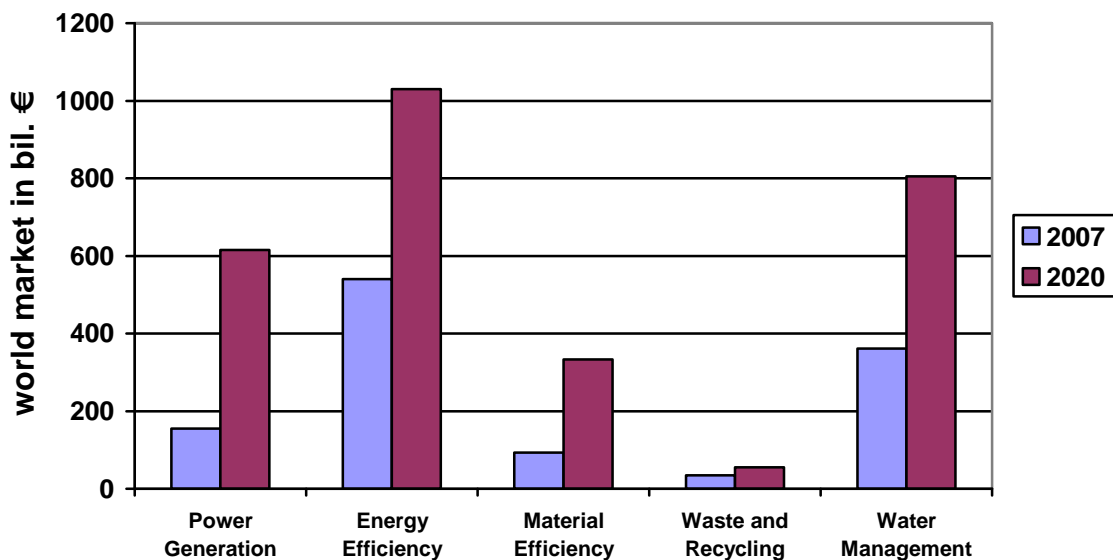
2.1 Megatrends of sustainability and economic challenges

The world's population is growing. Along with this growth, the consumption of energy and material resources rises sharply. The advance of industrialization and the changing lifestyles in emerging economies are among the most important drivers. In industrialized countries, demographic change goes along with the necessity to change the lifestyle to a more sustainable one. Some major trends can be delineated, which characterize the major challenges of sustainability:

- the enormous use of energy and the continuous climate change,
- the use of material resources, rising prices and the beginning scarcity of some of them,
- scarcity of water in many regions of the world,
- demographic change,
- the reduction of arable land and
- the reduction of biological diversity.

These megatrends present the human race with one of the biggest challenges ever. But behind each of these trends, there is not only a challenge to be found. There is an abundance of economic possibilities to be explored and exploited by innovative firms. The consultancy Roland Berger studied five major markets on behalf of the German Environmental Ministry (BMU 2009).

Figure 1: Scale of sustainable world markets in 2007 and 2020



Source: BMU 2009

The projected development in the global markets for environmental technology is a sharp growth. The 2007 market size of € 1.400 billion will grow at a rate of 6.5 % annually to a size of € 3100 billion in 2020, but:

- It is an open question, which products will best serve these markets.
- It is an open question, which firms will profit from the growing markets.

Established corporations have the chance of growing. Start-ups have the chance to establish innovative products in growing markets. Most probably, many innovative products will contribute to solving the world's problems as they are already about to do in sectors like renewable energy, energy efficiency or material efficiency.

At least the German Government, with its activities around a so called ecological industry policy, and Barack Obama's US Government, with its energy & environment program, have recognized these markets and the opportunities they imply. President Obama described the situation of the US as follows: *"So we have a choice to make. We can remain one of the world's leading importers of foreign oil, or we can make the investments that would allow us to become the world's leading exporter of renewable energy. We can let climate change continue to go unchecked, or we can help stop it. We can let the jobs of tomorrow be created abroad, or we can create those jobs right here in America and lay the foundation for lasting prosperity."*¹

The former German Environmental Minister, Sigmar Gabriel, saw the sustainable technologies sector as a major driving force for economic restructuring after the economic crises. *"The co-operation between environmental policy, economic policy and labour policy has reached a new level. The environmental sector is modernizing the German economy and is growing even faster than we expected two years ago when we published the first edition of the book "Greentech made in Germany". The sector is a source of hope in the current economic crisis."*²

Also, Japan's Premier Naoto Kan points out that after the Fukushima disaster there is a need to strongly develop the renewable energy sector in Japan: "Taking this as a lesson, we have to lead the world in clean energy, such as solar and biomass, and make it a major pillar of a new Japan," the centre-left leader told a parliamentary committee (Straits Times 2011).

This paper tries to point out the specific role entrepreneurship may have within the process of developing a strong and competitive environmental sector. It tries to highlight that those economies fostering sustainable entrepreneurship are most prone to create maximum growth in these markets.

¹ President Obama, March 19, 2009, http://www.whitehouse.gov/issues/energy_and_environment/ assessed 4.8.2009.

² Sigmar Gabriel, 7.5.2009, http://www.bmu.de/pressemitteilungen/aktuelle_pressemitteilungen/pm/43956.php accessed 4.8.2009 and translated by the authors.

Furthermore, they may create the most valuable solutions to the most important problems the world has to deal with in the coming years.

When dealing with the megatrends of sustainability it seems appropriate to change the Schumpeterian wording of creative destruction. Like David Audretsch et al. (2006) have already proposed, the term creative construction seems better to express the challenge of inventors and entrepreneurs contributing to better solutions for a better world.

2.2 Entrepreneurship and Economic Growth

The Global Entrepreneurship Monitor (1999) explains about one third of the growth of national GDP with the national level of entrepreneurship: “The correlation of start-up rates with short-term measures of GDP growth was 0.6, suggesting that 36 percent of the variation in national economic growth is accounted for by variation in new firm start-up rates. It is probably appropriate to assume that one-third of national economic growth is related to the activities of established firms, one-third to the entrepreneurial sector and the remainder to the interaction between these two sectors, measurement error or unknown processes” (Kauffman Centre 1999:39). In the view of the US-based national commission on entrepreneurship start-ups are also creating advantages in export levels (NCOE 2000: 4). Additional long term effects are created by successful entrepreneurs who become business-angels and support the start-up of further ventures (NCOE 2000: 5).

Since 1995 a couple of contributions have been made on the linkage between entrepreneurship and economic growth. In some cases, this is analysed through the level of turbulence, which is defined as the number of entrants and death rates of enterprises.

Figure 2: Research results on entrepreneurship and economic growth 1995 to 2009

Authors	Year	Sample	Result
Audretsch & Fritsch	1996	Data for German start-ups of the 1980s from social statistics	Negative correlation, higher turbulence leads to lower rate of growth
Reynolds	1999	Data for US-states from 1976 to 1992	Positive correlation, turbulence accompanies economic growth, but does not cause it
Callejon & Segarra	1999	Spanish data from 1980 to 1992	Positive correlation, turbulence contributes positively to the growth of total factor productivity in regions as well as industries
Foelster	2000	Employment data for Sweden 1976 to 1995	Positive correlation, increases in self-employment share has a positive impact on regional employment
Audretsch & Fritsch	2002	German regional data for 1983-1989 and 1993 to 1998	Positive correlation, high start-up rate is related to high regional growth, especially in the long term perspective

Holtz-Eakin & Kao	2003	Data for US-states	Positive correlation, turbulence is related to positive changes in productivity
Audretsch, Keilbach & Lehmann	2006	German regions 1989 to 1992	Positive correlation, start-up activity fosters (causes) economic growth, especially in high-tech industries
Global Entrepreneurship Monitor	2009	Entrepreneurship data from 64 countries	Positive correlation, the Global Entrepreneurship Index, GDP and Global Competitiveness Index are all correlated (which does not imply causation)

Source: Borderstep

With the exception of the Audretsch and Frisch study (1996) based on German data from the 1980s, all studies find a positive correlation between start-up activity and different economic growth indicators (e.g. productivity, employment, GDP). Since the GEM 2009 derives this from data of 64 nations, the diagnosis seems to show some robustness. Audretsch, Keilbach and Lehmann (2006) argue that the German economy has shifted away from a growth dependence on established, incumbent firms in the 80s to a more American style growth dependence on entrepreneurship in the new century.

The results of Callejon and Segarra (1999) and Audretsch, Keilbach and Lehmann (2006) also point out that this finding is generally true for individual, and especially for high-tech, industries.

The effect of entrepreneurship on growth is explained by Audretsch, Keilbach and Lehmann (2006) by knowledge spillover effects. They argue that in business processes of established organizations and research projects, many ideas are caught in a “knowledge filter” and discarded because they do not bear a visible relation to the task, which is currently being carried out. But these ideas may have a value in other domains of society. Entrepreneurial persons may recognize associated opportunities and manage to permeate the knowledge filter by commercializing those ideas by starting a new firm. Since those ideas would, without the entrepreneurs, be discarded for good, the commercializing by start-ups effectively adds to economic growth. It may be of interest that Audretsch, Keilbach and Lehmann (2006) see this effect in a regional context because personal contacts and relationships facilitate this effect. It should be kept in mind that strong research, public and private, remains the basis for the knowledge spillover effect.

2.3 Entrepreneurship and Innovation

About 67 % of all innovations are initiated by entrepreneurs in SMEs (Kauffman Center 1999: 4). Timmons (1998: 11) highlights that with a focus on fundamental innovation, this rate is as high as 95 %. Looking at small US firms, the National Commission on Entrepreneurship (2000) lists major innovations in the 20th century:

Figure 3: Major innovations by small US firms in the 20th century

Acoustical suspension speakers	Geodesic dome
Aerosol can	Gyrocompass
Air conditioning	Heart valve
Airplane	Heat sensor
Artificial skin	Helicopter
Assembly line	High capacity computer
Automatic fabric cutting	Hydraulic brake
Bakelite	Piezo electrical devices
Biosynthetic insulin	Prefabricated housing
Continuous casting	Pressure sensitive cellophane
Cotton picker	Rotary oil drilling bit
Fluid flow meter	Safety razor
Frozen foods	Soft contact lens
Fosin fire airinguisher	Six-axis robot arm
	Spectographic grid

Source: NCOE 2000

Entrepreneurs are also found at the origins of whole sectors. Home computers, online-shopping, supermarkets and convenience food - without entrepreneurs they would not exist (Timmons 1998). National economists find significant links between the total entrepreneurial activity in nations and innovation measured in number of patents with the strongest link to high-growth-potential start-ups (Wong et al. 2005). Wong concludes *“This provides food for policy makers in terms of targeting entrepreneurial activation measures.”*

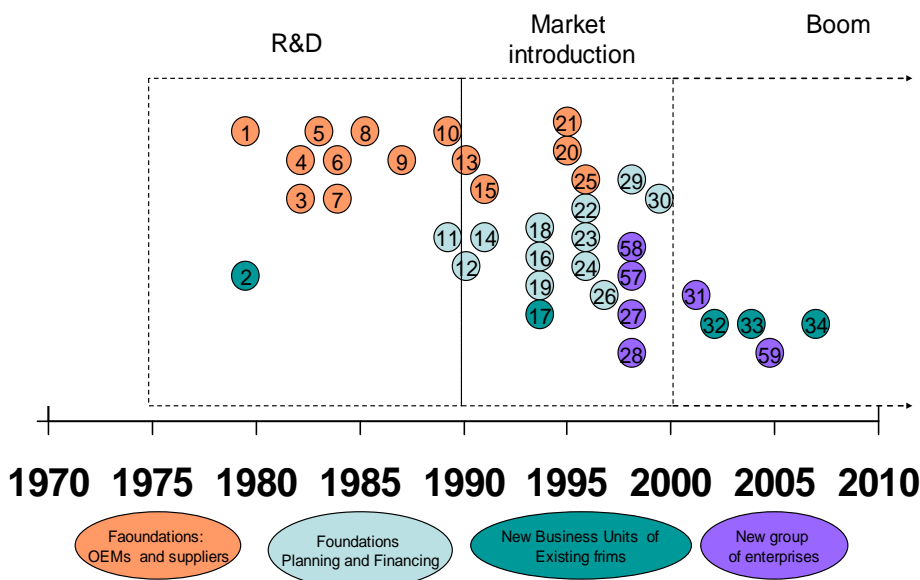
Zimmermann and Hofmann (2007) find that innovative start-ups at least create a lot more jobs than non-innovative start-ups. They are limiting this finding to those start-ups, which market a product or service, which was created by considerable R&D effort. Innovative start-ups marketing products, which were developed without high R&D effort did not perform better than non-innovative start-ups.

3 Entrepreneurship in sustainable markets

There is at least some evidence suggesting that the importance of entrepreneurship for growth and innovation is also true for sustainable markets. Fichter and Arnold (2003) analysed the genesis of 14 sustainable product innovations. 10 of them have their origin in a start-up. „Further on it is of interest that in all nine cases, in which the innovation was associated with the development of a completely new market, a start-up (7 cases) or at least a new business unit (2 cases) has been involved“ (Fichter and Arnold 2003: 44 f.).³ Petersen (2003) studied market leaders in 64 markets for sustainable products. In 46 cases, he found that the market leading companies had been started up with the clear intention to develop sustainable products. Petersen attributes those companies to the environmental movement, which lent them the problem based motivation and cultural framework for their creation.

However, to build up a huge sustainable market, the sustainable start-up firm itself does not have to survive at all. Many start-ups vanish because the entrepreneur with his idea at a later stage decides to get employed in an established firm or the start-up might be bought, lock, stock and barrel, by an established firm, as many examples in renewable energy have shown in the last 10 years. This can be shown with a consideration of the dynamics of firms, which have been started up or diversified within the sector of wind energy in Germany since the 1970s.

Figure 4: Dynamics of firm start-ups in the German wind energy sector



³ Translated by the authors

Source: Borderstep

The R&D phase is strongly dominated by start-ups, with just the one exception of MAN, a big engineering enterprise, which decided to close down its wind energy activities in 1989, just one year before the first market introduction activities were really successful.

When the technology was available, a second round of service start-ups were founded, which did the actual planning and financing of wind energy parks.

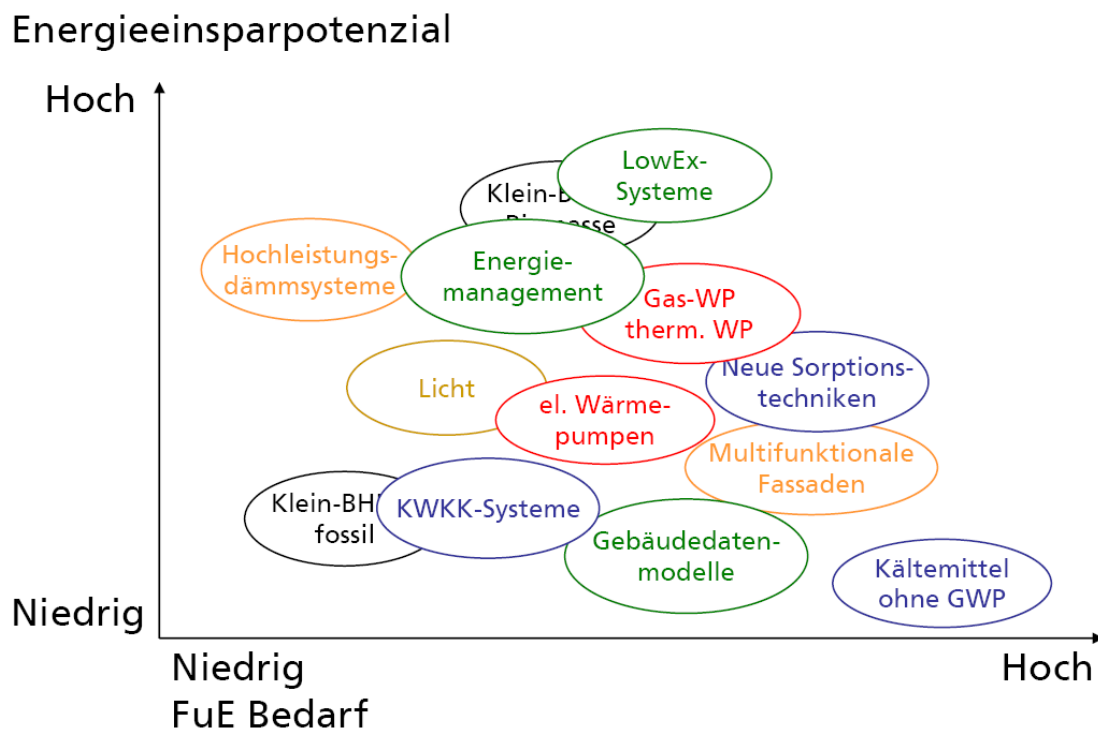
At the end of the 1990s, mergers and acquisitions reduced the number of active manufacturing OEM-firms. GE, Siemens and other major corporations moved into the sector. In 2008, the biggest wind energy manufacturer with a world-market share of 19% was the Danish Vestas (practically a wind energy start-up), followed by US-based General Electric (based on the German start-up Tacke Wind Energy, from 1997 to 2002 owned by Enron, 18%), the Spanish Gamesa (Joint Venture of older Gamesa and Vestas founded 1994, 11%), the German start-up Enercon (9%), the Indian Suzlon and German Siemens (both based on German start-ups, each 7%). All of these 71% of the 2008 world market have there origin in wind energy start-ups.⁴

In the sectors of photovoltaic and solar thermal as well as at the level of speciality electronics suppliers a very similar picture can be drawn. All these sectors would most probably not have emerged without start-ups.

If the technology portfolio of the renewable energy sector would be complete by now, the further support of start-ups would not matter. Indeed, sector specialists recognize an amazing spectrum of innovative technologies ready for the market (Kewitt 2009, Bradtke 2009, Henning 2009). However, there are still areas remaining where innovation seems necessary and possible, but has not yet occurred. In a future oriented conference organized by the German Ministry of Economics and Technology in early 2009, Henning mentioned some technologies for which he saw a high potential for energy efficiency, as well as a high necessity of further research and development.

⁴ Market shares based on a press release of February 27th 2009 from emerging energy research, online www.emerging-energy.com assessed on 30th July 2009.

Figure 5: R&D requirement versus energy efficiency potential



Source: Henning 2009

As an example, low-exergy energy sources like geothermal heat and cold have just started to be explored. It is most probable that major innovations will occur in this area. Additionally, there are many more areas where existing technological solutions are not considered satisfactory today. Since start-ups are providing

- innovative new solutions to sustainability problems,
- contributions to economic growth and
- contributions to international competitiveness,

they should remain in the focus of economic policy. They should certainly be considered a useful way to foster innovation and growth in the focus areas of sustainable future markets.

4 Instruments to foster creative construction

There is a spectrum of instruments available, with which entrepreneurship can be supported. Audretsch et al. (2006) position entrepreneurship policy as a third post-war economic policy paradigm. From the 1950s through the 70s, they see economic policy as focussing on the growth of huge corporations, which could be more efficient than small ones. After all, more efficient production meant better access to export markets. SMEs were seen as a kind of regional culture, which impeded economic performance, but could not be disposed of.

In the 70s, the paradigm of the knowledge economy was developed. Huge amounts of R&D spending fostered knowledge stocks being built in universities and huge corporations, but the success in transferring this knowledge into marketable products was but limited.

At the beginning of the 80s, US economic policy began the development of first instruments for an entrepreneurship policy. One of the first actions was the *Bayh-Dole-Act* of 1980, which had the objective to unlock all those inventions made during publicly funded research projects, which had been gathered by the state and of which only 5% were used economically (Audretsch et al. 2006). The *Bayh-Dole-Act* made it possible for universities and SMEs to get hold of those inventions at reasonable terms and dramatically fostered the economic use of knowledge accumulated during public research projects. Another example is the US program *Small Business Innovation Research* (SMIR), which started during the 80s and allocated a research budget to innovative small firms.

Furthermore, Sternberg found, that innovation centres are an additional means to create advantages for innovative firms. Hundreds of them have come into existence in the last two decades. The above mentioned measures were shown to have triggered the start-up of new firms (Sternberg 1996).

These localized centres also were the starting point for localized entrepreneurship policy. One of the next instruments applied locally were start-up competitions (Ripsas 1997 und 2001), which then spread to regional use. In some cases, start-up competitions have also been applied in a sector specific context (Zoche 2002), mostly in IT and mobility. Competitions and awards create advantages for the donor as well as for the winner. Competitive awards create, amongst others, information for markets, thereby encouraging private and public capital investment in early stage development. Also, they create knowledge about high-potential start-ups, which will subsequently be headhunted by regional business developers. Besides mostly localized start-up competitions, internet based information systems came into existence in the last years.

In general, entrepreneurship policy in the view of Audretsch et al. (2006) deals with two major problems of start-ups: One of them is the access to capital, which in the different phases of the start-up process is difficult. The other is the issue of intellectual property rights, which have to be protected but are not easy to handle. For both problems public consulting (e.g. carried out by innovation centres) is available. Additionally, entrepreneurship policy deals with the target of local and regional economic growth and subsequently tries to continuously identify high-potential start-ups, preferable in relation to already existing business clusters of the region in question.

On the basis of a thorough analysis of entrepreneurship support in Germany, Koch and Michler (2005) highlight quite different recommendations for policy:

- They argue that structural economic change as well as differences between regions should be accepted and made an integrated part of economic policy.
- Political influence on entrepreneurship activity should be recognized as limited.
- Policy should put additional effort in elite-institutions like elite-universities, from which high class spin-offs can be anticipated. Concentration of research in powerful and huge organisations might also be considered.
- The set of instruments for entrepreneurship support should be better structured and easier to understand.
- Private entrepreneurs should – like they do in the US - play an important role in entrepreneurship support.

5 Experiences in fostering creative construction

In general, sustainable entrepreneurship is largely profiting from more and more research tenders focussing on sustainable development problems and looking for marketable solutions. On EU-level and also in national states, such tenders have been issued quite often during the last years, enabling increasing research in this field and creating a range of ideas, which could possibly be commercialized. But the problem of getting those ideas off the ground undoubtedly remains the same as in every other field of knowledge. The problem of research results not being put into practice is widely known, also in this field of research. Although there is a lot of venture capital available for sustainable start-ups, the gap between innovation support and the state when a start-up becomes of interest for venture capital, seems to be a critical point. In preparation of this paper, only a few experiences could be identified in fostering sustainable entrepreneurship with entrepreneurship policy instruments. There are (and were) a couple of start-up competitions focussed on sustainability (amongst hundreds of general start-up competitions) and there are some specialized innovation centres (amongst hundreds of general innovation centres). That's about it. A few specialized innovation prizes do not turn the tide. We can only portrait some of the most interesting activities to show what should be done on a much larger scale – indeed the scale of activities should reflect the huge market potential mentioned in chapter 2.1.

5.1 The MIT's "Ignite Clean Energy Business Plan Competition"

A good example for a business plan competition with a focus on sustainable entrepreneurship is the annual „Ignite Clean Energy Business Plan Competition“ (ICE), run by the non-profit Organization „Energy Special Interest Group“ of the Massachusetts Institute of Technology (MIT) Enterprise Forum of Cambridge. It is open to both students and early-stage professionals from all over the world – but with a strong practical focus an eastern USA - who compete year-round at several stages accompanied by intensive mentoring.

Founded in 2004, its ultimate goal is to foster and stimulate innovation in the renewable energy sector in order to leverage Massachusetts' position as an important centre for green technology and to create new jobs in this region. The participants, in turn, have the opportunity to develop business skills, network with industry professionals, attract potential investors and win \$200,000 in cash and services. The start of the competition is in November with several kick-off and team-building events on the whole east coast, in addition to events in Oxford, UK. After 7 months, the number of competitors is narrowed down to 30 semi-finalists, who then attend a boot camp for superior coaching. The real challenge consists of writing a summary for the judges and a 10-minute sales pitch. The finals are open to the public, which enables a lot of media attention and the chance to promote one's start-up. In spite of the audience, every decision is made by a jury, whose evaluation criteria include the viability of the idea, a compelling business case and, of course, a convincing clean energy case.

So far over 250 teams have entered the past competitions, which helped several companies to boost their businesses. Many winners achieved considerable funding in different ways. 2005 winner "Liquid

Piston” received a \$ 70.000 small business innovation grant, 2006 finalist “Solasta” was awarded \$ 900.000 of the department of energy to develop next generation photovoltaic, 2007 winner “RSI Silicon” raised \$ 5 million in private funding and 2008 winner “FloDesign Wind Turbine Corporation” raised \$ 6 million in venture capital, \$ 500k in subsidized loans and \$ 1.4 million in product orders.⁵

Abe Schneider from NATEL, 3rd at the ICE06, is pleased to have participated: “... *The real 'payoff' - what makes ICE worthwhile - is the opportunity to network with highly qualified, like-minded people. It's a good stepping stone for a young company, and a great development experience.*” Further he states⁶: “*The mentoring process actually opened potential business opportunities to us, in addition to providing a diversity of 'fresh eyes' and new insights into means of improving our presentation.*” Due to the involvement of many notable sponsors, the quality of the competition has increased enormously, so that a lot of information for markets is created, encouraging private capital investment in early-stage development. The competition undoubtedly contributes to the position of the MIT as a world-leading university incubator for new enterprises⁷

5.2 Hanover’s “Special Award for Start-Ups in Climate Protection”

Hundreds of thousands of jobs in Germany have been created in the last years in climate protection and renewable energies. Start-ups have contributed strongly to this development. Hundreds of thousands of additional jobs are expected to be created in these sectors during the next 10 to 15 years. To achieve a fair share of this development for Hanover, the Borderstep Institute proposed a Special Founders Award „Climate Protection“, which was donated by the enercity proKlima Fund and announced for the first round in conjunction with the yearly StartUp-Impuls-Business-Plan-Competition of the HannoverImpuls business development agency in 2005.

Business start-ups in the areas of climate protection and renewable energy were scarce among those profiting from start-up incentives in the Hannover region up until 2004. Through invitations to tender, 11 participants were prompted to participate in the 2005/2006 competition. The number rose to 16 for the 2006/2007 competition and to more than 20 in 2007/2008. Two laureates shared the prize in the three of the first four competitions. In 2006/2007, three prizes were awarded.

Six of the nine laureates are technology start-ups. Of these, four start-ups (“ARES”, “AG RegEn”, “timbertower” and “sandwichtower”) have embarked upon the long road to develop a market-ready product from a technological innovation. All start-ups in the research phase were successful in acquiring research funding for the necessary research. Two of the start-ups raised a considerable volume of venture capital by contacts gained through the start-up competition.

⁵ See http://www.technopolevsm.com/fichiers/File/pdf/Documents_bulletin/ICE_Brochure.pdf assessed 2.8.2009.

⁶ See http://www.planoandsimple.com/primary_links/ice_testimonials assessed 2.8.2009.

⁷ The spin off success from MIT is described by Edwards and Eesley 2009.

Overall, the region is quite content with the activity. Still, four years after the first prize was awarded it becomes clear, that entrepreneurship is quite a long way from achieving regional economic growth.

5.3 YouNoodle.com

YouNoodle.com runs a website, which provides networking opportunities for start-ups, collects information on them and organizes the information in a directory. The activity includes worldwide start-ups, but has a strong focus in the US and English speaking countries. Sectors concentrations are observed in internet and IT, but the 27.000 listed start-ups also include 850 active in cleantech business. With its “start-up-predictor” it tries to predict their future outcomes and what they will be worth in three years. The necessary data comes from questionnaires, filled out by each founder, which concentrate on the business' concept, finances, founders and advisers and takes into account historic data. Further it tracks the progress of any early-stage company, once it has gone through the prediction tool, by processing 150,000 start-up news stories every day and makes the data available for business owners, customers, investors, entrepreneurship clubs and competitions.

Another mathematical algorithm is fed data from CrunchBase, which is the largest public wiki of technology company information, YouNoodle's own community and the tracking system, in order to generate a score for every start-up, on a scale of 0 to 100, which indicates the impact and importance of a start-up based on its traction, activity and buzz.

Through its services YouNoodle intends to support all interest groups in the start-up-business in making decisions and keeping track of new companies so that their resources are used most effectively. These services are also available for third-parties, including Angelsoft.com, Wired.com, the Daily Telegraph in the U.K., and Venturebeat.com, reaching an audience of over one million people per month.⁸ According to Allen Morgan of the Mayfield Fund, one of YouNoodle's investors, YouNoodle “is under no immediate pressure to make money”; the focus right now is rather on “growing the database”⁹. One of its founders, Bob Goodson, states that “there’s an opportunity to sell more advanced tools to government agencies and limited partners. For the government, these tools help them understand where to put their money in order to stimulate the economy, while LPs learn where to make smart investments”¹⁰. So far 150,000 people, 27,000 start-ups and 250 clubs and competitions

⁸ See http://younoodle.com/static/press/YouNoodle_Scores_Launch_February_19_2009 assessed on 5.8.2008.

⁹ See <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/04/12/BU4U170GLL.DTL> assessed on 5.8.2008.

¹⁰ See <http://venturebeat.com/2009/02/18/younoodle-scores-the-buzz-on-25000-startups> assessed on 5.8.2008.

have joined YouNoodle, what makes it to the largest-ever dynamic directory of active start-up companies¹¹.

Preliminary reports on the service in February 2008 led to some skeptical reactions. Venture capitalist Paul S. Kedrosky told The New York Times, *"If their tool did such a good job, they'd raise a fund themselves and beat the tar out of us"* (Ritchel 2008). Scott D. Anthony, president of the consulting and investment company Innosight, argued that if YouNoodle were to succeed ("and that remains a big if") it might lead to "substantial change in the venture capital industry", comparable to the way credit scores affected the work of loan officers (Anthony 2008).

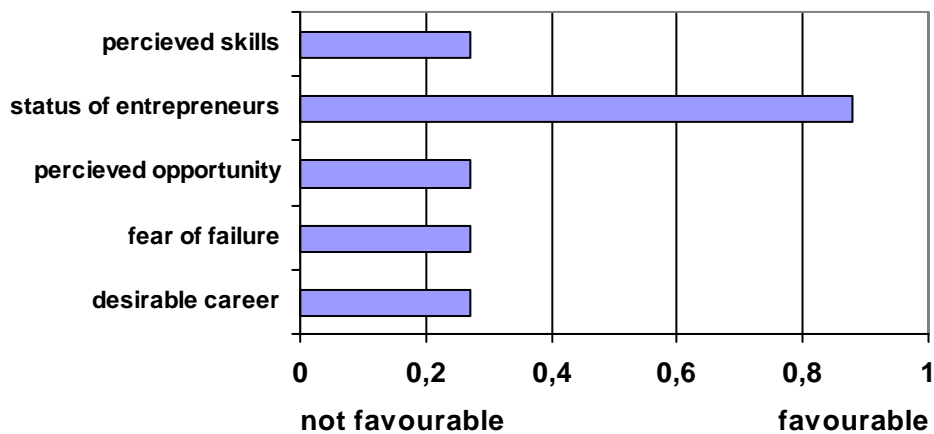
MIT's Ignite clean energy competition runs a YouNoodle group to foster communication and transparency.

¹¹ See http://younoodle.com/static/press/YouNoodle_Scores_Launch_February_19_2009 assessed on 5.8.2008.

6 What needs to be done in Germany

The Global Entrepreneurship Monitor has explored start-up-conditions and start-up-activity in a growing number of countries since 1999. In its national reports for Germany (since 1999) it reveals shortcomings in the German entrepreneurial system. Although in some aspects Germany has improved on the indicators during that time, the reserved position of many Germans to the idea of starting up a business remains constant and leads to a very low start-up rate. The following figures show the relative position of the German entrepreneurial system compared to the systems of other innovation driven economies.

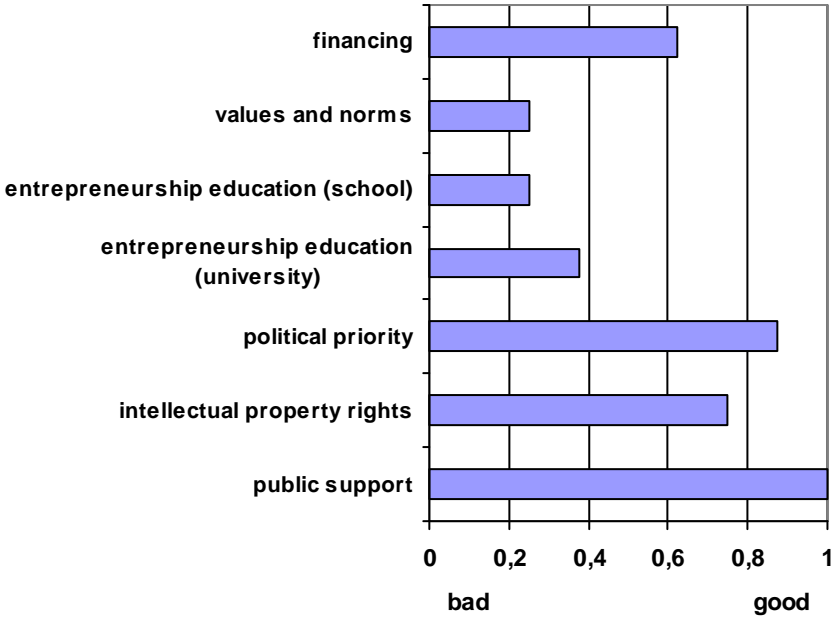
Figure 6: Attitudes of Germans towards entrepreneurship relative to other countries



Source: GEM 2009b

Figure 6 shows that the status of entrepreneurs in Germany is relatively high. On the other hand, entrepreneurship is widely associated with the fear of failure, only few people see business opportunities, they do not perceive themselves to be equipped with the necessary skills and knowledge and most people do not see entrepreneurship as a desirable career move.

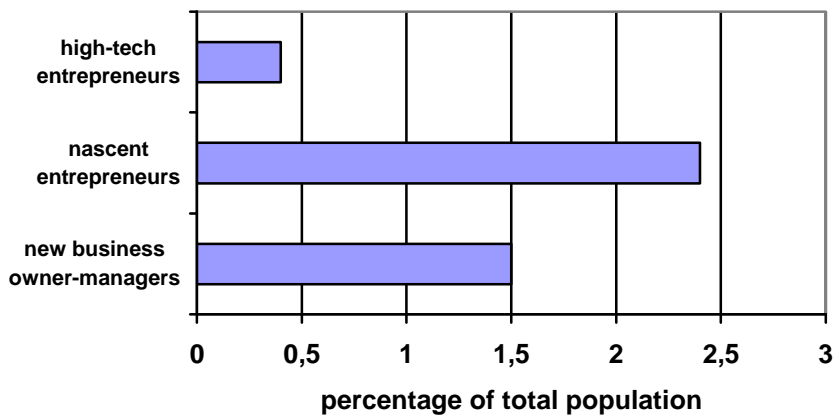
Figure 7: Relative framework conditions for entrepreneurship in Germany as seen by experts



Source: GEM 2009b

Figure 7 reveals that in the view of entrepreneurship experts, entrepreneurship in Germany is given a high political priority. Public support and the protection of intellectual property rights is very well taken care of. Capital sources exist on a comparative level. However, entrepreneurship education in schools and universities is seen as a weak spot, as is the system of values and norms.

Figure 8: Relative number of entrepreneurs in Germany



Source: GEM 2009a: 20 (nascent und new business) und GEM 2009b: 15 (high-tech)

Resulting from the above framework conditions and attitudes it does not surprise that the entrepreneurial activity in Germany is low. In fact, the number of nascent entrepreneurs in Germany has sharply declined from 2006 to 2008 reflecting the economic boom, which supplied the chance of getting attractive jobs in industry and service. Especially young engineers were lacking of entrepreneurial activity.

Two facts are striking. A negative result is that while Germany has the 14th position (of 18) in the number of nascent entrepreneurs who plan to start up, its position regarding the number of young entrepreneurs who have been managing a newly started-up company for 3.5 years or less is even lower and only second to last (GEM 2009a). A positive result is that in high-tech entrepreneurship, Germany ranks as the third best of 16 comparable nations (GEM 2009b).

The social democratic Friedrich Ebert Foundation (2009) recently published a paper on industrial policy, which generally highlights similar deficits. In general they assert that the creation of technologies and clusters can not be planned and the low intensity of entrepreneurship is an important deficit of economic policy in Germany. Specifically, the paper criticises the idea to foster university based entrepreneurship. It further argues that university graduates are not as ready for a successful start-up as are e.g. 40 year old, experienced people. In consequence, sustainable technology clusters seem to be an environment in which innovative people gather experience, create ideas, make contacts and only then start up to prove that a new technology is viable and can make a difference.

As a result of our analysis some conclusions can be drawn for possible political action.

6.1 Recommendations to policy for discussion

In Germany, an entrepreneurial career seems not to be desirable and many people do not really see business opportunities. On the other hand, huge industrial sectors in the field of renewable energy came into existence with entrepreneurs being the driving force. Although this is more and more the subject of discussion and press articles, much more could be done to enforce awareness. As late as 2008, a book on the innovation process of wind energy (Bruns et al. 2008) was published, in which the role of entrepreneurship remains largely hidden and economic instruments of the state seem to have blown the sector into existence¹². A better public knowledge about the origin and success of German firms in emerging sustainable markets could possibly create more optimism in researchers and technicians and courage to become nascent entrepreneurs and for nascent entrepreneurs to really start-up.

A related question is that of knowledge about the really successful entrepreneurs. Every kid in the USA as well as in Germany knows who Bill Gates is and that he is a self-made man in computing. But nearly nobody in Germany can tell who Aloys Wobben is. The fact that he was one of the first entrepreneurs in wind energy in the 80s, appeared on the list of the 100 richest Germans in 2006 at position 82, in 2007 and 2009 at position 24 and in 2010 at position 29 with a fortune of 2.9 bil. € might be tremendously striking (Manager Magazin 2006, 2007, 2009 and 2010). His company owns about 40% of the worldwide wind energy patents. However, nearly nobody in the public knows about him.

Alois Wobben and the huge group of successful German entrepreneurs in sustainable ventures are not only important to make the people in Germany believe that at least some of them are as successful and competent as Bill Gates and Werner von Siemens, but that they are also important for the process of unfurling entrepreneurship in Germany. In the American entrepreneurial culture, many activities to foster entrepreneurship are run or financed by entrepreneurs. The Ewing Marion Kauffman Foundation was founded by an entrepreneur who gave a lot of his fortune to help develop an entrepreneurial culture in American business. In Germany, not too many examples exist in which entrepreneurs are active in creating more entrepreneurship. It would be great to get the companies and entrepreneurs who are members of the trade associations related to renewable energy involved in activities to develop not only the existing technologies and sectors, but also to support the first steps to create even more sectors which try to develop new ways of exploring renewable energy sources.

A next and up to now not fully explored way would be to concentrate research in sustainability challenges, solutions, technologies and markets in regional clusters. World class research is often shown to be the root of high-growth spin-offs. A consistent strategy to focus sustainability technology research could therefore be a missing link between research funding (executed by the ministry of re-

¹² First policy recommendations of a second project on innovations biographies have been published by Bruns (2009). Concerning the pioneer phase they recommend to stabilize the innovation process, protect the niche, support pioneers and make use of the activity of civil society. No real connection to entrepreneurship policy can be identified.

search) and market development (executed by the ministry of the environment or possibly, in the future, the ministry for economics). Furthermore, all attempts to focus sustainability research should be accompanied by strong activities to foster close-to-university business and entrepreneurship education.

As a starting point, an international expert conference could be the chance to discuss the matter, reach a consensus about the question of the existence of unexploited opportunities and at least, start of a constructive process.

6.2 How many employees could the renewable energy sector have today if entrepreneurship policy had been better?

A simple calculation may throw some light on the question of what Germany might have missed by NOT supporting entrepreneurship as strongly as it has been in other nations.

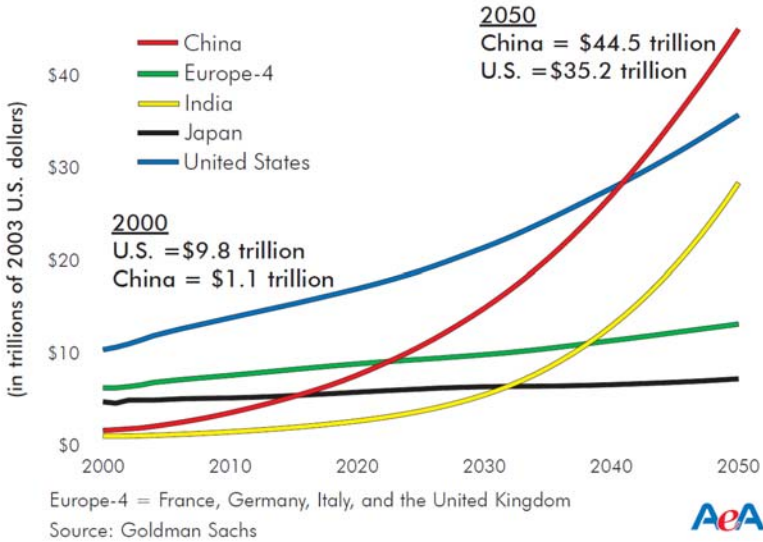
In March 2011 the German environmental ministry reported that there were 367.400 jobs in the sector of renewable energy in 2010 (BMU 2011).

The Global Entrepreneurship Monitor (GEM 2009a) reveals that in Germany there are 2.4 % nascent entrepreneurs in the population and about 1.5 % are new business owners or managers. In the USA we find 5.9 % nascent entrepreneurs in the population and about 5 % new business owners or managers. Even if we correct for the good German performance in high-tech ventures (an advantage of a factor of 2 compared to the US, GEM 2009b) the USA would still exceed Germany by a factor of 1.2 (20 % more) in nascent entrepreneurs and about 1,7 (70 % more) on the level of new business owners or managers.

Had these numbers been achieved in past years, the German renewable energy sector could have been even bigger. 20 % more would mean 440.880 employees, 70 % more would mean 624.580 employees. Although this calculation is obviously much too simple, it makes it clear that not every possible business opportunity has been exploited and subsequently not every possible job has been created. 70.000 to 250.000 additional jobs could have come into existence in the past 15 years. We should at least give some attention to the question of how we can make sure that in future nearly all opportunities will be exploited. That would help the German economy as well as the sustainability of a number of world markets.

In fact, it will be necessary to speed up. In the US, the Obama Administration is already striving for environmental innovation and invests huge amounts of money in the renewable energy sector as well as in energy efficiency. After the Fukushima disaster Japan will also invest very strongly in renewable energies (Straits Times 2011). According to China's 15 year science and technology plan until 2020 advanced storage technologies, alternative and renewable energies and environmental technologies will be strongly supported (AEA 2007). Last, but not least, in the economy of the 21st century, the predominance of the US, Europe and Japan will most probably be severely challenged by China, India and others.

Figure 9: The rise of the dragon: projected GDPs in the 21st century



Source: AEA 2007

Renewable energy, energy storage and energy efficiency have obviously left the sustainability niche and are hitting mainstream markets world wide. Other sustainable markets, like water saving or material efficiency, are internationally less recognized and provide potential for German national competitiveness. Sustainable entrepreneurs are already working in these two - and further - sectors, which are still hidden to international mainstream thinking.

German economic policy will face a time when every possible resource for growth and competitiveness has to be exploited. Sustainable entrepreneurship is one of them.

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