Disruptive Innovations and Business Models

by

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[International Business Economics]
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Introduction

Every company, both large and small, set growth targets and most of course aim for positive profitable growth. However many companies are pressured by the demands of the equity markets to growth rapidly and more than expected. When brokers and analysts calculate a company's share value they include an expected level of growth in their calculations, this basically means that if a company want to create shareholder value they not only need to grow, but need to grow more than what is expected. This affects not only companies with a stalled growth, but also companies with a strong growth as the only way its managers can deliver a rate of return to its shareholders in the future that exceeds the risk adjusted market average is to outperform the expectations by growing more than the market expects.[1] The harsh reality is that if a company is expected to grow 5 percent and another is expected to grow 20 percent and they both deliver the expected growth rates, both will only produce a market-average risk-adjusted rate of return. No matter how high the growth rate, if it is expected that growth rate will only produce market-average risk-adjusted rates of return for any future investors. This is a bit simplified as valuation analysis normally includes a terminal value and therefore expects the company to close down sometime in the future. So if a company is valuated at a growth rate of 5 percent, and still maintains that rate after 5 years the stock price will typically rise. However as this applies to all companies, no matter their growth rate, the point is still the same; the market is a though partner and just meeting the expectations won't create any meaningful reward.[2]

Research shows that when a company's core business has matured, thereby stalling the company's growth rates, the pursuit for new platforms to secure ongoing high growth rates includes taking significant and often very costly risks.[3] This is an obvious fact when you look at the number of mergers and acquisitions which fail and also if you look at the very few companies who are just able to survive from the 60'ies to the millennium. [4]

In 1987 Forbes republished its first 'Forbes 100' list from 1917 and compared it to its 1987 list. Only 39 companies were still alive and from those 39 only 18 had managed to stay in the top 100. These 18 companies are well-know and very respected American companies which have survived the Great Depression, the Second World War, and the oil and inflation shocks and so on. [5] Of those 18 survivors, Amoco has since then been absorbed by BP, Westinghouse Electric has been bought by Viacom (now

[1] *The Innovator's Solution,* p.4, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[2] *The Innovator's Solution,* p.21, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[3] *The Innovator's Solution,* p.1, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[4] *Creative Destruction,* p. 7, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[5] *Creative Destruction,* p. 7, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

renamed to CBS Corporation), two of the companies have merged (Exxon and Mobil to ExxonMobil), Texaco and Chevron merged; today Chevron has pretty much absorbed Texaco which is now primary a brand, Pacific Gas & Electric (PG&E) went bankrupt in 2001 however the State of California bailed out the utility provider. Citigroup has been hit extremely hard by the current financial crisis, and have been given massively federal financing to avoid collapsing and in January 2009 the company announced that it was splitting into two companies. AT&T Corporation was bought by SBC in 2005 however the merged company is named AT&T Inc. [6]

If we take a look at the companies' position on Forbes about 20 years from 1987, the tendency is very clear. Time is cruel on most companies.

Table 1

Name	Growth in market capitalization CAGR 1917-1987 (%)	Position on Forbes 'The Global 2000' list (2009)
General Electric	**7.8**	**1**
Eastman Kodak	**7.7**	**1546**
DuPont	**7.2**	**192**
Sears, Roebuck	**6.9**	**739**
Ford Motor	**6.9**	**549**
General Motors	**6.9**	**844**
Exxon	**6.9**	**4**
Proctor & Gamble	**6.7**	**22**
Amoco	**6.5**	**N/A**
Westringhouse Electric	**6.0**	**N/A**
Chevron	**5.9**	**9**
Mobil	**4.8**	**4**
Texaco	**4.7**	**N/A**
Pacific Gas & Electric	**4.2**	**281**
Citibank	**3.9**	**472 (Citigroup)**

[6] Own research. The different companies' homepages.

Southern California Edison	**3.3**	**323**
AT&T	**2.8**	**7**
USX	**2.1**	**611**

Source: *Creative Destruction,* p. 8, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York and Forbes at http://www.forbes.com/lists/2009/18/global-09_The-Global-2000_Rank.html date: 26 November 2009.

Even though these 18 companies all managed to survive to 1987 none of them managed to perform over that time span. During 1917-1987 they as a group created 20 percent less long-term return for their investors than the overall market did. The long-term US average during that period was 7.5 percent[7] and only two companies managed to perform better than that average, General Electric and Eastman Kodak. However since 1987 Kodak has since plummeted down the rankings.

If we look at the S&P the results are very similar. Of the 500 companies on the first list in 1957 only 74 of these were on the list in 1997, of these 74 only 12 outperformed the S&P 500 index. If the 1997 list was made up of the companies that were on the original list only, then the overall performance of the S&P 500 would have been 20 percent less per year than it actually has been. [8]

If we focus on the performance of companies who have been on Fortune's list of the largest companies between 1955 and 1995, as was done by the study *Stall Points*[9]*,* the task of maintaining a real, inflation adjusted growth rate of more than 6 percent seems to be a daunting challenge. Only 5 percent of the 172 companies that figured sometime at the Fortune list managed to accomplish this, the rest experienced that their growth stalled to a rate of the GDP or below. You would then expect that all of these companies would try to restart their growth, however only 4 percent of the growth stalled companies were able to just raise their growth to a level of just 1 percent above the GDP's growth rate. Stalling is both understandable and expectable as markets mature, however the *Stall Points* study shows that once growth has stalled it is nearly impossible to restart it. If this was not enough the equity markets severely punished the stalled companies; 28 percent of the companies lost more than 75 percent of their market capitalization, 41 percent lost between 50 and 75 percent, 26 percent lost between 25 and 50 percent and the final 5 percent lost less than 25 percent of their market capitalization. [10] So not only does a stalling growth entail a huge almost impossible challenge of trying to reignite the growth it also entails a brutal slaughtering of the stock

[7] *Creative Destruction,* p. 8, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[8] *Creative Destruction,* p. 8, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[9] *Stall Points,* The Corporate Strategy Board, 1998, Washington DC.
[10] *The Innovator's Solution,* p.5, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

price by the market, this will inevitable increase the pressure on the management to create growth, and fast, which does not make it any easier.

Christensen and Raynor describe a pattern that many companies follow, when they experience growth problems. *"When the core business approaches maturity and investors demand new growth, executives develop seemingly sensible strategies to generate it. Although they invest aggressively, their plans fail to create the needed growth fast enough; investors hammer the stock; management is sacked; and Wall Street rewards the new executive team for simply restoring the status quo ante: a profitable but low-growth core business."*[11]However when this status is reestablished the new management team faces the same challenge as the old did, to create growth for a mature business. The new management team is in precisely the same situation as the old management team, and in huge danger of suffering the same fate.

It is then very obvious that companies must work very hard to secure that their growth don't stall, as it is almost impossibly to do anything if this occurs however history tells us that it is almost impossibly for any company not to experience that their growth stalls, which makes the following problem formulation very crucial.

Problem formulation

It is obvious that many companies have a tough time dealing with the growth challenge however a sector that has experienced more or less constant growth are the solar power industry or more precisely the Photovoltaic manufactures. Both the disruptive theory and especially business model theory are quite new. Solar power is a good example of an innovation with many disruptive characteristics and a huge potential for disrupting the energy sector. It would therefore be interesting to apply the theories on this to research how disruptive innovations work but also put the disruptive theory in a business model context.

How has disruptive innovations and business models affected the solar power industry?

- **What are the innovative challenges of today's markets?**
- **What are the fundamentals behind disruptive innovation?**
- **What is the theory of Business Models?**

[11] *The Innovator's Solution,* p.3, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

Methodology

To answer the main problem:

"How has disruptive innovations and business models affected the solar power industry?"

Three sub questions have been posed to answer the main question. To be able to research how an industry has been affected it is necessary to first look at the foundations of the industry and in this context look at the general challenge that almost every company in the world faces. Disruptive innovation is still such a new theme that it hasn't been included in the teachings at Aalborg University consequently it was needed to both clarify this area but also clarify the foundation of the disruptive theory. It was essential to clarify what disruptive innovations are, why they can make such a big difference and which challenge it is that they solve. This is the reason why the sections of *The Innovative Challenge* and The *Two Categories of Innovation.*

The *Business Model* section has of course been included because a discussion of the theory is needed to be able to apply it to the Photovoltaic sector. However as business model research is in its very early days which have made it tough to find a lot of solid materials. Many researchers write very different things and it is clear that the research area hasn't developed a general taxonomy yet, which of course complicates the usage of business model theory in a project like this.[12]

The business model term emerged at the end of the twentieth century and has been focused on defining business models and identifying the elements of business models. Some definitions are quite abstract while others are detailed and encompassing of the business functions. An explanation to this is that the definition are grounded in the business model's intended use and not sufficiently grounded in theory. This has caused that the *language of business model theory* is blurry and that there is no real general common ground. [13] The foundations on which many researchers discuss are very different which has resulted in numerous concepts, ontologies and frameworks hence it can be hard to get a solid understanding of the theory.

The project will be carried out using deductive reasoning which begins with an abstract concept and then tests that concept with empirical evidence. Support for the concept is achieved if the data collected are consistent with the proposed concept. Data collection is often conducted in the form of interviews with senior management however this has not been possible in the conduction of this project because of an

[12] *A Business model Research Schema,* p.1, Lambert, Susan, 19th Bled eConference – eValues, Flinders University, Australia
[13] *A Business model Research Schema,* p.2, Lambert, Susan, 19th Bled eConference – eValues, Flinders University, Australia

obvious resource and time limitation. The data collection has been delimited to articles and the companies' homepages.

Theories

A well-built theory is constructed in three phases.[14] During the first phase the object of interest is described. It has to be thoroughly described of course, otherwise there's the danger of just observing a few success stories and then concluding that you have seen enough and now know the answer. Therefore this project aims to use as many sources with a significant foundation of data.

After the phenomenon has been properly described the second phase can commence during which the researcher will classify the phenomenon into categories. This is done to highlight the most important differences which will be described in more detail later. In the third phase the researcher articulates a theory that asserts what causes the phenomenon to occur and why. The theory must also display when the outcome can be different and why, which circumstances or categories that might change the outcome.

The second phase is about making the right categories which is crucial in developing useful theory. The aim is to avoid making recommendations just based on what a few excellent companies have done. It is nonsensical to believe that every company can attain success just by copying the actions of a very successful company. The circumstances will almost always be different therefore you can't solely rely on attribute based recommendations. In the past many academics have recommended companies to integrate, non-integrate, outsource and focus on the core business or diversify the business, these are all attribute based recommendations however this has not worked for every company as history clearly states.[15]

Because of this the project has aimed at only using theories with a solid foundation of data, as described. Christensen and Raynor's *The Innovator's Solution* has been applied a lot in the project. It is a book that is a part of huge research done especially by Christensen which has now stretched to over almost two decades. The book has a significant empirical foundation to be applied under the demands of this projects methodology.

Another much used book is Foster and Kaplan's *Creative Destruction*. This book draws a lot of its data from *The McKinsey Corporate Performance Database* which contains detailed data from more than a 1,000 US

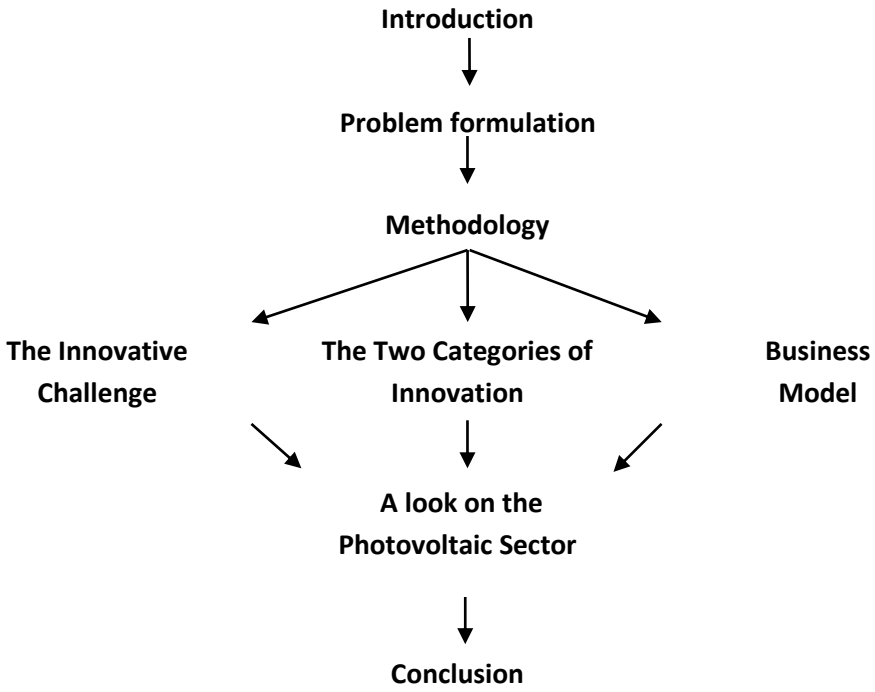
[14] *The Innovator's Solution,* p.12, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[15] *The Innovator's Solution,* p.14, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

companies. This gives the book an astonishing data foundation and is therefore included as a cornerstone in the project.

In the business model section of the project especially two sources have been used. Magretta's *Why Business Models Matter* and Zott and Amit's *The Fit between Product Market Strategy and Business Model: Implications for Firm Performance*. Because of the described problems with the business model theory it was had to choose which sources to use. Magretta was chosen because it gives a good overview of the subject. The article draws on material from her book *What Management Is: How It Works, and Why It's Everyone's Business* which of course means that it has a significant foundation. The article by Zott and Amit has a solid theoretical foundation and a dataset of about 300 companies. They use an acknowledged method and with their solid theoretical foundation and the 300 companies' dataset, the article has a solid enough foundation to be included.

Project Design

A project design has been created to give a brief overview of the whole project.



The Innovative Challenge

Many researchers have studied the hard challenge of sustaining growth and have different answers typically including that the managers of the failed companies were not good enough or too risk averse and that new-growth businesses are unpredictable.[16] However history clearly rejects the two first claims. As described earlier the very vast majority of companies fail to keep a sustained growth and almost none manage to reignite growth once it has stalled. This also means that most managers, and many talented managers, throughout time have failed to overcome this challenge, unless the big companies with their big salaries and glorified jobs are unable to attract the most talented managers, which of course are nonsense.

The claim that the managers become risk averse is also in stark contrast to the many examples of companies with a stalled growth investing heavily in a product or by acquiring a new company. Many companies have put billions on the line, some have won but many have lost, as can be seen in the section about failed mergers earlier in the paper.

The third claim that creating new high growth business is unpredictable and random seems by Christensen and Raynor.[17] The reason for this conviction is that the very processes that lead to success or failure have not been proper researched. It would also seem strange that a manager should invest in many new innovations and then see which ones did best and then focus on them, and close the rest. It must be possible for an organization to consistently develop new useful innovations, if they get the processes right, new research also points in that direction.

The history of companies being unable to restart stalled growth only shows that companies are handling the situation badly, because there is no denying that growth very much still exists in the business world so the conclusion must be that companies are not able to identify that growth or are not able to handle potential growth areas or businesses.

The Importance of the Processes

It is very infrequently that a complete idea for a new growth business emerges from an employee's head normally it has to be modified before it can be launched and funded as a new growth business. During this journey from a raw idea to a new business the idea goes through a series of processes that modifies and shapes the idea. These processes determine whether the idea is good enough to earn funding or will be discontinued, and powerfully influence what managers can do and cannot choose to do. Many of these

[16] *The Innovator's Solution,* p.7, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[17] *The Innovator's Solution,* p.8, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

processes or forces are highly predictable, and even though managers may be unpredictable these forces that act upon them are similar in their mechanism of action, their timing and their impact on the character of the product and business plan that the company ultimately tries to implement.[18] By understanding these processes and forces that the managers work under it is possibly to make innovation more predictable and also to optimize the chances for new business success.

Midlevel managers play a crucial role in a company's innovation process, as it is them who choose which ideas will be presented to the senior management and therefore which ideas will get the chance to win funding. These managers shift and shape the ideas that they receive, however they do that under the influence of predictable forces, these forces determine just how innovative the company is.

Midlevel managers are typically somewhat risk-averse. They therefore hesitate to support an idea that targets a market, which is not assured, as if the project fails the company will have lost millions and their own career prospects will have taken a serious hit. Ambitious managers even hesitate to present a project that they are not confident will receive the backing of the senior management, because if they propose an idea that the senior management find weak they will think the same of the proposer and the midlevel managers reputation will be damaged.

This means that the processes of many firms have been shaped to approve the ideas, which resemble the successful ideas of the past. They actually consistently reject ideas that target markets where demand is small, which creates a dilemma for ambitious growth-seeking managers because the exciting growth markets of tomorrow are small today. This means that if the manager wants to be promoted he doesn't have the time to seek the exciting growth opportunities, because this system as it is now, probably would favor a colleague who in the short term has create more growth, even though being able to enter the future high growth markets are essential for a company's survival.

It is rarely a lack of new ideas that is the real problem for companies trying to launch exciting new-growth businesses however it is the processes and their underlying values that create problems for the company. The senior management ideas and perspectives are typically very different from those at the bottom. The top-level management is very focused on existing customers, which means that when new ideas are developed they are processes to satisfy current customers' needs when they could be developed to create real disruptive growth that could significantly change the future of the company. If a management understands these factors and are able to shape these processes to optimize new growth business, the

[18] *The Innovator's Solution,* p.9, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

company will significantly increase its chances of defying history and keep a sustained high-growth in the long term.

The Market vs. the Company

The research behind Foster and Kaplan's *Creative Destruction* shows that there has never existed a company that continually performs better than the market in fact in the long run the market always wins. This is a very interesting fact. Despite the market don't have any highly educated vastly experienced managers, any meticulous crafted organizational structures, advanced management methods and so on, it still outperforms every company. How can it be that the market is wiser than the managers who think performance all the time?

The answer is that the capital markets motivate the creation of companies, allow their efficient operations however when the companies loses its ability to compete, the market rapidly and remorselessly removes them. Most corporations operates with management philosophies based on *continuity,* as a result they are not able to change at the pace and scale of the market. Consequently they are not able to create value in the long term at the pace and scale of the markets. [19]

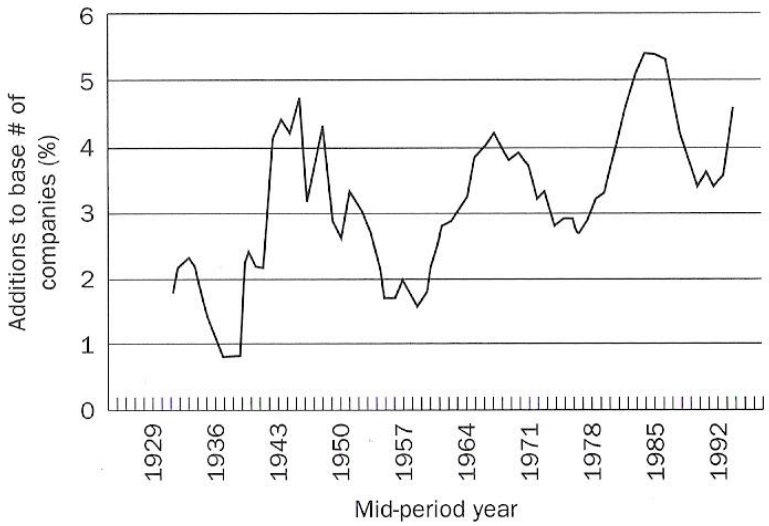
It is typically among the relatively new entrants that the highest growth rates are found at least for a time. The structure and the mechanisms of the market enable these companies to deliver better returns than even the best surviving companies. Low performing companies are removed by the market in favor of the new high performing companies in a process Joseph Alois Schumpeter called *the gales of creative destruction.*[20] The challenge of keeping up with the market is a huge one, one that few managers have the time and energy to take on, however this is exactly what is needed if a company wants to sustain market levels of long-term performance – and who doesn't what that?!

The most significant difference between companies and the market is in the way they enable, manage, and control the processes of creative destruction. Companies are built on the assumption of *continuity* with a focus on operations, while markets are built on the assumption of *discontinuity* with a focus on creation and destruction. Because rapid creation and extensive destruction creates more wealth the market encourages this. It is far less tolerant of long-term underperformance that companies are. Excellent companies do win the right to survive, but not the ability to earn above-average or even average shareholder return in the long-term. [21] This is the result of the companies own control processes, that as

[19] *Creative Destruction,* p. 10, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[20] *Creative Destruction,* p. 10, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[21] *Creative Destruction,* p. 10, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

described in the section '*The importance of the processes',* prevents the companies from seeing the need for change.

Figure 1: Change in the S&P 500; 7-year average
Source: *Creative Destruction,* p. 12, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

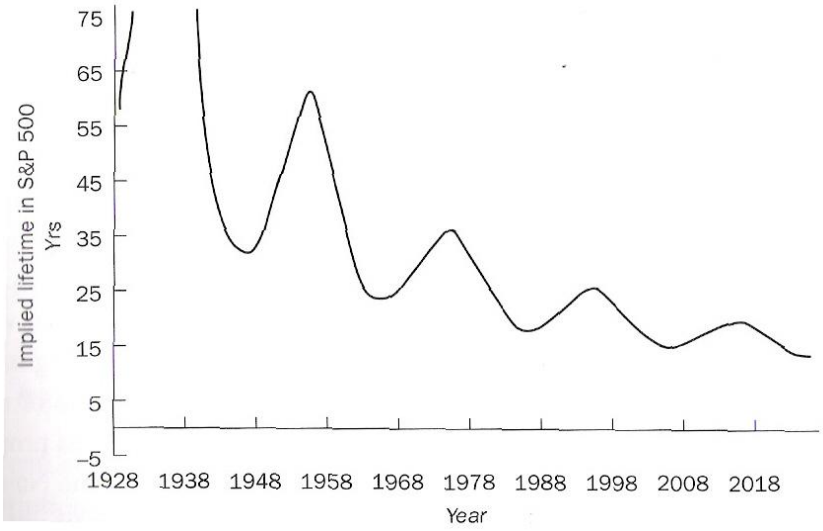


Discontinuity

In the 1920s and 1930s the turnover rate of the S&P 90 was about 1.5 per cent per year, which meant that a new entrant to the list could expect to be there for about 65 years. The companies of that era were built on continuity – perpetual continuity. However much have changed since, the turnover rate of the S&P 500 in 1998 was approximately 10 per cent consequently an average lifetime on the list of 10 years. This is a huge difference and displays a reality that is very far from the foundation of continuity.

The turnover rate in the S&P 500 has steadily increased in waves since the 1930'ies as can be seen from the two tables. They show that the minimum level of change in the US economy has been increasing throughout the 20th century, as even though there were several crises, none of them entailed a level of change that were lower or just about the same as the previous crisis. Foster and Kaplan expect this development to continue and have calculated that the average lifetime of a company on the S&P will be only 10 years in 2020 if the past patterns continue. [22]

Figure 2: Average lifetime of S&P 500 companies
Source: *Creative Destruction,* p. 13, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York



Since the 1990s the global economy has changed especially because of the meteoric rise of the IT industry which is probably still in its very youth, we haven't by any means seen the limits of information technology. The effectiveness of software

[22] *Creative Destruction,* p. 13, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

programming continues to grow and communication technology is developing so rapidly it can be hard to keep up. Just the development of mobile phones and its possibilities are frankly amazing. In just a few years it has gone from a little phone with a black and white display, to a larger phone with color display and camera to
a rather large phone with no buttons where the owner is on Facebook and Twitter constantly and are able to communicate with the whole world without ever making a phone call or sending a text message!

Incumbent companies have an unprecedented opportunity to take advantage of these times and events however if history is any guide only about 1/3 will be able to survive the next 25 years. At least survive in an economically significant way. Most of the current incumbents will die a transformational death as they will be acquired by or merged with a stronger organization. This is the fate of many companies because they lack a competitive adaptiveness, as Foster and Kaplan bluntly state it: *"most of these companies will die or be bought out and absorbed because they are too damn slow to keep pace with change in the market."*[23] The philosophy of continuity is no longer valid nevertheless it is still a philosophy that majority of the current companies are built on. It is fairly obvious that the global business environment keeps changing hence discontinuity dominates. The companies that will survive the next 20-25 years will be built on this philosophy these companies will master the art of creative destruction and be remade like the market. [24]

This is indeed a difficult task to create a company with control over existing operations but also with an environment that allows ideas to flourish and old ideas and operations to die a timely death. This will probably require trading out traditional assets, challenging existing channels of distribution or making dilutive acquisitions however survival can't be attained without dropping the assumption of continuity.

How to Develop the Ability to Innovate and Change According to the Market

Many companies are not able to change the corporate culture or their actions even in the face of clear market threats. This is due to a phenomenon called *cultural lock-in* and is the reason why companies find it very difficult to respond to market signals. It results from their habits of managing, from their processes. This basically means that the company has of a defined and/or undefined way of doing things by which it has typically built up the company and achieved success, nevertheless when the market shifts these habits and processes makes the company unable to change accordingly because they are *stuck in the past.* This cultural lock-in reduces the company's ability to innovate and to phase out operations with a less exciting

[23] *Creative Destruction,* p. 14, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[24] *Creative Destruction,* p. 15, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

future. When cultural lock-in occurs it signals the start of an inexorable decline to inferior performance. The lock-in often shows itself by three general fears; the fear of channel conflict with important customers, the fear of cannibalization of an important product line, and the fear of earnings dilution that might result from a strategic acquisition. [25] These fears are typical and fair however they are not felt by the market so it moves wherever it wants and often where the company dares not.

The essence of the cultural lock-in problem is the habits as described, also known as mental models. Once these are formed they can be extremely hard to change as they are the core concepts of the company. In successfully companies they are well crafted and have allowed the management to anticipate the future and act accordingly, but by doing this they also become self-reinforcing, self-sustaining, and self-limiting.[26] When the market or the environment change they are therefore extremely hard to change. In that scenario they cause the management to make consistently bad decisions, when the company starts to underperform while being threaten by new high-performing companies the mental models have created a set of defensive routines, as the failure to challenge status quo and superiors, which makes change impossible. These habits and processes also obstruct the ability of the organization to innovate at the scale and pace of the market. If a company is based on continuity a new business proposal can be turned down because its probable success cannot be proven in advance. Instead the company will launch incremental growth ideas that are based on current capabilities and mental models.

The market is completely free of all these humanlike flaws as it has no culture, leadership or emotions, and more importantly no memories, fears or remorse. It just waits for the forces at work to play out, for new companies to be created, for acquisitions to make room and it silently allows weaker companies to be put up for sale and leaves it to the buyers to decide whether to reorganize them or close them down. At just the smallest sign of weakness the market takes action and it consistently removes the weakest companies thereby improving overall returns.[27]

The Aim

History shows that companies are designed to operate not to evolve this means that they are not able to match the performance of the overall markets because of an inability to adapt as fast as the markets. Companies in general have to become better at creating and destroying.

Companies have to be redesigned to evolve from their current status of being built to operate this is a huge challenge that will require more than a few adjustments. It not possibly just to add the creation and

[25] *Creative Destruction,* p. 17, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[26] *Creative Destruction,* p. 18, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[27] *Creative Destruction,* p. 20, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

destruction to the organization it has to be built in the foundation of the company. The market operates better than the companies because it freely let new companies enter and it eliminates companies with no competitive prospects more ruthlessly. The creation and destruction process of the market proceed much faster than it does in companies. [28]

Companies must be redesigned on the philosophy of discontinuity as on organization that stimulates the creative destruction through generation or acquisition of new companies while eliminating poor performing areas of the business without losing control of the operations. If the current operations are healthy then it is the rate of creative destruction within the company that will determine the long-term competitiveness and performance of the company. To be able to create new businesses faster the management will have to change the way they think. Most managers think convergent which means they focus on clear problems where the convergent thinking provides well-known solutions quickly. Order, simplicity, routine, clear responsibilities, unambiguous measurement systems, and predictability are the core of convergent thinking. It's based on continuity and is effective at handling small incremental differences and changes however larger transformational changes confuse the system. Instead managers should also implement divergent thinking as it fits with discontinuity because it focuses on broadening the context of the decision making. This makes it more concerned with getting the questions right that just getting it answered as fast as possible. [29]

To be able to manage by divergent thinking it is necessary to a broad context of information to stimulate the posing of the right questions. Rather than control people's actions management shall control motivation and selection of the employees. To improve the long-term performance the strategic planning process must be rethought because as it works now it fails most companies. This is due to the fact that it hinders the dialogue that it is meant to stimulate. The control systems must also be rethought as they need not only to control operations but also to allow the creative destruction process. The company should only control the most necessary, if a control process isn't essential then eliminate it. The objective is to shorten the feedback time and to decrease the number of intermediaries between measurement and action. [30]

The aim is to let the market control wherever possible. Large companies should shift the burden of integration to a corporate level and should refrain from making uniform systems that have to be applied to every business area. The managers who run the business areas shall decide which mix of controls that are

[28] *Creative Destruction,* p. 22, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[29] *Creative Destruction,* p. 19, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[30] *Creative Destruction,* p. 23, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York

best for them, because they know best. These changes will create a shift from focusing on minimizing risk to facilitating creativity exactly what is needed in the long-term.

The Two Categories of Innovation

Many companies believe that if there is a competitive fight the answer is just to throw money at the problem. This is based on the assumption that it is always the big resource-rich companies that will win if they use their resource advantage over smaller companies.[31] However the Forster and Kaplan research clearly shows that the biggest companies don't win the fights, it's more the contrary which seems to be the truth as the turnover rate of the different company indexes are increasing.

If we take a closer look at this apparent contradiction that money makes you fail, research shows that when innovations are incremental and sustaining the large incumbents of an industry will usually enhance their dominance however regarding breakthrough disruptive innovations they are conservative and ineffective in exploiting the potential and possibilities of the new innovations. This is due to the different circumstances of the two types of innovation. In sustaining innovation circumstances the challenge is to make better products that can be sold for more money to attractive customers, while in disruptive circumstances the challenge is to commercialize a simpler, more convenient product to a new or unattractive customer segment. Research shows that in sustaining circumstances the incumbents almost always win however in disruptive circumstances the entrants are most likely to beat the incumbents.[32]

It is this phenomenon that is the reason for many established companies troubles, especially long term growth troubles. When we look at the different industries almost all of them will experience changes that significantly changes the rules of the game, technologies that change the whole industry. These innovations are the disruptive innovations and when research shows that established companies are conservative and ineffective in dealing with these innovations, it also gives a strong indication to why no company have managed to keep an above market growth in the long term. Because the disruptive changes are increasing hence the turnover rate of the company indexes are raising, which means that this challenge for established companies are growing by the minute.

This issue is even more complicated than just the fact that incumbents are unable to handle disruptive innovations, because technologies or business ideas are rarely intrinsically sustaining or disruptive. It has to be molded to be either sustaining or disruptive and when you have a senior management team which, as described earlier, are focused on current customers it is almost impossible to develop disruptive innovations because they focus on a new customer segment which are usually unattractive. Therefore

[31] *The Innovator's Solution,* p.31, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[32] *The Innovator's Solution,* p.32, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

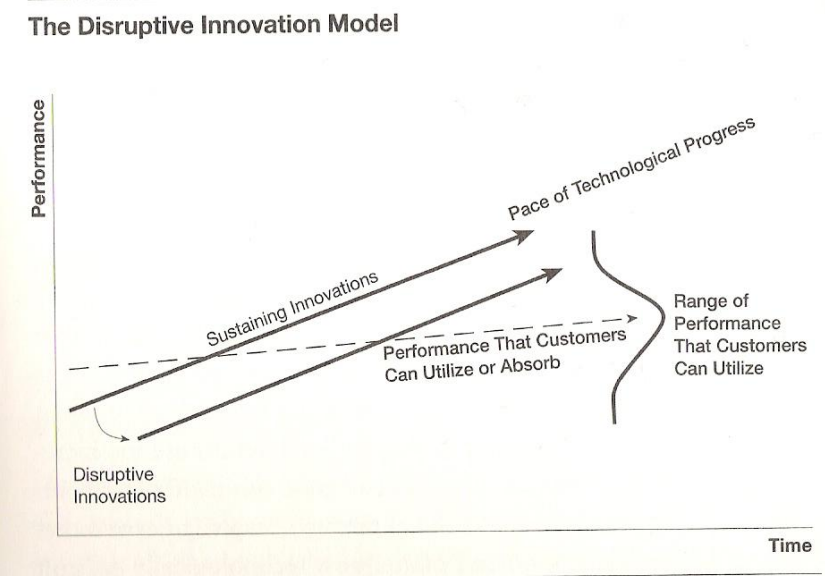
many companies mold their new innovations to be sustaining even though disruptive innovations greatly increase the odds of competitive success.[33]

To substantiate the conclusion made so far and to be able to analyze business models in a disruptive innovation context it is necessary to discuss the disruptive innovation model.

The Disruptive Innovation Model

As Christensen's simple model shows he has identified three important elements of disruption.[34] The first is the rate of improvement that customers can utilize or absorb. An example are the power that high-end cars now possess under the hood, it is very hard for customers to actually use all that power because of the speed limits, traffic jams, safety concerns and so on. The dotted line represents the average customer.

Figure 3: The disruptive Innovation Model
The Innovator's Solution, p.33, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press



The second element is the pace of the technological development. This signifies the rate of which the companies develop new attributes to their products which he calls the pace of technological progress. It is important to notice that in almost every industry the rate of the technological progress is higher than the rate of performance that customers can utilize or absorb. This occurs because companies are striving to satisfy customers who are not yet satisfied with their products, who demands more and are able to pay for it. A good example is the laptops, when they first entered the markets many customers liked their mobility but they were far behind desktops in performance, so at that point they were below the dotted line in figure 3. Since then laptops' performance have sky rocketed and now contains so much power that the average user can't use it. This development have indirectly created netbooks, which are small, light and low on performance compared to the average laptop however they are

[33] *The Innovator's Solution,* p.32, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[34] *The Innovator's Solution,* p.33, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

more cheap, have longer battery time and are more mobile because they usually weigh less than half of a normal laptop. Many laptops have moved to far away from the dotted line which have enable netbooks to steal a significant share of the market and start a new trend where mobility, image and easiness are the core factors.

The third element is the distinction between sustaining and disruptive innovation. The sustaining innovations target demanding, high-end customers with better performance than was previously available. The sustaining innovations are both the year-by-year incremental improvements that most companies develop but they are also the leapfrogging breakthrough innovations, for example the iPhone. It doesn't matter how technological difficult the innovation is, when concerning the battle of sustaining innovations the established competitors almost always wins.

Disruptive innovations don't aim to bring better products to high-end customers instead they disrupt the market by introducing products and services that are not as good as current products. But disruptive technologies offer other benefits such as they are simpler to use, more convenient and cheaper and they appeal to a new segment or a segment of less demanding customers.[35] Once the disruptive product gets a foothold in the new or low-end market the improvement cycle begins. As seen on the previously figure the pace of the technological progress is faster than the pace of new innovations/functions that customers can absorb or use. So as the new product starts out with being not good enough for most customers this will change as the product improves, and more and more customers will find the products satisfying performance wise hence the old products will have no chance against the new disruptive product because it has the advantages of typically being simpler, more convenient and/or cheaper. When this happens the disruptors are on a path that will ultimately crush the incumbents as they will be left paralyzed trying to defend a product by throwing resources at it. The industry leaders' resource allocation process is designed to support sustaining innovations, which makes them unable to respond. The incumbents are designed to move upward the market to more attractive customers so they rarely defend the low-end market or the new market that the disruptor find attractive.

The Disruption of the Steel Market

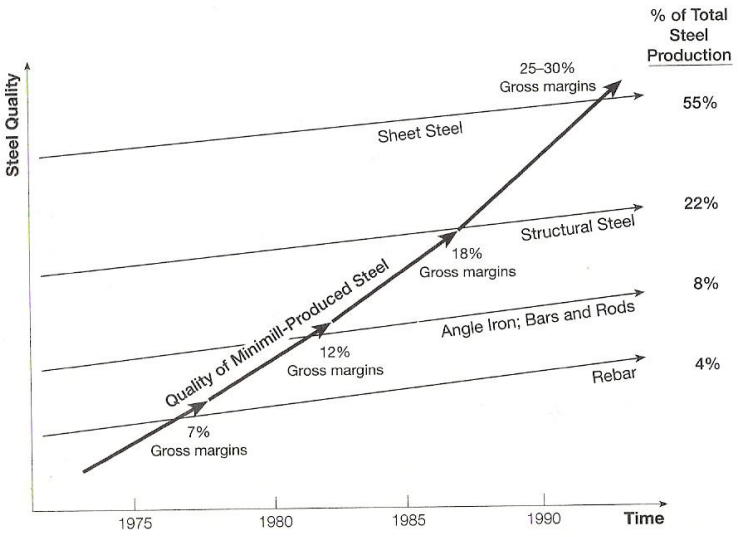
Christensen describes a good example of how easy established leaders are to beat for a new disruptive technology. It is also a tale of the decline. One of the former largest companies in the world USX or US Steel, which can be seen in table 1 on page 3 as once being in Forbes top 100 however now it has plummeted down the rankings and have lost its market leadership.

[35] *The Innovator's Solution,* p.34, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

Looking back the minimills disrupted the steel producers by getting a foothold in the low-end of the market. This was of course where the lowest gross margins were and the integrated mills surrendered the segment without a fight, because they could then focus on the more profitable market segments. When the minimills were fighting against the integrated mills the gross margins were high because the minimills could produce the low-end products much cheaper than the integrated mills. However they were not able to produce products of a higher quality, so the only customers that were interested in their products were the low-end segment. When the minimills had driven the integrated mills out of the low-end market, the price plummeted as it was now only minimills competing against each other. If the minimills wanted to attain high gross margins again they would need to move up the market. So they started researching how to improve their quality and soon they were able to move up a market level. The same thing happened as the previous one. The integrated mills moved aside so they could focus on the most profitable customers in the business and the minimills had glory days until they had driven all of the integrated mills of the segment and the price plummeted again.[36]

Figure 4: The Up-Market Migration of Steel Minimills

The Innovator's Solution, p.34, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press



Source: American Iron and Steel Institute; interviews with company executives. Note that the tonnage percentages do not sum to 100 percent because there are other specialty categories of steel.

The same course of events repeated itself till the minimills was a dominant factor in the high-end level of the market and many of the traditional huge steel manufactures was out of business. This is not an example of incompetent steel managers but an example of the generic dilemma many executives find themselves in: Should we invest to protect our least profitable, least loyal and most price-sensitive customers? Or should we invest in the most profitable parts of our business with customers who reward us with higher gross margins for quality products? Because they act on an assumption of continuity the answer is very

[36] *The Innovator's Solution,* p.38, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

predictable and that makes them flee rather than fight.[37] That is why disruption can be so powerful; the incumbents are motivated to flee rather than to fight, which makes them much easier to beat.[38]

Sustaining Innovation Isn't the Enemy

Aggressively chasing sustained innovation have brought many companies a lot of growth and it is exactly what the minimills did in the previous example, after they had implemented a disruptive product. However the sustaining innovations are so attractive to established firms that the best sustaining companies systematically ignores disruptive threats and opportunities until it's too late. [39]

A sustaining-technology strategy is however not appropriate for a entrant to build a new-growth business, because if you are going after the incumbents customers by trying to offer a better product, the incumbents are very motivated to fight, not matter how big a corporation the entrant has behind it. There are many examples of large companies entering a new market with a sustaining innovation getting beat, even though they invested considerably more than the incumbent defenders.

A Disruptive Business Model

Because a disruptive business model enables the company to achieve attractive profits at low prices which is required to conquer the low end of a market makes it a very valuable corporate asset. Furthermore when the executives move the business up market to levels where the products are of a higher quality but also where the gross margins are higher, much of the price increase will fall to the bottom line. This will continue as long as the disruptor competes against the higher cost incumbents of the industry. It can be done the other way around. When a company tries to take a higher cost business model down the market, almost none of the additional revenue will fall on the bottom line because it will all be absorbed by overheads. This is also why that established companies who want to exploit disruptive technologies have to do it with a business model which is designed for disruption. This often means that it needs to be very different from the current business model of the 'mother company'.

All good managers aim to move up the market in an effort to keep their margins strong and their stock price healthy, thereby also dumping less profitable products in the lower end of the market. If they stand still they end up in the unwanted position of fighting it out with similar companies with similar products which inevitable will drive the prices down. This actually means that every company is paving the way to be disrupted, because they are willing to move away from the low-end of the market and allow new

[37] *Creative Destruction*, Foster, R. & Kaplan, S., 2001 Doubleday/Currency, New York
[38] *The Innovator's Solution,* p.39, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[39] *The Innovator's Solution,* p.41, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

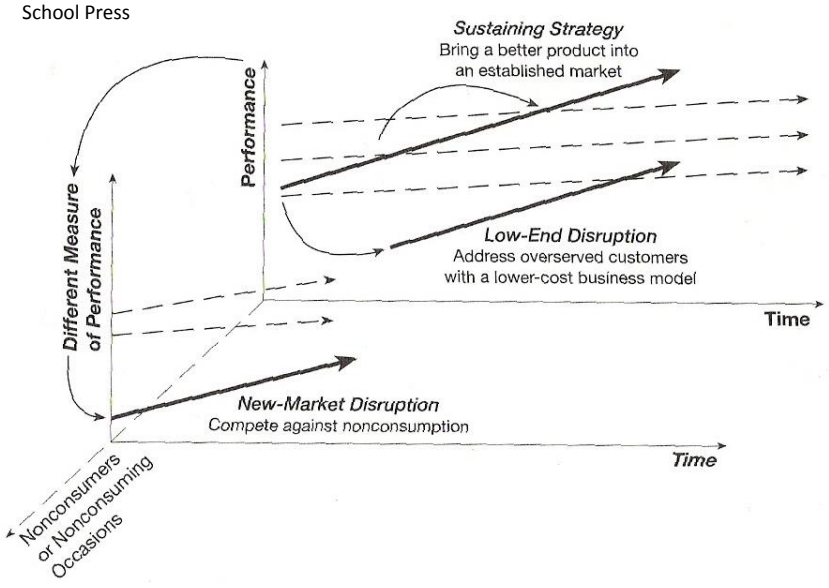
companies to enter. Disruption does not guarantee success but it increases the odds of creating a new growth business from 6 to 37 percent.[40]

Two Categories of Disruption

As can be seen on figure 5 there are two different kinds of disruptive innovations. The difference from a normal x-y diagram is that there is added a third dimension which represents new customers and new contexts of consumption. The original dimensions, performance and time, represents a market where the companies operate; working with suppliers and channel partners in order to most efficiently and profitably satisfy the customers. Within this network each company on the basis of its strategy, cost structure and so on, determines its perceptions of the economic value of an innovation. It is these perceptions that shape the rewards and threats that the company expects to experience through the innovations.[41]

Figure 5: The Two Categories of Disruption

The Innovator's Solution, p.44, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press



The third dimension represents a new context of consumption and competition. It can either be new customers who previously lacked the money or the skill to buy and use the product or it can represent a new situation in which the product can be used because of improvements in simplicity, portability, and production cost. For each new context of consumption a vertical axis can be drawn representing performance in the new context and a horizontal axis representing time. This kind of disruption is called *new-market disruptions*, as opposed to the old *low-end disruption*.[42]

New-Market Disruptions

New-market disruptions compete against non-consumption because they are cheap and simpler to use so they enable a whole new population to use them, a population who have not used the previously generations of products. Canon's desktop photocopier was a new-market disruption because it enabled a lot of people to conveniently make photocopies close to their desk, gone were the days where they had to

[40] *The Innovators Dilemma,* Christensen, C.M., 1997 Harvard Business School Press
[41] *The Innovator's Solution,* p.44, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press
[42] *The Innovator's Solution,* p.45, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

go the company's photocopy center and make a technician do it. Because Canon made it so easy, people began to make a lot more photocopies. The challenge for new-market disruptors is to create value network that can overcome not an incumbent but non-consumption.

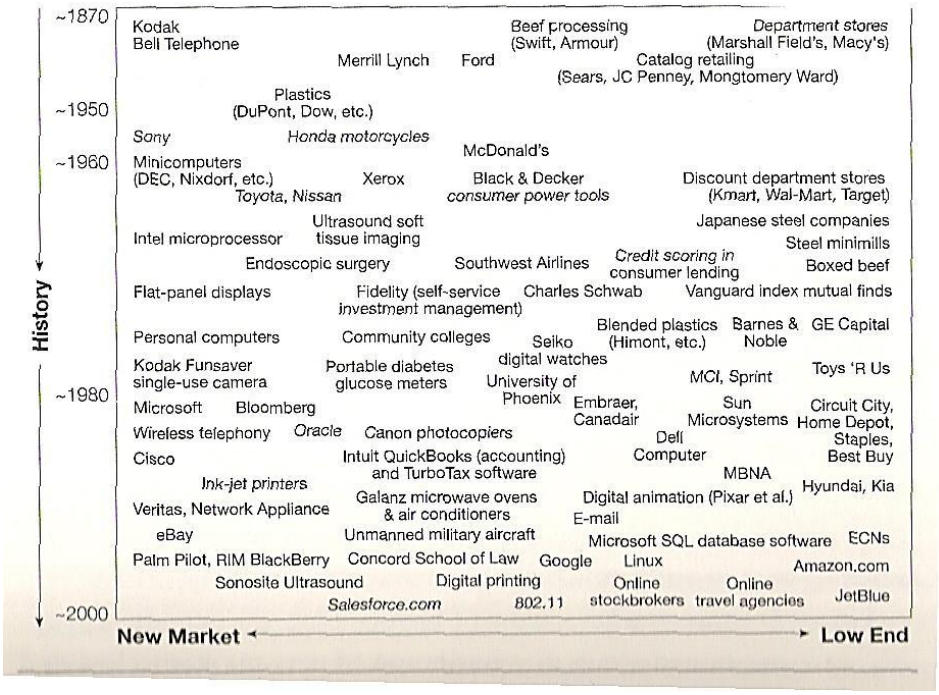
At the start new-market disruptors compete against non-consumption, however gradually them improve to be able to pull customers out of the traditional *mainstream* market and into the new market, when that happens they are of course disrupting the incumbents of the *old* market. They start by pulling customers in the lowest tiers and gradually move up as they improve performance. So disruptors don't invade the mainstream market, they pull customers out of it and into the new market. Because the disruptors start by attaining customers from the non-consumption and then by the lowest tiers of their market, incumbents doesn't feel threatened. For a while they actually appreciate the disruptor because it enables them to replace the low-end low-margin customers with high-end high-margin customers. They of course don't realize that it signals the beginning of the end. [43]

Low-End Disruptions

Disruptions that take their starting point in the low-end of the original or mainstream value network are low-end disruptions. Even though they are different from new-market disruptions they create the same painful dilemma for the incumbents. The new-market disruptions make incumbents ignore the attackers – the low-end disruptions motivate them to flee rather than attack. A good example of low-end disruptions is the retailing market, where several discount retailers have disrupted established retailers. Many products that before was sold in specialty shops are now being sold in much larger stores with much less educated staff than before. It is because the discount retailers realized that the customers didn't need

Figure 6: Examples of Companies and Products Whose Roots Were in Disruption

The Innovator's Solution, p.48, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press



[43] *The Innovator's Solution,* p.46, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

highly educated staff to help them purchase many products such as paint, hardware, kitchen utensils, toys, and sporting goods. Customers in these tiers of the markets were over served by the incumbents and new discount retailers' business model enabled them to make money at a much lower gross margin.

It's easy to see why many traditional retailers chose to flee instead of fight. They had the choice of either attacking the discount retailers by matching their low prices, which would make their own gross margin plummet something which would be unsustainable with their profit margin, or they could choose to devote their shelf space to high-end products which usually had a higher gross margin that the products that the discount retailers were selling, thereby increasing their profits. It made perfect sense for the retail incumbents to flee rather than fight, to get out of the tiers the discount retailers were motivated to enter.[44]

Many disruptive technologies are hybrids, in the meaning that they combine both new-market and low-end approaches. Discount Airliners targeted both the low-end of the market and the non-consumption (people who drove or took the train). Figure 6 shows that many of the most famous disruptive technologies or companies are positioned in between the pure new-market and low-end approaches.

[44] *The Innovator's Solution,* p.47, Christensen, C.M. & Raynor, M.E., 2003 Harvard Business School Press

Business Model

Business model and strategy are used very slovenly however experiences from Wal-Mart and Dell show that these concepts have huge practical value. They are fundamental to performance and no organization can afford to use them slovenly. [45] The business model is a structural template that describes a company's transactions with its external environment.[46] Whoever the company transacts with the business model encompasses it.

Essentials

A good business model is essential to any successful company, no matter whether it's a new venture or an established company. Business models are stories that answer the old but important questions: *Who is the customer? And what does the customer value?* But also the fundamental questions of *How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?*[47] A successful business model often presents a better way of operating than the existing alternatives. It may offer more value to a certain segment or it could completely replace the old way of *doing business* with a new standard which future entrepreneurs must try to beat. The most powerful business models not only shifts existing revenue among competitors it also increases demand.

A big advantage from having a well formulated business model is that managers will work consciously on that conception of how the entire company works which enables every decision, initiative, and measurement to provide valuable feedback. Profits too also become a source of feedback because they will tell the management whether the business model is working. If a company fails to meet its expectations it should then reexamine the business model and try to optimize it.

The Two Reasons for Failure

When business models fail it because they fail at least one of the two tests; the narrative test (the story doesn't make sense) or the numbers test (the P & L doesn't add up). The online grocery business failed the numbers test, because the customers weren't willing to pay significantly more for buying groceries online than offline, and when the online groceries had to endure new costs for marketing, service, delivery, and technology the math just couldn't add up.

[45] *Why Business Models Matter,* p.86, Magretta, Joan, May 2002, Harvard Business Review
[46] *The Fit Between Product Market Strategy And Business Model: Implications For Firm Performance*, p. 1, Zott, Christoph & Amit, Raphael, Strategic Management Journal issue 29, 2008
[47] *Why Business Models Matter,* p.86, Magretta, Joan, May 2002, Harvard Business Review

An example of a company who failed the narrative test is the Priceline Webhouse Club. It was a company who basically tried to gather a lot of consumers, then make then agree on a price for a product and then tell every producer, that they would like to buy X thousands of their product of that price. The consumers however could only wish for a type of product at a certain price, not wish for a specific brand. They wanted to be a power broker for individual consumers however their *story* assumed that the large producers wanted to play that game, not recognizing that they have spent years and millions on building consumer loyalty. Clearly these companies had no interest in Priceline undermining their prices and brand loyalty by teaching consumers to buy on price alone. The story didn't make sense.[48]

Many models fail because they are built on wrong assumptions about customer behavior. They are solutions in search for a problem, which actually is ironic because a good business model forces the managers to think thoroughly about their business. The business model is a great planning tool, because it focuses attention on every part of the business fit into the working whole.

Business Model vs. Strategy

Every solid successful organization is built on a sound business model, whether or not the managers actually have made one or not. But a business model isn't the same as strategy, even though it is often used interchangeably. Business models describe how the pieces of the business fit together as a system, but it doesn't take a very important factor into consideration: competition. Dealing with competition is a strategy's job.[49]

A competitive strategy explains how the company will outperform their rivals; how they will achieve success by being different. The logic is obvious; if every company in a market offers the same services and products to the same customers by performing the same kind of activities, no company will prosper. To see the difference between business model and strategy Wal-Mart is a good example.

When Sam Walton opened his first Wal-Mart in 1962 the discount retailing business model had existed for a few years, it actually emerged in the mid-1950s. Sam Walton had visited a few discount retail stores and had seen a lot of potential, so when he opened his first store he had borrowed a lot of ideas from e.g. Kmart. But it was what he chose to do differently that made Wal-Mart so successful. His model was the same as Kmart, but his strategy was different. A difference was the customers he targeted. Many of the competitors had their stores in large metropolitan areas, but Walton chose to serve small towns with populations of 5,000 to 25,000 people, a strategy which proved to be very profitable. He also had another

[48] *Why Business Models Matter,* p.90, Magretta, Joan, May 2002, Harvard Business Review
[49] *Why Business Models Matter,* p.91, Magretta, Joan, May 2002, Harvard Business Review

approach to merchandising and pricing, while the competitors relied on private label good, second tier brands, and price promotions Wal-Mart offered national brands every day for the same low price. Many companies have pursued the discount retailing business model, but only a few have succeeded over the long term, like Wal-Mart because their strategies set them apart. [50]

Another good example of the relationship between business models and strategies are Dell Computers. Michael Dell was a true business model pioneer, unlike Sam Walton he invented a completely new business model which of course now is well known. When Dell appeared on the scene every other personal-computer maker sold through resellers Dell however chose to sell directly to the end customers, something which gave the company a huge advantage because it cut out the costly link that was resellers and it supplied Dell with a lot of information which made the company manage its inventory much more efficient. Dell business model functioned much like a strategy, it made the company different and it was also very hard for competitors to copy. If the competitors copied the business model of Dell they would disrupt their existing distributions channels and push away the sellers they relied on. The competitors found themselves trapped by their own business model, they were in problems if they copied Dell's business model but also in trouble if they didn't. A business model like Dell's which changes the economics of an industry and is difficult to copy, can create a strong competitive advantage.

An important area of the Dell story related to this discussion is the role that strategy has played in Dell's success. The business model determined which activities Dell would perform, and which they didn't, however the company still had to choose which customers to target and which products and services to offer them. In the 1990s where most of their competitors targeted private customers Dell targeted corporate customers which were far more profitable. Later the Dell management noticed that their average selling price to private customers were increasing even though the industry's was falling. Because Dell sold direct and therefore could analyze customers in depth, they found out that consumers who were looking to buy their second or third computer and were looking for more power and didn't need to be walked through every step of the buying process, increasingly came to Dell even though the company wasn't targeting them.

Now that everybody is selling online Dell still has the same business model but have change where to apply the model; which geographic areas, which customers, and which products.

[50] *Why Business Models Matter,* p.91, Magretta, Joan, May 2002, Harvard Business Review

Business Models as a Contingent Factor

Christoph Zott and Raphael Amit published in 2008 a study where they researched how a company's business model influences the performance or more exactly the posed the question: *"How do the firm's business model and its product market strategy interact to impact firm performance?"*[51] This is an example of Contingent theory, which suggest that there is no optimal strategy for all organizations and submit that the optimal strategy varies based on certain factors, which are called contingency factors.

Business models has become an increasingly important contingency factor due to the development in information and communications technology, which has enable companies to interact in many different new ways. The developments have pretty much change the way companies transact and organize both within and across company and industry boundaries. Because of all the new possibilities a company has the need for a broader concept to apply on a company's value creating is necessary to research and explain the new situation. The business model answers this need and represents this broad concept.

The business model research is a very new area however a really important one as it has been proved that business models affect companies' value creation and value capture. Zott and Amit include product market strategies in their research also because they believe that managers need to know how business models and product market strategy, *independently as well as jointly*, affects the performance prospects of the company. From this projects point of view this research is interesting because they find that business models and product market strategy are distinct constructs that affect firm performance. This is significant because the research shows that business models create value and therefore can be used to explain why some companies outperform other companies. Also they find that novelty-centered business models, which the analyzed companies will be, coupled with a differentiation or cost leadership strategy enhances the company's performance. They also find that a novelty-centered business model combined with early entrance into a market have a positive effect on performance. Both these statements will be, at least to some degree tested in the study of the companies later in this project.

[51] *The Fit Between Product Market Strategy And Business Model: Implications For Firm Performance*, p. 1, Zott, Christoph & Amit, Raphael, Strategic Management Journal issue 29, 2008

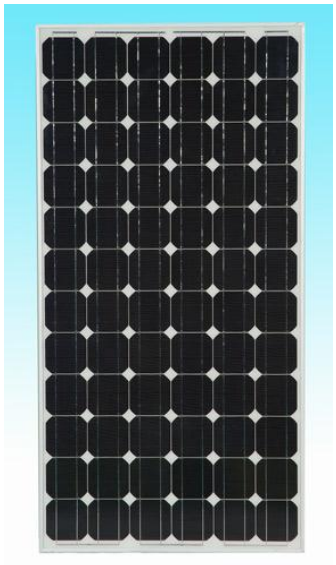
A look on the Photovoltaic Sector

In this section the top five companies of the industry of photovoltaic producers will be scrutinized. The aim is to apply the discussed theory to the top five companies in search for answers to how the relationship between business models and disruptive innovations are.

In recent years the Crystalline solar has driven demand and growth however thin-film solar is expected to drive the growth in the future. The thin-film panels use only a fraction of the silicone that Crystalline uses thereby making it significantly cheaper. Thin-film has also been adopted by many architects because they can be implemented with sleekness which along with its extraordinary functionality at a reduced cost makes it very appealing for green thinking architects, companies and homeowners. The potential for thin-film solar energy is huge but it is still a very young technology.

Thin-Film Solar

Crystalline Solar



The industry

The photovoltaic industry has a history of rapid high growth spurred on by the technical improvements that have pushed the cost energy supplied by solar power close to that of traditional fossil fuels. Much of the success of this sector has been attributed to the incentives that the users of this technology receive. [52] The global financial crisis has also hit this industry and especially the incentives have been reduced however as the growth rates the last decade has been extremely high the outlook for the photovoltaic industry still looks filled with growth.

[52] *PV Analysts: Cautious Optimism for 2010,* Moran, R.H., Photovoltaics World Magazine Vol. 2 Issue 1 Jan/Feb 2010

Figure 7: Solar Milestones

http://www.renewableenergyworld.com/rea/news/article/2009/12/pv-industry-history-weve-come-a-lot-farther-than-we-think

1979	1998/1999	2008/2009
Eight PV cell/module manufacturers shipping over 10MWp	1998–1999: Four cell/module manufacturers shipping over 10MWp; nine shipping over 5MWp	2009: One technology manufacturer shipping >1GW; 12 shipping 100–500MWp; one shipping >500MWp of internally produced technology.
Global technology revenues: $134 million	Global technology revenues (1998): $720 million	Global technology revenues: (2008) >$20 billion, (2009) ~$11 billion
Technology shipments to the first point of sale were 1.5MWp	Technology shipments to the first point of sale (1999): 175.5MWp	Technology shipments to the first point of sale (2008): 5.5GW; in 2009, estimated 4.8GW
40% of the world's population lived without electricity	1999: 40% of the world's population lived without electricity	2009: 40% of the world's population lived without electricity
Grid connected application: 0% of all sales	Grid connected application (1999): ~30% of all sales	Grid connected application (2009): 98% of all sales
Average module price to the largest buying group, in current dollars of the year: $11.00/Wp	Average module price to the largest buying group, in current dollars of the year: $3.30/Wp (1999)	Average module price to the largest buying group, in current dollars of the year: (2008) $3.25/Wp, (2009) $1.90
Conventional wisdom: efficiencies would max out at 30%	In 1999, this estimate exceeded 30%	In 2009, all technologies are reporting record lab cell efficiencies
Cumulative shipments (sales): 3.1MWp	Cumulative shipments (sales), 1999: 962.3MWp	Cumulative shipments (sales), 2009: >20GW
Industry participation consisted of kilowatt level start up plants	Industry announced plans for the first 100MW plants	More than one manufacturer with gigawatt capacity

2009 was a very bad year compared to a golden time in 2004 to 2008. Many smaller weak companies are only in business because of the capital they raised in this period and are therefore expected to get acquired, merge or go bankrupt in the short term future. The demand for solar modules are estimated to grow a massive 43% in 2010, a number based on the at least more positive financial outlooks for 2010 compared to 2009 and a significant fall in the prices of several important elements of the photovoltaic production.

The Top Five Companies

Q-Cells AG, Germany

The is world's second largest manufacturer of solar cells and have experienced huge growth rates as can be seen on figure 8. Q-Cells has expanded heavily in recent years so the business includes many different product lines with multicrystalline and monocrystalline solar cells based on silicon wafers being its core business. The company also has several subsidiaries including some which are testing different thin-film solar technologies and they have made a joint-venture with Swedish producer Solibro.[53]

The company has more than 250 engineers and scientists employed to solve the company's aim of driving down the cost of Photovoltaics. Besides the development, production and marketing of the solar cells made

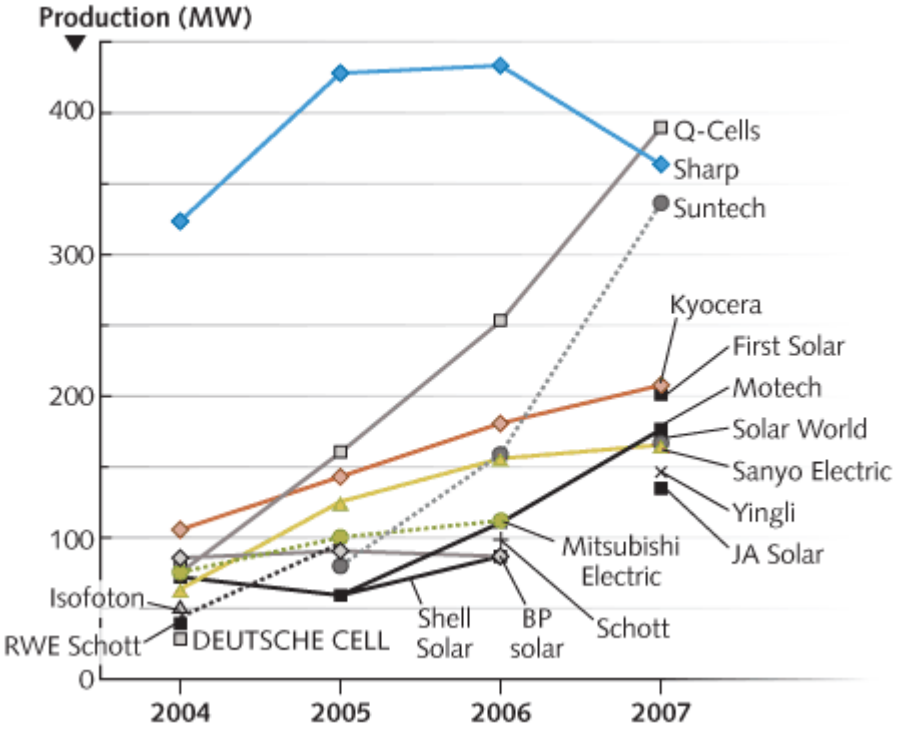
[53] *Land of Giants: PV Players and Prospects*, Appleyard, David. Renewable Energy World Magazine, March 2008

of the two kinds of crystalline silicon the company also manufactures thin-film technologies based on various technologies.

Q-Cells are also engaged in projects business with the company specializing in the planning, engineering, construction and maintenance of solar parks and rooftop arrays. It is also offering industrial consumers green energy solutions. [54]

Figure 8: Development in top end of the solar market

http://www.renewableenergyworld.com/rea/news/article/2008/09/explosive-growth-reshuffles-top-10-solar-ranking-53559



Sharp Solar, Japan

Sharp Solar is a division of the multinational Japanese Sharp Cooperation which among other things produces home appliances, office electronics, phones, flat screens and solar power.[55]

Sharp Solar is investing a lot in the thin-film solar cell area, including a recently opened new factory in Japan. This focus has made Sharp one of the leading players of the thin solar segment. The company produces solar products that target everything from homeowners to large solar parks. They even have a long-term strategy of being able to *harvest* solar energy in space and then *beaming* it back to the earth.

As can be seen on figure 8 Sharp experienced a decline in 2007 caused by raw materials shortage however they plan to take back to number one position by solving the raw materials shortage of course and by expanding across the entire solar value chain what they call Sharp's Total Value Chain.

[54] Q-Cells' homepage: http://www.q-cells.com/en/company/index.html date: January 2010
[55] Sharp Global homepage: http://sharp-world.com/corporate/info/index.html

Suntech Power, China

Suntech offers a large range of different products to the customers like Q-Cells and Sharp. Unlike Sharp the company only develops and produces solar cells and modules, they do not operate in any of the other parts of the photovoltaic supply chain. [56]

Multicrystalline modules

As the two other described companies Suntech is also investing heavily in Thin-Film technology and in their business in general. The company has received a lot of acknowledgement in recent years highlighted by the *Frost & Sullivan* Global Company of the year award 2008 for solar energy development and their achievement of the world record conversion efficiency for a multicrystalline module. So far Suntech's large team of scientists and engineers has continuously managed to increase the performance of their solar technologies.

Kyocera, Japan

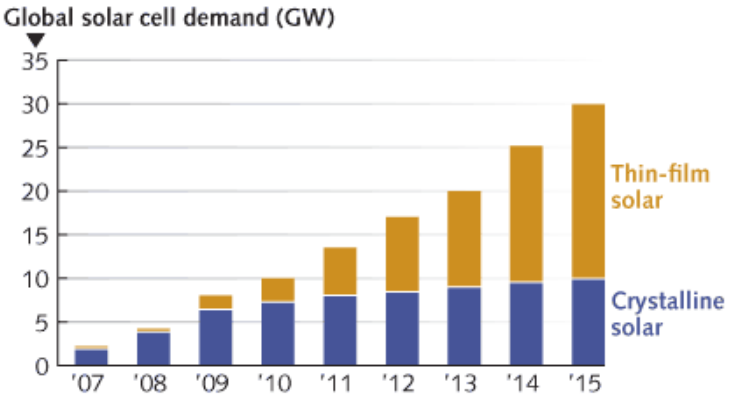
The Kyocera Corporation produces several different products including advanced ceramics, office electronics and solar cells.

Kyocera is also following the trend by investing in its business, aiming to double its 2008 capacity in 2012. The company builds and develops only crystalline modules however they are not totally traditional as they will supply Toyota with solar cells for the new Toyota Prius. [57]

As the company focuses only on traditional solar cells, which are still the largest part of the global market, it has still put the company in more stagnant state. Kyocera is as described investing in their business, however it not the segment which is considered to drive to future growth as can be seen by figure 9.

Figure 9: Global Solar Cell Demand Development

http://www.renewableenergyworld.com/rea/news/article/2008/09/explosive-growth-reshuffles-top-10-solar-ranking-53559



[56] Suntech's homepage: http://www.suntech-power.com
[57] Kyocera's homepage: http://www.kyocerasolar.com/

First Solar, USA

First Solar is a quite new player in the industry, formed in 1999 and launched its commercial products in 2002. The company is the largest manufacturer of thin-film solar modules and has achieved a lot in this area in its relatively few years and is now the biggest photovoltaic producer in the world today. It only produces thin-film modules and is the first company who introduced non-silicon thin-film solar modules into high-volume, low-cost production. Its modules are placed in free-field, commercial rooftop, and residential rooftop solar power plant applications. [58]

Analysis

Based on the theory presented the five described companies will now be analyzed however this will be carried out with some reservations as it have been extremely hard to find solid source material as the companies withhold their deepest thoughts, strategies and how they detailed run their business. For obvious reasons it hasn't been a possibility to enter in some arrangement with the companies in question so the sources of information have been various articles and the companies' homepages. None of the articles have directly described the issues searched for so much of the analysis has to have been pieced together from many indirect sources. However there exists quite a lot of information about the solar power industry so it hasn't been hard to get *a feel* for the industry which has laid the foundation for the more detailed analyze.

Even though this is the top companies in the solar power market, their recent history and outlook are very different. They all possess a technology with the potential to disrupt the global energy market, however even the solar power technology is changing a lot in these years, something that will have a big influence on these five companies.

The development in this sector is quite rapid. The increase in the modules ability to transform rays of sun into power is impressively high and in just a few years the industry have changed from being almost only crystalline solar modules to being around 50 % crystalline and 50 % thin-film, and the prediction is that the thin-film technology will increase its domination of the world solar power market. At the moment that prediction seems to be correct which is underlined by the rapid rise of First Solar and the demise of Kyocera. It is very interesting and very unique that a company who has experienced a lot of growth and

[58] First Solar's homepage: http://www.firstsolar.com/en/index.php

which revenues will probably increase considerably in the future can be interpreted as being in demise, but then again the Photovoltaics industry is also very unique.

Disrupting a disruptive technology?

The thin-film technology is a very interesting technology because even though being extremely young it has had a huge effect on the solar power industry. It is only a few years ago that almost every new solar power installation was based on crystalline modules however all this has changed as the thin-film modules have taken a huge chunk of the market. The advantage of thin-film is that it is cheaper, more convenient and has many more possibilities for usage. It still isn't as good as crystalline modules to convert sunrays into power however because it is significantly cheaper both to produce and transport it is preferred in many contexts.

The thin-film technology has many disruptive characteristics. It is a simpler more convenient product which at least initially was sold to a more price sensitive segment who valued price over the fact that "traditional" crystalline modules had a higher performance. It is a testament to how fast technology changes, that a technology that is in its youth and have a solid demand can be disrupted by another technology. There is no doubt that the solar power industry is very much based on discontinuity because everything changes so fast. The incentives that the different governments can be introduced one day because of a focus on green energy and be disappeared the next day because of a financial crisis.

The thin-film technology is both a new-market and a low-end disruption. It is a new-market disruption because it has enabled a whole new segment to use solar power modules, as the possibilities for using the thin-film are much bigger. It has caused the demand of solar power modules to increase significantly. But because the technology has improved so much it is now also able to pull customers out of the crystalline modules' market. The technology is also a low-end disruption because it also took its starting point in the low-end of the market because it is significantly cheaper hence available to a segment that normally couldn't afford solar power modules.

As for a single firm this also shows on a broader view that even though an industry is very young and experiencing high growth rates it can still be disrupted which is a frightening situation for companies, because their can earn a lot of money with a young technology. Their customer base can keep expanding however they are still being disrupted, and it is only when the market stops growing that the company will realize it because then the new technology will start taking customers from the company and the company will be too far behind to adopt the technology.

Another sign of the disruptive nature of the thin-film technology is the rise of First Solar. As written earlier:

> *"…while in disruptive circumstances the challenge is to commercialize a simpler, more convenient product to a new or unattractive customer segment. Research shows that in sustaining circumstances the incumbents almost always win however in disruptive circumstances the entrants are most likely to beat the incumbents"*[59]

First Solar is as described a relatively new player in the industry and is characterized by only producing thin-film modules. The company started as a very small business but is now the world largest Photovoltaics producer which is a testament to the quote.

The lessons of First Solar

First Solar has overtaken the top position by gambling on the right technology. They gambled on a market that was small then, but that had huge potential. The have achieved high levels of growth by only focusing on thin film, does that mean that they also have a different business model, which enables them to achieve more success with the thin-film than the other companies? Based on the information available it is a very hard question to answer but there can be no doubt that their business model is different to the rest of the top five.

First of all Sharp and Kyocera are divisions that are part of a large company, which usually has a significant effect on the business model, and the rest of the business for that matter. As described earlier this is a potential pitfall because the processes are geared to serve its current customers. Especially Kyocera is a good example of how a company is protecting is current business thereby making its future very predictable. Kyocera are investing heavily in their production capacity however not in thin-film technology. Their chase of economies of scale will probably be the beginning of the end for the Kyocera Solar division. They have a cultural lock-in on the old business and are experiencing the earlier described fears, e.g. channel conflicts and cannibalizing their crystalline modules, so they try to protect their business by improving capacity and moving up-market.

Q-Cells and Suntech Power are focusing on both thin-film and crystalline modules and have experienced some success, however they are lacking behind First Solar. A positive point is that they are testing with a lot of different technologies however the big test is if they are able to use the creative destruction and actually de-emphasize their crystalline modules which they now consider their core business. Because the market are giving clear signs in which direction the development are going, 5-10 years ago the industry was

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dominated by crystalline players, today the top is mainly made out of players which emphasize both segments, however the clear number one is a thin-film player and the thin-film companies have significantly more success than their crystalline counterparts.

Can First Solar have *molded the innovation* in another way? It is possible because they don't have the traditional thinking of old modular cells, and therefore probably have a new business model and other channels. First Solar has probably aimed for cost leadership since they started because that's an obvious advantage of thin-film, this combined with a novelty-centered business model (which all the five companies have) increases performance as Zott and Amit showed. It was hard to conclude for certain how the different companies interact with their external environment, but you would expect that they would be affected by the past as the theory describes. This means that First Solar probably have some different channels because they are a new-market, low-end disruptor. Their cost-leadership will have affected every range of the company's operations.

The First Solar significantly higher growth rates are also a tribute to the conclusion that it is necessary to spin off the department of potential high growth, either as a different company or as an independent division because it enables the spin off to have a different business model thereby allowing it to organize itself to fulfill its potential.

Conclusion

Many managers experience the horror of being unable to create significant growth for their companies. When a company's growth rate has stalled it is very hard for managers to reignite it, the project furthermore demonstrate that no company has ever achieved to maintain a long-term growth rate higher than the growth of the GDP. When the companies mature they are unable to create new high-growth businesses.

The problem isn't that the companies are generally unable to create new ideas, the problem is that the processes designed to handle these new ideas aren't capable of creating new high-growth business. This is a huge problem for the companies because the market constantly develops new ideas and constantly punishes the companies that aren't able to innovate at a sufficient level. Most companies are built on the assumption of continuity however the market is built on discontinuity which makes it remorseless in its destruction of non-performing companies. In the last 70+ years the level of discontinuity has been constantly increasing. The technological development in every market is more rapid than ever and this means that companies who don't innovate sufficiently will be removed by the market at a much higher speed than ever before. It is necessary for companies to be built on discontinuity instead for continuity if they want to secure their long term survival however many companies find it hard to change their culture and processes because they are *culturally locked-in* on the old ways.

The project establishes that in a battle of sustaining innovation the incumbents regularly win however in a battle of disruptive innovation the new entrant normally wins. New disruptive companies don't compete head on with the incumbents, instead they start at the low-end of the market or at the non-consumption which motivates the incumbents to flee rather than fight. There are two different types of disruptive innovation, the low-end and the new-market disruption. What is common for both types is that a new disruptive innovation needs a business model which is designed for it. If a company tries to make a new growth business, that business needs an independent business model so that the processes can be designed to the disruption.

The business model theory is a very new scientific area which is not yet as *mature* as the rest of the theories used in the project. This has constrained the project in several ways however the business model is a structural template that describes a company's transactions with its external environment. A good business model is essential to any successful company, no matter whether it's a new venture or an established company. Many models fail because they are built on wrong assumptions about customer behavior. They are solutions in search for a problem, which actually is ironic because a good business model forces the managers to think thoroughly about their business however a business model isn't the same as strategy, even though it is often used interchangeably. Business models describe how the pieces of

the business fit together as a system, but it doesn't take a very important factor into consideration: competition. Dealing with competition is a strategy's job.

The project examines the Photovoltaic business and the five biggest manufactures. The industry is dominated by two types of technologies; crystalline and thin-film. Crystalline is the traditional technology however demand and usability has increased so significantly that the thin-film is now considered the future.

The project concludes that the Photovoltaic industry is currently being disrupted by the thin-film technology, showed by the rise of First Solar. The industry is a good example of what happens in a disrupted industry because the traditional producers of crystalline modules are being disrupted and are losing their market share. What is special about the Photovoltaic industry is that it has experienced a lot of growth and the crystalline technology is still very young however the industry shows that there is no technology that is too young to be disrupted and that a company can be disrupted even though the company is achieving high growth rates. This shows that in today's market, no company is safe no matter how well it is doing, every company can be disrupted.

First Solar's rise to the top of the industry is a testament to the thin-film technology but also shows that a new disruptive technology needs a business model designed for it. First Solar only deals with thin-film hence its processes are designed to fulfill the potential of that technology which turns its business model into a competitive advantage since the technology is disrupting the market. First Solar strengthen the claim that it is necessary to spin off the department of potential high growth, either as a different company or as an independent division because it enables the spin off to have a different business model thereby allowing it to organize itself to fulfill its potential.

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