

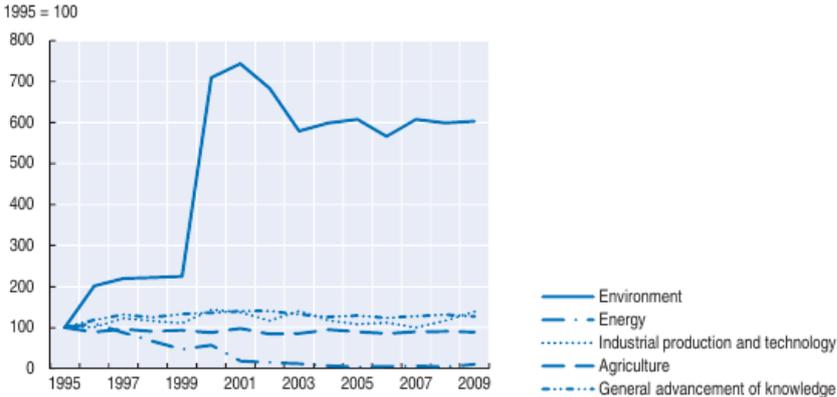
## Two approaches to foster innovation in environmental business

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1	<p><b>Key words</b></p> <p>Special Green Business Cases innovators, Start-up-Nation, clean-tech, GDP spending on R&amp;D, national innovation framework, patents, environmental licensing, water technology, waste water treatment, emefcy: wastewater and renewable energy, Desalitech: increase water-use efficiency, Aqua Solutions: water and energy savings in laundry, green-tech, Woosh: provide drinking water, Phinergy: high energy dense batteries, Heliatek: solar films, Nill-Tech: oil from plastics, DeVeTec: waste heat to electricity, Chido's mushrooms: sustainable mushroom production</p>
2	<p><b>Introduction</b></p> <p>In our days the world is facing a bulk of environmental challenges. While some of them might be considered as <i>local</i> and can be traced back to specific polluters (e. g. waste water emission) other challenges have more of a <i>global</i> nature and might be reasoned by millions of actors. On the side of the local challenges Israel is confronted with a relatively small, water-scare, densely populated, and highly urbanized territory. Geopolitical concerns about energy, water and food supply provide additional challenges.<sup>1</sup></p> <p>In contrast Germany has some concerns regarding the ambient air and also the wastewater treatment has to be improved. Furthermore, the decision of closing down all nuclear power plants brings additional environmental challenges due to the fact that the energy gap has to be bridged with fossil power plants as long as there are not enough renewable energy plants available.<sup>2</sup></p> <p>To tackle all these challenges businesses have an outstanding role. Beside the fact that companies often cause environmental harms, they also can be the solution: In the role of <i>innovators</i> they have to find new means and technologies that help to displace existing business models and ensure monopoly profits for the innovator.<sup>3</sup></p> <p>The paper at hand is focusing on those innovative companies that try to tackle environmental challenges by providing new means and techniques and hereby are specified as <i>green businesses</i>. After giving an overview about the German and Israeli economy some specific companies are described in the context of their environmental challenge. The paper finishes by giving a short conclusion about the findings.</p>
3	<p><b>Economic background for green businesses</b></p>

<sup>1</sup> cf. OECD (2011), p. 3; Braathen & James (2011), p. 1.

<sup>2</sup> cf. OECD (2012), p. 3, 19.

<sup>3</sup> cf. McCraw (2007), 72 f.

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	<p>Although Israel and Germany nowadays have a <i>market economy</i> with a nearly free market as economic system it is obvious that both countries differ in institutions and actors that serve these markets. On the one hand Germany came with its Rhine capitalism (based on a social partnership between employers and unions) from the direction of a mixed economy. Historically this brought upon 39 of the world's largest 500 companies (measured by revenue)<sup>4</sup> and <i>small and medium enterprises</i> which still stay at the core of innovations within the German economy.<sup>5</sup></p> <p>On the other hand Israel came more from the direction of a command economy by making use of <i>kibbutzim</i> that still today exist within the economy. Even if Israeli players nowadays only play a minor role in the group of the largest 500 companies<sup>6</sup> it can be considered as a prosperous innovative economy: In 2009 some 63 Israeli companies were listed in the American stock exchange NASDAQ which brought the country the title of "Start-up Nation" what refers to the huge amount of <i>startups</i> (institutions dedicated to create something new and that can be used for a repeatable and scalable business model) that were founded in Israel.<sup>7</sup> Next to laws that comprehend public environmental protection expenditures, mainly these startups make the core of the green business growth. The huge amount of startups might be reasoned in governmental Research &amp; Development (R&amp;D) outlays that are seven times higher than at the end of the 1990s (see the following graph).<sup>8</sup></p> <p>Figure: Development of Israeli R&amp;D by socio-economic objectives</p> 

<sup>4</sup> cf. Fortune (2009).

<sup>5</sup> cf. Söllner (2011), p. 1086.

<sup>6</sup> cf. Fortune (2009).

<sup>7</sup> cf. Ries (2011), p. 27 ff.; Senor & Singer (2011).

<sup>8</sup> The following data about Israel covers the areas governed by Israeli authorities. Its use is without prejudice to the status of Golan Heights, East Jerusalem and the West Banks.

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	<p>Source: OECD (2011), p. 38.</p> <p>These R&amp;D outlays of the Israeli government brought to the field of environmental technologies (in Israeli widely named “clean-tech”<sup>9</sup>), which comprises for example 270 water technology companies where 22% are startup companies or 60 companies that conduct R&amp;D in the field of biofuels, synthetic fuels, electric cars, fuel cells, and alternative engine technologies.<sup>10</sup></p> <p>While Israel was fostering business growth with 4.4% of its Gross Domestic Product (GDP) in 2010 Germany only spend 2.8% of its GDP for R&amp;D what can be considered as a relatively low share.<sup>11</sup> In contrast to Israel Germany encourages environmental innovation by a strong national innovation framework which is supported by a broad industrial base, a high level of participation in international trade and strict environmental regulation. The framework was established by the turn of the century and comprehends environmental laws that are more general than sector specific and try to change whole markets.<sup>12</sup> At the core here was the National Development Strategy (NHS) which was formulated in April 2002 and contained management mechanisms, coordination mechanism, and goals like the inter-generational equity (incl. resource and climate protection), a good quality of life, social cohesion, and international responsibility. Regarding innovation rates it brought a shift from local challenges in the areas of air, water, and waste to a more complex environmental agenda including topics of climate change. Projecting this innovation onto the number of resulting patents into the area of environmental technologies brings up the chart like it is shown below. By comparing this data please keep in mind that with a population of 7,7 million people and a GDP of 252,8 billion USD in 2012 Israel is exceptionally successful with environmental licensing in relation to large countries like Germany with its 80.5 million residents and a GDP of 3,25 trillion USD.<sup>13</sup></p> <p>Figure: Patents in environmental technologies</p>

<sup>9</sup> cf. OECD (2011), p. 11.

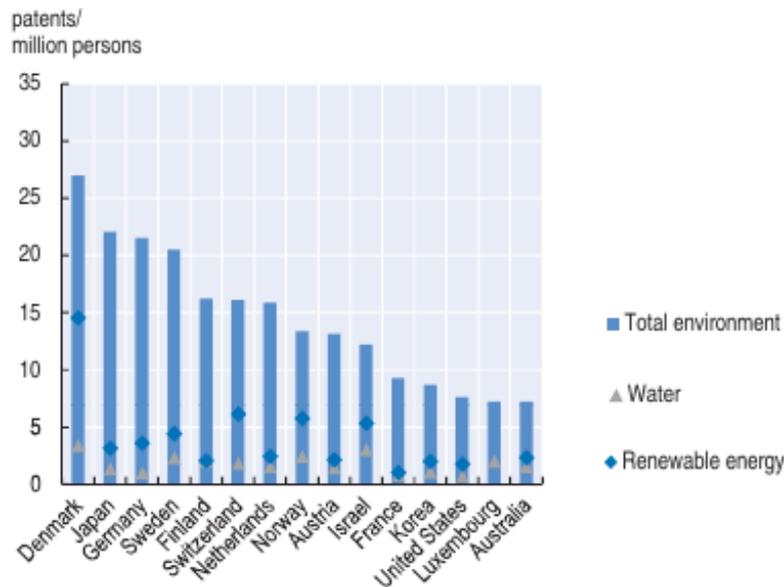
<sup>10</sup> cf. OECD (2011), p. 34-42.

<sup>11</sup> cf. OECD (2012), p. 81.

<sup>12</sup> cf. OECD (2012), p. 9, 31, 79.

<sup>13</sup> cf. Central Intelligence Agency (2013).

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4	<p data-bbox="231 985 662 1019"><b>Examples of green businesses</b></p> <p data-bbox="231 1041 1412 1232">To support a growing society within a water scarce country water technology and waste water treatment play an exceptional role in Israel what is also indicated through the relatively high number of patents that are related to water technology. Inventions in this area often have also positive environmental side effects like the following three examples show.</p> <p data-bbox="231 1254 1428 1545">The startup <i>emefcy</i> provides an innovative approach that is tackling two challenges in parallel: wastewater treatment and renewable energy. While conventional wastewater treatment needs a huge amount of power, emefcy developed an Electrogenic Bioreactor (EBR) in which bacteria process organic contaminated wastewater. In parallel the EBR makes use of the electric current that is part of the bacteria's metabolic activity. According to emefcy the EBR technology enables to save 76 million tons of carbon dioxide equivalents.<sup>14</sup></p> <p data-bbox="231 1568 1412 1803">Similar to emefcy also <i>Desalitech</i> is challenging two problems. By replacing the traditional reverse osmosis desalination scheme with closed circuit desalination Desalitech is able to reduce up to 50% of desalination energy consumption by increasing water-use efficiency. Founded 2007 in Israel the company now is headquartered in the United States and received 13 million USD as venture capital.<sup>15</sup></p> <p data-bbox="231 1825 1428 1915">The third example <i>Aqua Solutions</i> aims at water and energy savings by providing a solution for industrial laundries that can be used with existing washing machines. By using electro-</p>



Source: cf. OECD (2011), p. 39.

<sup>14</sup> cf. Israel NewTec (2011) , p. 74.

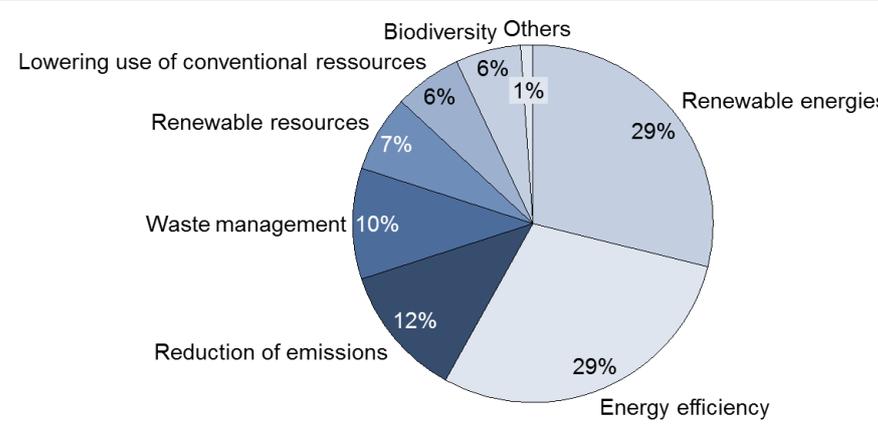
<sup>15</sup> cf. Doom (2013).

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	<p>activated water instead of chemicals Aqua Solutions is decreasing water and electricity consumption also saving costs from an economic point of view. Furthermore the amount of phosphates and non-biodegradable materials is reduced drastically. In numbers this solution decreases 50% of the water consumption, up to 80% of the energy consumption, and 80-90% of the amount of chemicals used in the laundry process.<sup>16</sup></p> <p>Beside water and energy management the green-tech sector comprehends of course other fields. For the field of waste management nowadays <i>Woosh</i> is becoming a talking point. This startup is following the idea to reduce the amount wasted plastic bottles by setting up water dispenser in high-traffic pedestrian areas. Here people can bring their water bottles, register with the service and clean or filling their bottles. The registration should engage people to behave responsible so that water is not wasted. Within the first two weeks of test mode <i>Woosh</i> set up seven water dispensers in Tel Aviv that helped to avoid the production, transportation and landfilling of 7,000 plastic bottles.<sup>17</sup></p> <p>Even if one might think that Germany is the automotive nation it has to be said that also Israel is active in the area of Electronic Vehicles. Here the startup <i>Phinergy</i> is focusing on aluminum-air and zinc-air batteries that have a high energy density, no carbon dioxide emissions and contain fully recyclable materials. While the energy source is a zinc or aluminum anode the electrolyte is mainly based on water. Due to the fact that one kilogram aluminum has an electric capacity of 0.3 kWh (which is three times higher than a conventional lithium-ion battery) the battery can be used within electric cars for 2,000 km and needs only to be refueled with water as electrolyte. Besides providing water for those cars fuel stations also could save the waste water which is contaminated with aluminums hydroxide. It can be recycled by making use of surplus production of wind turbines so that pure aluminum and water are the outcomes.<sup>18</sup></p> <p>Similar to the Israeli side also the German startup industry is very diverse. Like the following graph indicates startups in Germany are mainly engaged in the areas of renewable energy and energy efficiency.</p> <p>Figure: Patents in environmental technologies in 2008 in Germany</p>

<sup>16</sup> cf. Israel NewTec (2011) , p. 20.

<sup>17</sup> cf. Shamah (2013) .

<sup>18</sup> cf. Lossau (2013) .

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	<div style="text-align: center;">  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <caption>Data from Pie Chart</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Renewable energies</td> <td>29%</td> </tr> <tr> <td>Energy efficiency</td> <td>29%</td> </tr> <tr> <td>Reduction of emissions</td> <td>12%</td> </tr> <tr> <td>Waste management</td> <td>10%</td> </tr> <tr> <td>Renewable resources</td> <td>7%</td> </tr> <tr> <td>Lowering use of conventional resources</td> <td>6%</td> </tr> <tr> <td>Biodiversity</td> <td>6%</td> </tr> <tr> <td>Others</td> <td>1%</td> </tr> </tbody> </table> </div> <p>Source: cf. Fichter &amp; Weis (2013), p. 3.</p> <hr/> <p>Within the sector of renewable energies and energy efficiency <i>Heliatek</i> is researching and developing on solar films that are based on small organic molecules. This organic solar technology is (in difference to conventional crystalline and thin-film solar energy) able to avoid excessive heating and to absorb a very broad spectrum of light so that energy also can be produced in low light conditions. Due to the fact that one gram of material can be used for one square meter of the Organic Photovoltaic Cell (OPV) the technology can also be used for traditional solar panels what might result in organic OPV skins, smart green buildings with OPV facades and windows or functional fashion that is able to heat up or cool down. Currently the company is leaving the R&amp;D phase and searching investors to build up production facilities with a capital need of 60 million EUR.<sup>19</sup></p> <p>In the area of waste management several approaches can be found within the Germany industry. While <i>Nill-Tech</i> currently is planning and building a facility that is able to generate 850 liters of oil out of 1 ton of plastics,<sup>20</sup> <i>DeVeTec</i> has developed a steam expansion engine that converts waste heat into directly usable electricity.<sup>21</sup> And also for organic waste a further economic usage could be found that also contributes against poverty and starvation. The startup <i>Chido's mushrooms</i> is using coffee ground to raise various mushrooms like shiitakes or various kinds of oyster mushrooms. Beside growing and selling mushrooms the company offers trainings and home growing kits so that people are engaged to grow up mushrooms on their own what avoid transportation emissions and cutting of timber for the traditional growing of mushrooms.<sup>22</sup></p>	Category	Percentage	Renewable energies	29%	Energy efficiency	29%	Reduction of emissions	12%	Waste management	10%	Renewable resources	7%	Lowering use of conventional resources	6%	Biodiversity	6%	Others	1%
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<sup>19</sup> cf. Wandke (2013) ; Hess (2012) .

<sup>20</sup>cf. energy mag (2013) .

<sup>21</sup> cf. ecosummit (2013) .

<sup>22</sup> cf. Töpper (2013) .

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<b>5</b>	<b>Conclusion</b> <p>As it was outlined Israel and Germany are tackling different challenges by making use of different approaches. While Israel is confronted with scarce resources and motivating businesses with a high R&amp;D funding Germany is trying to get independent from conventional energy sources by forcing companies by law to sustainable changes in the market. Although if both sides have startups within the environmental scene it has to be said that Israel is much more successful in promoting startups than Germany what might be reasoned in the mandatory military service, immigration in Israel or that Germany is still “too serious” for startups.<sup>23</sup> Whatever the reason might be: By tackling different challenges and using different approaches both countries provide a good foundation to learn from each other and to compare and discuss the results of different practices. And of course this pluralism is a perfect basis for a symbiosis like in the case of the Israeli startup <i>Arava Power</i> where Arava initiated a solar power plant that was designed, built, and maintained by the German industrial giant Siemens.<sup>24</sup></p>
<b>6</b>	<b>References</b> <ul style="list-style-type: none"><li>&gt; Braathen, N. A.8, &amp; James, G. (2011). Taxation, Innovation and the Environment: A Policy Brief. Paris. Retrieved from <a href="http://www.oecd.org/env/taxes/innovation">www.oecd.org/env/taxes/innovation</a>.</li><li>&gt; Central Intelligence Agency. (2013). The World Factbook. <i>cia.gov</i>. Retrieved from <a href="https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html">https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html</a>.</li><li>&gt; Doom, J. (2013). Desalitech Gets Liberation Capital Investment for Water. <i>bloomberg.com</i>. Retrieved September 2011, 201310, from <a href="http://www.bloomberg.com/news/2013-06-11/desalitech-gets-liberation-capital-investment-for-water.html">http://www.bloomberg.com/news/2013-06-11/desalitech-gets-liberation-capital-investment-for-water.html</a>.</li><li>&gt; ecosummit. (2013). DeVeTec. <i>market.ecosummit.net</i>. Retrieved September 2011, 201310, from <a href="http://market.ecosummit.net/c/DeVeTec">http://market.ecosummit.net/c/DeVeTec</a>.</li><li>&gt; energy mag. (2013). In Mannheim - Aus Plastikmüll wird Öl. <i>energy-mag.com</i>. Retrieved September 2011, 201310, from <a href="http://www.energy-mag.com/in-mannheim-aus-plastikmull-wird-ol/">http://www.energy-mag.com/in-mannheim-aus-plastikmull-wird-ol/</a>.</li><li>&gt; Fichter, K.8, &amp; Weis, R. (2013). Green Economy Gründungsmonitor. Oldenburg.</li><li>&gt; Fortune. (2009). GLOBAL 500 - ranking of the world's largest corporation.</li></ul>

<sup>23</sup> cf. Senor & Singer (2011) ; Zange (2012) .

<sup>24</sup> cf. Wainer (2010) .

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	<p><i>money.cnn.com</i>. Retrieved September 22 11, 2013 10, from <a href="http://money.cnn.com/magazines/fortune/global500/2009/countries/Germany.html">http://money.cnn.com/magazines/fortune/global500/2009/countries/Germany.html</a>.</p> <ul style="list-style-type: none"><li>&gt; Hess, J. M. (2012). 3 Smart Green Startups from Germany Poised to Conquer the Global Market. <i>ecosummit.net</i>. Retrieved September 2011, 2013 10, from <a href="http://ecosummit.net/articles/3-smart-green-startups-from-germany-poised-to-conquer-the-global-market">http://ecosummit.net/articles/3-smart-green-startups-from-germany-poised-to-conquer-the-global-market</a>.</li><li>&gt; Israel NewTec. (2011). <i>Israeli Cleantech Companies Catalog</i>. Jerusalem: The Israel Export &amp; International Cooperation Institute.</li><li>&gt; Lossau, N. (2013). Dieses Auto wird mit Wasser betankt. <i>welt.de</i>. Retrieved September 11 11, 2013 10, from <a href="http://www.welt.de/wissenschaft/article117549279/Dieses-Auto-wird-mit-Wasser-betankt.html">http://www.welt.de/wissenschaft/article117549279/Dieses-Auto-wird-mit-Wasser-betankt.html</a>.</li><li>&gt; McCraw, T. K. (2007). <i>Prophet of Innovation - Joseph Schumpeter and Creative Destruction</i>. Harvard: President and Fellows of Harvard College. Retrieved from <a href="http://books.google.de/books?id=wBXQOuQ73vwC&amp;printsec=frontcover&amp;dq=schumpeter+innovation&amp;hl=de&amp;sa=X&amp;ei=IAZHUtr4FoittAatsYGAAQ&amp;redir_esc=y#v=onepage&amp;q=innovation&amp;f=false">http://books.google.de/books?id=wBXQOuQ73vwC&amp;printsec=frontcover&amp;dq=schumpeter+innovation&amp;hl=de&amp;sa=X&amp;ei=IAZHUtr4FoittAatsYGAAQ&amp;redir_esc=y#v=onepage&amp;q=innovation&amp;f=false</a>.</li><li>&gt; OECD. (2011). <i>OECD Environmental Performance Reviews: Israel 2011</i>. Paris: OECD Publishing. doi: 10.1787/9789264117563-en.</li><li>&gt; OECD. (2012). <i>OECD Environmental Performance Reviews: Germany 2012</i>. Paris: OECD Publishing. doi: 10.1787/9789264169302-en.</li><li>&gt; Ries, E. (2011). <i>The Lean Startup</i>. New York: Crown Publishing Group.</li><li>&gt; Senior, D.8, &amp; Singer, S. (2011). <i>Start-up Nation: The Story of Israel's Economic Miracle</i>. New York: Twelve.</li><li>&gt; Shamah, D. (2013). Remember when water was free? It is again in Tel Aviv. For now. <i>timesofisrael.com</i>. Retrieved September 21 11, 2013 10, from <a href="http://www.timesofisrael.com/remember-when-water-was-free-it-is-again-in-tel-aviv-for-now/">http://www.timesofisrael.com/remember-when-water-was-free-it-is-again-in-tel-aviv-for-now/</a>.</li><li>&gt; Söllner, R. (2011). <i>Ausgewählte Ergebnisse für kleine und mittlere Unternehmen in Deutschland 2009</i> (pp. 1086–1097). Wiesbaden.</li><li>&gt; Töpfer, V. (2013). Er macht aus Abfall Cashflow. <i>spiegelonline.de</i>. Retrieved September 18 11, 2013 10, from <a href="http://www.spiegel.de/karriere/berufsleben/mckinsey-berater-buddemeier-macht-auf-oeko-pilze-zuechten-in-berlin-a-893141.html">http://www.spiegel.de/karriere/berufsleben/mckinsey-berater-buddemeier-macht-auf-oeko-pilze-zuechten-in-berlin-a-893141.html</a>.</li></ul>

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	<ul style="list-style-type: none"><li data-bbox="236 320 1412 504">&gt; Wainer, D. (2010). Israel's Kibbutzim Shift From Red to Green. <i>businessweek.com</i>. Retrieved September 13 2011, 201310, from <a href="http://www.businessweek.com/stories/2010-06-24/israels-kibbutzim-shift-from-red-to-greenbusinessweek-business-news-stock-market-and-financial-advice">http://www.businessweek.com/stories/2010-06-24/israels-kibbutzim-shift-from-red-to-greenbusinessweek-business-news-stock-market-and-financial-advice</a>.</li><li data-bbox="236 533 1114 566">&gt; Wandke, B. (2013). A strong network of investors. <i>heliatek.com</i>.</li><li data-bbox="236 595 1404 779">&gt; Zange, M. (2012). You are too serious - Or why Germany still sucks for startups. <i>iopanic.com</i>. Retrieved September 15 2011, 201310, from <a href="http://iopanic.com/post/39747628779/you-are-too-serious-or-why-germany-still-sucks-for">http://iopanic.com/post/39747628779/you-are-too-serious-or-why-germany-still-sucks-for</a>.</li></ul>