

# ELEC6049: REPORT 2, How Does Technology Make Money? - Emerging Companies

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## ABSTRACT

### Complete Abstract

This report investigates whether the acquisition of patents is important to an emerging company. Notes from the invited seminars are included along with extra research into related companies. Three case studies are done in more depth on three companies - Atmel Technologies Ltd. Nest and Iridium. It is shown that patents are valuable assets to a company, but they are only particularly useful an emerging company when it is the first to market. Being first to market and holding patents on the product creates a monopoly for the patent holder to become successful with very little competition. Other than this, patents tend not to be worth while for an emerging company due to the costs involved.

## INTRODUCTION

Starting a company is a very difficult task to undertake. There is much discussion as to the strategy that should be taken in order to make the company successful [1, 2]. In this report, an emerging company is one which has been around for eight years or less [3]. An emerging company is deemed successful if it then becomes an established company after the 8 year mark. An established company is one where the company has developed a product range for a specific market [4]. It can also be successful if it is acquired by and/or merged into an established company.

A patent is legal protection over an invention. They cover how things work, their operation and their manufacture. According to [5], a patent must be:

- a new and novel idea
- an inventive step that it not obvious to an expert in the relevant field
- manufactured or used in an industry

As well as this, [5] says a patent cannot be:

- a mathematical or scientific theory, discovery or method
- dramatical, musical, literary or artistic discovery
- presentation of information, or some computer programs
- an animal or plant variety
- a method of medical diagnosis or treatment
- immoral or against public policy

Valid patents provide the holder “an ‘absolute’ monopoly” over their invention for 20 years [6]. This is the main advantage to own a patent as it results in other companies being unable to copy your idea to undermine the patent holder. This exclusivity can also increase the value in a company, and established companies may wish to purchase and merge to acquire the intellectual property of a company. An example of this is Atmel’s acquisition of Quantum Research Group to acquire IP around touch screen technology [7]. This gave Atmel a quick start in this market. Patents themselves can also be licensed or sold in the case that they are not exploited by the patent holder.

Patents can typically cost between £230 - £280 to file. Renewal costs are then between £70 and £600 depending on the age of the patent [8]. The technology patented must earn more money than it costs to hold the patent, else it loses the patent holder money. However, holding a patent is one aspect of the costs - there are also the costs involved in defending your patents. This mainly includes the legal fees involved in taking the accused to court. Therefore a company must be in a strong financial situation to be able to hold and successfully defend a patent; a luxury that can not always be exercised by an emerging company.

There is a long running debate around whether computer programs and algorithms can be patented [9, 10]. An algorithm can be seen as a mathematical method, which violates the IPO’s rule for patents. However, in the USA, there are no such restrictions, and allow a “new, non obvious and useful” process to be patented [11].

In [3], a six stage plan for an emerging company is discussed. Although this is aimed at the biotechnology industry, the strategy still applies to other areas. The later parts of the strategy concern the research and development, and in particular, the acquisition of patents.

This report aims to investigate whether the early acquisition of patents leads to the success of an emerging company. Four possible combinations have been identified and depicted in figure 1. A company can either acquire patents early, or later on. The company can then be either a success or a failure as previously defined.

The report is comprised three sections. The first discusses material from the invited talks, with thought to the hypothesis. The second documents a number of case studies investigating the hypothesis. The final section then concludes the report.

## **SECTION 1 - INVITED TALKS**

### *Lecture 1 - Gary Steele & Nanotech Semiconductor Ltd.*

Nanotech Semiconductor Ltd provides a case study of a successful emerging technology company. The company was founded in 2003 by prolific entrepreneur Gary Steele, following great success with his Acapella Ltd

	No Patents Acquired	Patents Acquired
Business Success		
Business Failure		

Figure 1: Patent-Success Synergy Matrix

and Microcosm Communications Ltd business ventures [12]. Nanotech was a fabless IC company with expertise in CMOS analog and mixed-signal designs for the fibre communications industry, and is cited in [13] as being the fastest growing start-up in the fibre-optics IP market in 2010. The company was sold to Gennum Corporation in 2011 for \$34m (USD) [14], which was subsequently acquired by Semtech in 2012.

One of the company's key innovations was transmitter/receiver chips for fast Ethernet links. The uniqueness of the design was achieved by combining the transimpedance amplifier and the limiting amplifier into a single chip. This required significant progress in noise suppression. In [15], Steele is quoted, "We put a lot of intellectual property into the noise suppression." This gives an insight into the role of patenting within Nanotech. Patenting new technology is preferable, since it protects the innovation and maintains a competitive advantage. However, as an emerging company, capital to invest in patenting was not always available. This leads to the selective approach to patenting, whereby only strategic patents for the most commercially critical technology was obtained. The patent strategy for Nanotech was a compromise between adequately protecting the technological innovations and capital cost.

The role of patents in the exit strategy of an emerging company is also an important aspect for consideration. While Nanotech did not have a vast patent portfolio, it can be seen through patent history the migration of patents from Nanotech Semiconductor to Semtech Corporation [16] [17]. Emerging companies can be acquired by larger established companies for a number of reasons, one of which is the ownership of a high-profile IP portfolio. The Acquisition of Nanotech Semiconductor by Gennum Corporation can be partly attributed to synergistic expertise and technology portfolios [14], however the role of IP in acquisitions should not be overlooked.

## *Lecture 2 - David Parker & Perpetuum*

Perpetuum are a Southampton based business specialising in energy harvesting modules. The company was founded in 2004 and began life as a component supplier for their power module. Perpetuum do not classify as an emerging company in the current day, but the early life of the company and their patent acquisitions are discussed here. They are a venture capital funded start-up involving multiple investors. It was a spin off from a technology developed at Southampton University.

Perpetuum currently hold 22 patents. Their first was issued on the 23rd August, 2007, some 3 years after they began. These early patents prevented any other businesses from being able to reproduce their technology. However, the company initially struggled with business. Their target market was the Oil and Gas industry as

they use large drills which vibrate, making it a perfect spot to house their module. The main issue was that the target market had no application for the module that Perpetuum were attempting to supply.

Due to the business not fulfilling their potential, they undertook a change. The core competencies of the company were considered. It was easy to see that the main core competency of Perpetuum was in developing energy harvesting modules. A second core competence was added to the company of developing a wireless sensor for their module, transferring the product developed from a component, to a system. This change in focus was accompanied by a change in market - the system was aimed at the transport industry, particularly trains, where there was a gap for a remote monitoring system of the bearings and suspension.

Even though Perpetuum had a great, novel idea with patents to protect them, it did not make them money by owning the patents alone. The patents definitely helped, as it meant no other company could have undermined them during the time they were pursuing the non-existent market in oil and gas. The patents here acted as a barrier to the market, giving them the time to find the correct opportunity to become a success. Perpetuum have grown rapidly since the shift in core competence and market, with a turn over of around £2 million in 2013. There is no doubt that Perpetuum will become ever more successful through the combination of a good idea in the correct market, with patents to protect their product.

### *Lecture 3 - Iain Gavin & Amazon Web Services: HAILO*

Amazon is, without any reasonable doubt, an established company. Founded by Jeff Bezos in 1994 as an online bookshop the company shipped their first book in July 1995 [18]. Amazon now has three different parallel business interests. The original retail aspect, a 3<sup>rd</sup> party selling service via the website and Amazon Web Services (AWS). AWS powers the other two aspects of the business by providing the IT infrastructure that enables such excellent customer service but also acts as an accelerator for other businesses by removing the requirement for on-premises IT solutions. They achieve this by maintaining large server farms from which computing power can be *rented* to facilitate the IT needs of a company. They also provide varying degrees of cloud based storage; subject to access latency.

AWS considers a typical split in effort toward a computing heavy business venture, with an on-premises IT solution, to be 30% towards the actual business and 70% towards IT overheads [19]. Their goal is to reverse this distribution by handling the IT infrastructure for the business. One such company that has succeeded using AWS is HAILO [19]. Launched in 2011 with investments totalling over \$80 million (USD) from some well known sources such as Union Square Ventures, Accel Partners and Sir Richard Branson [20]. The company maintains a smartphone app that links customers with the local taxi services however this idea is not unique. At the time there was already a large market for smartphone enabled cab rides so something else must have been their source of success [21]. Market saturation and a software only product makes patenting redundant so it must have been down to the delivering and quality of the service that has made them a global success. Disassociating IT from the business using AWS may well have been a contributing factor to HAILO's ability to concentrate on product delivery.

The Amazon group as a whole is very technology driven, the founder filed the first two patents under "Amazon.Com, Inc" just before their first sale, and considers innovations as the best method to drive down the prices of the products they sell [22, 23]. Reasoning behind this idea is shown in Figure 2. This cycle enables price reduction which naturally improves sales. The key step is providing the technology which can improve efficiency therefore staying ahead of competitors. Amazon keeps delivering the required technology, whilst patenting aggressively, and at the end of 2013 created another media buzz by publishing a patent for "anticipatory package shipping" [24]!

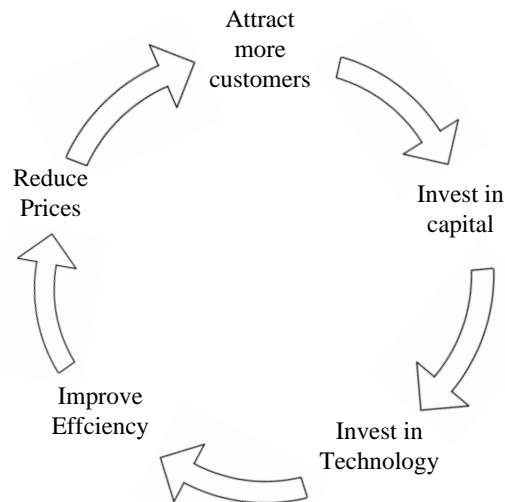


Figure 2: Scale & Innovation Drives Down Costs. Taken from [19].

## SECTION 2 - CASE STUDIES

### *Nest Labs - Patents for Defence and Value*

Nest Labs was founded in May 2010 by Tony Fadell and Matt Rogers [25]. The company designs innovative smoke alarms and thermostats that feature iterative learning and are internet connected. From humble beginnings, Nest have now sold 14 million thermostats and 50 million smoke alarms and employ over 300 people [25]. The company was acquired by Google for \$3.2bn cash [26] in February 2014 [25], thereby making Nest a successful emerging company by the definitions used in this report. This case-study will examine the acquisition by Google and ascertain the criticality of patents to the success of this emerging company.

Nest has a strong design heritage, both co-founders were ex-Apple employees and CEO Tony Fadell is widely accredited as the father of the Apple iPod [27]. Many Nest employees are also Apple alums [26]. This includes Richard ‘Chip’ Lutton, appointed as Vice President and general counsel in 2012 [27], who was heavily involved in Apple’s patent strategy [26]. Nest has a somewhat unusual patent strategy for an emerging company. Before the Google acquisition Nest had already settled 100 patent disputes [28]. It also owns 200 patents and has another 200 ready to file [28, 29]. The company signed an agreement with Intellectual Ventures in September 2013 granting access to IV’s 40,000 strong patent portfolio [29]. This is an aggressive approach to patenting, which is not normally pursued by an independent emerging company due to the legal costs [3]. The expertise gained through some of the employees experience at Apple must play a role in Nest’s patenting strategy.

Nest’s aggressive patent strategy is partly motivated by defence. The company has faced three major patent disputes since its inception. Thermostat manufacturer Honeywell filed a lawsuit against Nest for patent infringement in 2012 [30, 31, 32]. The claims surrounded several patents for technology in Nest’s intelligent thermostat. Although the lawsuit is ongoing [33], Nest has largely dismissed these claims, and have stated that Honeywell often use this strategy whenever posed with competition. As a result of this first lawsuit, Nest hired Richard Lutton and entered the deal with Intellectual Ventures [34]. Additional patent infringement cases have been filed by First Alert in November 2013 over Nest’s intelligent smoke alarm [33, 34]. Allure Energy are also pursuing a lawsuit for proximity control technology in Nest’s thermostat [35]. Taking an aggressive approach to patenting will allow Nest to defend itself against these more established companies [35]. Disruptive technology such as the Nest thermostat has the ability to transform a marketplace, and stall major revenue streams for incumbents [28]. Larger established companies often use the threat of expensive patent litigation to manage the threat of emerging disruptive technology, as Honeywell, Allure and First Alert have in this case

study. While a defence strategy can be expensive, when combined with an appropriate level of expertise and financial backing, an emerging company can adequately defend itself in court, allowing the company to profit from its technology.

A final area of patent strategy that is evident in this case study is valuation at exit. Google has acquired a number of businesses with a focus on extending its patent portfolio. Nest marks its second largest acquisition to date, with Motorola Mobility being the largest [26]. Google now owns double the patents it held in 2012 [28]. This is a result of the patent wars over the Android operating system, which has cost Google 100s of millions of dollars [28]. The technology Nest Labs develops clearly has a value to Google, and this value lies partly in the 200 patents the company holds.

#### *Atmel - Patents not vital to success*

Atmel Technologies was founded in 1984 by a former Intel employee, George Perlegos. They were venture capital funded, with only \$30,000 in initial investment. Atmel in the current day are a very well established company, with offices in many different countries, multiple product ranges and had a turn over of \$150.93 million in the last quarter of 2013 [36]. For the purpose of this case study, the early life of Atmel provides a good case study with respect to their patents.

Atmel hold around 1200 patents as of 2014 [37] in varying aspects of technology, from touch screen related methods, to fabrication techniques. Their first patent was issued on 16th May, 1989 [38], 5 years after the company was founded. In the years previous to their first patent, Atmel encountered patent issues.

In 1987, Atmel were the subject of a patent infringement case from Intel. Intel claimed that Atmel's EPROM technology which they were selling to Motorola and Nokia, infringed on the patents they held. Atmel could have fought a legal battle against Intel, but they chose not to. This could have been due to the costs associated with patent litigation, or that Atmel were guilty of infringing on Intel's patents. As Atmel didn't own any patents at this time, it looked like Intel would win the case.

With hindsight, the decision to not fight the legal battle was the correct one. Little money was spent on the proceedings, and it forced Atmel to redesign their EPROM technology. Their new design turned out to not only out perform Intel's device, it also consumed less power. Later, this improved memory was included in their microcontrollers, providing an edge in a different market as the EPROM could be included on chip. Atmel's first patent was about their EPROM fabrication process [38]. This patent was then followed by 3 more that year, all based around their EPROM technology [39, 40, 41].

This case study shows that the acquisition of patents is not necessarily a good thing. If Atmel had gained early patents of their EPROM technology, they may have been more likely to fight a costly patent litigation case against Intel. Given the little funding Atmel started with, it could have cost them more than money, with time being wasted. It could be argued that the initial technology did in fact, infringe on Intel's patents, and could therefore not be patented. However, due to the financial standings of the company, the costs for both owning and defending a patent were possibly too much at the time. Even if Intel did not hold patents, and did not prosecute Atmel, the overall success of Atmel could be debatable. Their renewed effort on memory devices impacted their later microcontroller memory, of which is now a very large core competence of Atmel.

Since their success with EPROM memory, Atmel received extra funding [42] and purchased foundries to further their R&D into silicon memories. In the modern market, Atmel develop both hardware and software products. Their initial success was spurred by not having a defence against someone else's patents. In this situation, patents would have not been advantageous to Atmel.

find out what Atmel had to do to compensate Intel

### *Iridium - Failure with patents*

In 1998 Iridium, a company that spun out of Motorola in 1991, launched their telecommunications service to the public. In 1999 Iridium filed for bankruptcy [43]. The company started a ground breaking Low Earth Orbiting (LEO) satellite network which was made possible by a total \$5 billion (USD) investment from Motorola. Expanding upon existing mobile phone technology Iridium offered global connections without delays. Satellite technology is extremely complex and the seven years before release was spent designing, constructing and launching the network [43]. It is widely agreed that the failure of the company can be attributed to the expensive handsets and call tariffs [43]. Initially they managed to attract less than half the number of expected customers and these fell quickly as issues with the handsets arose [44].

Iridium holds over one thousand patents; two of which are key and based around the original idea which was conceived by three engineers [45, 46, 47]. This aggressive patenting strategy evidently did not protect the company from failure and the argument can be made that patents were redundant in their approach. The concept was, and in fact still is, on the very crest of the technology wave and required a very large amount of backing to implement. Why patent in this situation? Patenting provides very little to the business drawing time and money away from other sections however the cost and time to process patents is insignificant in the context of this grand venture.

Iridium has made a comeback since this fatal chain of events and is currently working to upgrade the network under the new brand *IridiumNEXT* [48]. Resolving their previous issues by aiming services at industries, such as maritime and oil, that can make far better use of a truly global network [49]. It can be argued that the large number of patents assisted Iridium when making a return.

Iridium needs completing

## **CONCLUSIONS**

A number of companies with varying patent strategies have been considered. They are categorised in the Patent-Success Synergy Matrix in figure 3. Here, the categories are not boolean - but on a scale. The  $x$  axis represents the patenting strategy from few to many. The  $y$  axis is proportionate to the success. The more successful the company is, the further up the company is represented on the matrix.

In this situation, it is difficult to compare Hailo and Amazon to the other companies. This is due to them both being software orientated. As discussed in the introduction, software is difficult to patent, and so does not provide a good comparison to the other, hardware orientated companies.

Atmel were verging on the line of failure/success in their early days. They managed to recover their business after accusations from Intel to form a very good company, with patents in place to protect them.

Iridium, Nest and Perpetuum all show a similar strategy - they were all first to market with their inventive idea. The acquisition of patents for these companies was key as it allowed them to gain a monopoly over their market. All three companies had good, inventive technology. Nest and Perpetuum became successes with the future looking bright for the younger Perpetuum. They both hold good standings in their markets with the needed legal defence to help them. Iridium, however, had a good idea, and the patents to back their venture. But due to a large amount of new technology to realise their goal, and unreliable hardware meant customers were put off. The company put a large amount of effort into their product without the certainty of customers or success. If the company was successful, the patents would have been a great aid to give them exclusivity to their market.

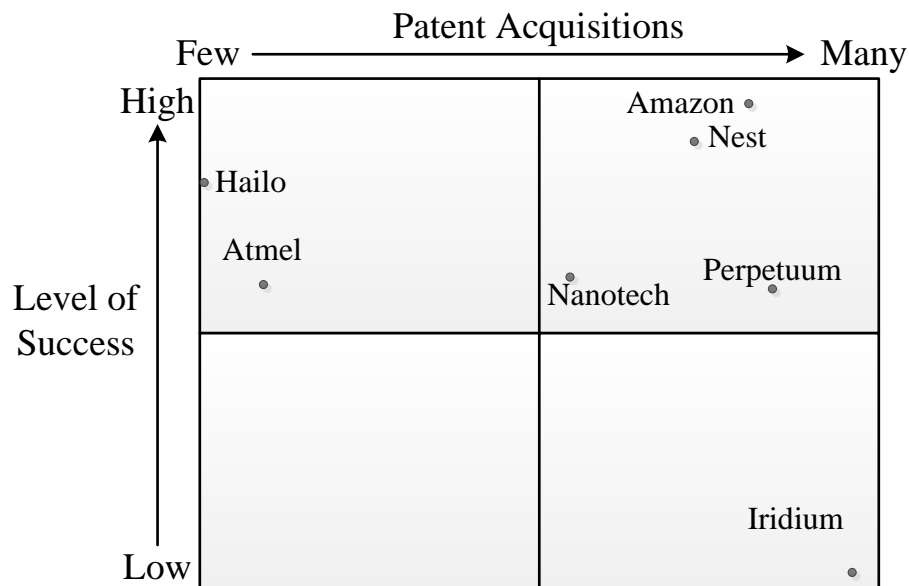


Figure 3: Patent-Success Synergy Matrix with companies

Nanotech are an exception, to some extent. They hold very few patents [50] but still remained successful as they were bought out by Gennum Corporation. This could be due to the fact they were not the first to the market, or that they managed to develop a product that was the best available. By filing for a patent, they would have to disclose the workings of their device, whereas the company may have wished to keep it a trade secret.

It is clear that if you are first to market, patents are extremely valuable as they give you a monopoly over the market. This removes a large amount of the competition until a company develops a similar technology which does not violate patents, and out performs the existing product. However, this is difficult to do as by the time such a product is made, the market holder would be well established with good customer relations.

Patents are not the golden key to success. Holding good patents is not an excuse to neglect basic entrepreneurialism and business strategy. There is a large lesson to be learnt from Iridium's failure for all emerging companies. It is also not necessary to hold many patents to be successful either. Atmel managed their early life without patents, and therefore were flexible in their R&D to develop a product. Their memory won the market not out of exclusivity, but from good performance and business strategy.

In conclusion, the acquisition of patents is a tricky, but important decision to make. Patents should be acquired where needed to give exclusivity. They add value to a company, as well as defence against other companies copying a product. However, patents are not an alternative to the basic business strategy and skills needed to be successful.

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## APPENDIX

## 1. TEAM CONTRIBUTIONS

Note that for each report there will be a different chair person. The chair person is expected to lead the report writing process, including ultimate decision on topic, the allocation of research and the collation of content provided by others. Hence it is expected that one team member contribute more per report, thus averaging out over all three reports for the module. The contribution to the module as a whole will be approximately even from each team member.

Team Member	Contribution
Thomas J. Smith 23914254	Lecture 1 and Nest case study sections. Cheif of figures. Full lecture notes appendix.
Henry S. Lovett 23900091	Chairperson for this report. Atmel case study, lecture 2, introduction and conclusion.
Ashley J. Robinson 24008346	Iridium and lecture 3 sections.

## 2. MEETING MINUTES - KICK-OFF MEETING

<b>Purpose</b>	ELEC6049 Team Kick-Off Meeting
<b>Date and Time</b>	Tuesday 4th March 2014 at 12:40
<b>Venue</b>	1st floor Murray Building, Highfield Campus
<b>Participants</b>	TJS (Tom Smith), HSL (Henry Lovett), AJR (Ashley Robinson)
<b>Apologies</b>	None
<b>Agenda</b>	Assign Chair for this report. Generate initial ideas for research. Agree expectations of work and schedule. Agree date and agenda of next meeting.

### *Minutes of the Meeting*

ID	Subject	Notes and Discussion	Action
1.0	Chair	The group decided that HSL should be the chair for this report. AJR is still pursuing job applications and will hence chair the final report.	-
2.0	Feedback	The feedback from the first report was good. The group have decided to look more at strategy rather than the history of a company.	-
3.0	Start Up Company	A definition from literature is needed as to how to classify a start up company. All are to look for ideas.	<b>ALL A1.0</b>

<b>ID</b>	<b>Subject</b>	<b>Notes and Discussion</b>	<b>Action</b>
4.0	Initial Ideas	Good ideas make money in a start up. However, how does one define a “good” idea? What drives desirability for products.	-
5.0	Kickstarter	Kickstarter was deemed unproductive - it is not how a start up makes money, merely a mechanism for ex-celling good ideas	-
6.0	Hypothesis 1	Need a good idea and a good market. HSL raised point of RAMBUS which was both a good idea and had a good market, but was unsuccessful due to poor management decisions. Also unknown if this was a start up at the time, and if this even applies to the hypothesis suggested.	-
7.0	Hypothesis 2	Patents, publicity or trade secrets. Start ups that manage to get patents for a desirable technology, whether it is applicable at the time or future, could become desirable to larger companies to fund. HSL raised example of Quantum Research Group who were bought out by Atmel.	-
8.0	Deadline	TJS raised that the deadline is 3 weeks today - 25th March.	-
9.0	Research	Ideas have been raised, but TJS suggested we research and have a clear starting point and idea before looking at the case studies. Due to Zepler outage, disabling most of us doing most other work, more effort will be put into this module this week to compensate	<b>ALL 2.0</b>
10.0	Git	Git has proved useful. A new report template is to be set up.	<b>HSL 3.0</b>
11.0	Next meeting	Group decided to meet <b>5th March</b> as no one can do other work so will concentrate on this.	-

#### *Action List*

<b>ID</b>	<b>Action</b>	<b>Comments</b>	<b>Status</b>
A1.0	Definition of a ‘Start Up’	Find a definition from literature for what we can classify as a start up company.	Open 4th March
A2.0	Initial Research	All to do some research into a potential hypothesis. To be discussed tomorrow.	Open 4th March
A3.0	Set Git up	HSL to set add second report to the Git.	Open 4th March

*Next Meeting: 5th March 2014, 12:00, Level 3 Zepler, Highfield Campus. If Zepler is inaccessible, meet outside the building and find a room elsewhere on campus.*

### 3. MEETING MINUTES - PROGRESS MEETING

<b>Purpose</b>	ELEC6049 Report Meeting
<b>Date and Time</b>	Wednesday 5th March at 11:00
<b>Venue</b>	3rd floor Zepler Building, Highfield Campus
<b>Participants</b>	TJS (Tom Smith), HSL (Henry Lovett), AJR (Ashley Robinson)
<b>Apologies</b>	None
<b>Agenda</b>	Discussion of Hypotheses. Discuss of research done Thoughtshower some ideas for a Hypothesis. Identify a hypothesis to go forward with. Agree next meeting.

#### *Minutes of the Meeting*

<b>ID</b>	<b>Subject</b>	<b>Notes and Discussion</b>	<b>Action</b>
1.0	House Keeping	The minutes of the last meeting were adopted by the group	-
2.0	Research	The research done was interesting. A few papers were found about strategy with a discussion of patents. TJS 6% of start ups have a novel idea. HSL found a paper saying that Independent Ventures are more successful than Corporate ventures. TJS - Kodak held patents for digital cameras, but didn't persue because of destruction to the current film camera maret.	-
3.0	Hypothesis 1	Does a start up need an initial good idea?	-
4.0	Hypothesis 2	Is the early acquisition of patents key to the success of a start up?	-
5.0	Hypothesis 3	Is it better to be a corporate venture or an independent venture?	-
6.0	Discussion	3 was declined as not much literature was found. 1 opens up for a large discussion about why. We also know the answer already. It's very subjective - what is a 'good idea'? It is also more difficult to break up into 3 parts of work. 2 - more focussed. Would be a similar layout to previous report in section 2. Easy definition of terms. However, conclusion could be open ended as we don't know the answer!	-

<b>ID</b>	<b>Subject</b>	<b>Notes and Discussion</b>	<b>Action</b>
7.0	Other points	TJS - Section 2 could be areas of technology, rather than specific companies. HSL - big companies were once start ups, and were successful. Might be worth looking at their early years. AJR - conclusion may be difficult as we make differing points. Suggested the starting of a 'common themes' document.	<b>ALL A4.0</b>
8.0	Introduction	HSL to begin introduction. Define the hypothesis and the terms used - 'start up', 'successful' etc. . .	<b>HSL 5.0</b>
9.0	Research	AJR and TJS to start case studies research	<b>AJR TJS 6.0</b>
6.0	Minutes	The group agreed that HSL would collate these minutes.	<b>HSL A7.0</b>
7.0	AOB	Group to attend tutorial on the 11th March. AJR unable to attend due to job interview. Therefore the next meeting will take place 11:00 Wednesday 12th March, in Zepler Level 3 labs . The meeting was closed.	-

#### *Action List*

<b>ID</b>	<b>Action</b>	<b>Comments</b>	<b>Status</b>
A1.0	Definition of a 'Start Up'	Find a definition from literature for what we can classify as a start up company.	Open 4th March - Closed 5th March
A2.0	Initial Research	All to do some research into a potential hypothesis. To be discussed tomorrow.	Open 4th March - Closed 5th March
A3.0	Set Git up	HSL to set add second report to the Git.	Open 4th March - Closed 5th March
A4.0	Common Themes	ALL are to maintain a document listing common themes between studies	Open 5th March
A5.0	Introduction	HSL to begin introduction	Open 5th March
A6.0	Case Studies	TJS and AJR to begin research	Open 5th March
A7.0	Minutes	HSL to collate and type up minutes	Open 5th March

*Next Meeting: 18th March 14, in the scheduled tutorial session 12:00 05/2015.*

#### **4. MEETING MINUTES - PROGRESS MEETING**

<b>Purpose</b>	ELEC6049 Report Meeting
<b>Date and Time</b>	Tuesday 18th March at 11:00
<b>Venue</b>	3rd floor Zepler Building, Highfield Campus
<b>Participants</b>	TJS (Tom Smith), HSL (Henry Lovett), AJR (Ashley Robinson)
<b>Apologies</b>	None

<b>Agenda</b>	Discussion of Hypotheses. Discuss of case studies done Ideas for finding other case studies Agree next meeting.
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### *Minutes of the Meeting*

<b>ID</b>	<b>Subject</b>	<b>Notes and Discussion</b>	<b>Action</b>
1.0	House Keeping	The minutes of the last meeting were adopted by the group	-
2.0	Nest	TJS had completed a first draft of the Nest Case study. Shows a company who had valuable patents and was successful. HSL had proof read it. Agreed it was a good study.	-
2.1	Nanotech	TJS had collated the lecture notes from Gary Steele. Done extra research into one of Steele's companies, looking into patents. Deemed good idea and a similar structure to be kept for the other lecture notes. HSL to do this for Parker's notes looking at a company	<b>HSL A8.0</b>
2.2	Atmel	HSL done a outline of the Atmel case study. AJR raised an interesting point as if they would have been successful if they chose to fight their case. Outline looks good. Needs completion.	<b>HSL A9.0</b>
3.0	Final Study	Need to find a third case study. Ideally one which failed and look if this links to patent acquisitions. Maybe look into Steele's and Parker's history to help find. Or look at VC funded ventures.	<b>AJR A10.0</b>
4.0	Introduction	Introduction needs completing with more info about patents.	<b>HSL A11.0</b>
5.0	Conclusion	Need to begin conclusion. TJS to start an outline of it for HSL to complete once studies are done.	<b>TJS A12.0; HSL A12.1</b>
6.0	Patent Matrix	TJS raised that we can classify into four categories - Patent-Success, Patent-Failure, No patents-Success, No patents-Failure. Decided to use this to show different methods and can add an arbitrary scale to show strengths.	<b>HSL A13.0</b>
7.0	Minutes	The group agreed that HSL would collate these minutes.	<b>HSL A14.0</b>
8.0	AOB	Final meeting to take place 14:00 Monday 24th March, in Zepler Level 3 labs. Final seminar on Friday. The meeting was closed.	-



### Action List

ID	Action	Comments	Status
A1.0	Definition of a 'Start Up'	Find a definition from literature for what we can classify as a start up company.	Open 4th March - Closed 5th March
A2.0	Initial Research	All to do some research into a potential hypothesis. To be discussed tomorrow.	Open 4th March - Closed 5th March
A3.0	Set Git up	HSL to set add second report to the Git.	Open 4th March - Closed 5th March
A4.0	Common Themes	ALL are to maintain a document listing common themes between studies	Open 5th March
A5.0	Introduction	HSL to begin introduction	Open 5th March - Closed 18th March
A6.0	Case Studies	TJS and AJR to begin research	Open 5th March
A7.0	Minutes	HSL to collate and type up minutes	Open 5th March - Closed 18th March
A8.0	Lecture Notes	HSL to look into a company of Parker's	Open 18th March
A9.0	Case Study Atmel	HSL to complete Atmel Section.	Open 18th March
A10.0	Case Study	AJR to find case study and write it up.	Open 18th March
A11.0	Introduction	HSL to complete introduction	Open 18th March
A12.0	Conclusion	TJS to outline conclusion. A12.1 HSL to complete conclusion	Open 18th March
A13.0	Conclusion	HSL to add patent matrix to intro and conclusion	Open 18th March
A14.0	Minutes	HSL to collate minutes	Open 18th March

*Next Meeting: 18th Feb 14, in the scheduled tutorial session 12:00 05/2015.*

## 5. NOTES FROM INVITED PRESENTATIONS

These notes are raw and not altered in any way from when they were taken from the invited presentation. These notes have been distilled and focussed through the lens of our report title and hypothesis to the content shown in section 1.

### *Lecture 1 - Gary Steele - Fabless Chip Company Start-ups, examples and funding*

Graduated from Southampton in the 80s with a degree in electronics. Spent some time in the fabless chip market place which will be a focus of the presentation. Worked at National Semiconductor and at ES2. ES2 founded in 1985 is the largest European start-up with 100m dollars raised and a wafer fab built in France. In 1990 he started the first dedicated Fabless Chip Company called Acapella Ltd based at Chilworth Science Park, eventually sold it to Semtech which is a NASDAQ company for a fair profit. 1995 started Microcosm Communications Ltd which was truly venture capitalist backed. Had two rounds of venture one for 2m dollars and the other for 5.5m dollars. Around 16m dollars in today's money which after 5 years was sold to Conexant for 160m dollars which was a very good return (10-20 times return). Retired etc but then started Phyworks Ltd

also in Bristol with seed finance, it was bought out by Maxim shortly. Nanotech was started in 2003 and sold to Gennum in 2011 for a 2-3x return on investments.

Until 1990 the wafer fab and design processes were intimately linked. The process was unstable and the designs would be tweaked to fit the process. Also there was limited CAD support which resulted in poor simulation models and no 3D. TSMC in Taiwan was set up in Taiwan and standardised the Philips Semis CMOS processes. Large scale mass production leads to 30% net profit on 20bn dollar revenues. There was a high demand for this predictable process flow. Also alongside CAD tools such as those from Cadence. These have allowed these to separate design from Fab. Other foundries include SMIC China, UMC Taiwan, Silterra Malaysia, Global Foundry and IBM. Design companies pick the wafer fab that fits their design best and then an assembly and test house.

ARM is one of the most successful companies adopting a design based business model. The IP model seems very attractive. However we should be wary of basing these assumptions on one or two data points. When comparing the ARM IP model with Die sale price and chip sale price makes more profit, despite being less than Gross Profit Margin Percentage (GPM%). This is since the chip or die is more valuable than the IP and can still be sold in the same volume. Maxim and other good analogue design companies GPM around 70% across the business. Many more smaller volume orders than very high volume.

Example of product development - Fibre Optic Broadband. Originally low volume market with just sub-sea long distance communications considered but as this technology is reaching the home level, the volume rapidly increases. The transceiver PCB was one of the important areas of development. The development of Transimpedance Amplifiers in CMOS was a novel product. How did they protect their advantage? This saved around 2m dollars on around a 10m dollar spend. The design was also much simpler designs and the new technology can go through a much quicker fab process due to the more advanced CMOS processes. CMOS usually has better power characteristics, allowing some power savings.

When talking about Transimpedance Amplifier how did you protect your capability?

500k dollar design cost and another 500k manufacturing and development cost so around 1m dollar investment to start. After 5 years the cumulative gross profit was around 15m dollars. How do you get the 1m dollars in the first place. It took 2 years for Nanotech semiconductor to break even.

## **Funding Methods**

*Banks* - No

*Organic* from 1 pound to 100k pounds. Works by reinvesting profits for example a design consultancy. This requires slow growth given the 3 year chip cycle and 1m dollar funding required.

*Angel investors* from 100k to 1m pounds. The Government has a form of EIS tax relief for Angel investors. Can halve the true cost of investment and any capital gain is not taxed. However this still implies a modest growth.

*Venture Capital* from 250k seed to 5-10m pounds. Normally happens in several rounds.

*Venture Debt* similar to VC but a hybrid with debt. This is a way of reducing the stake the venture capitalist own of your business. The interest rate usually 10-13% which is quite high.

*Customer Co-funding* usually with a lead customer for around 2m dollars. Customer funding of several different IC designs. Perhaps includes some exclusivity agreements.

1 in 300 business plans are funded by venture capital. Europe and the UK chip sector has been a relatively modest success. There are around 10-15 VC funds. Often an annual or 18 month cycle for a VC funded

company. VCs need a company to have a big enough market, normally asking for a 1bn dollar market. Typically have a 1 in 10 success rate, which is why the market needs to be big enough to make the whole business be worthwhile. The successful one can often make a yield of 10+ times the initial investment. Around a 7 year commitment required to setup and run a successful VC funded business. Persistence is important. Initial Public Offering or Trade Sale, usually trade in the UK although IPO usually makes higher paper wealth. The paper wealth is difficult to change in to actual cash money though.

Thoughts on the future. How can EU compete with China and India with huge educated populations. Large problem with the billion dollar market problem where only a very few SoC companies can be successful. This is hard for VCs to make money out of. Probably analogue, mixed signal and RF is likely to make a successful VC funded business.

## Questions

How do you identify new markets? The fibre optic market kind of just came out of the blue. The company had a certain expertise after a customer initiated market venture.

Patents - Done both. Pros and cons to each. No patents they had no money so couldn't afford to. If you have enough breakthroughs and go quickly enough, you can beat the incumbent. This first to market undercutting is a single event. You win by being first and running fastest so you don't need patents. In more cash rich companies, you can afford to create it, but can you afford to protect it? If a bigger company has a better law firms? What about defending a patent?

Is it stressful? Yes.

## *Lecture 2 - David Parker - Southampton Photonics*

Creating bridges between Science and Technology, Technology and products and money. CEO of Southampton Photonics since 2002.

Are British Airways and Microsoft competitors? Yes or no? They are both competitors in the communication market. They both compete for your leisure dollar and business dollar. Microsoft allows you to do business remotely while BA allow you to do it face to face.

Are Waitrose and Aldi competitors? No they are clearly in the same market, but they have a different target customer. They are more adjacent competitors rather than direct. This is called market segmentation.

Customers are key. They are the binding force of the business. Expectations are varied, the customer wants the lowest price but the company wants to charge the highest. Returning to the Waitrose/Aldi case study - both deliver their customer segment the best 'value' but the expectation of value between the market segments is different. It is easy to get these confused within business. Looking at Apple, the innovation from Apple has changed the market more than any of their competitors.

Some historical context for discussing this includes looking at the dotcom and telecom boom and then the Lehman-crisis. Business is returning to basic business fundamentals. The impacts of the recession (are we still in it?) push forwards business fundamentals and to look at new fundamentals more stringently. Flexibility in the cost base has become more important. How do you create a business model that is flexible so that you can make loads of money in the boom periods, and not go bankrupt in the down-turns. Consolidation is inevitable - for the better or worse - is fuelled out of strategy, accelerated growth or to deliver shareholder value. Investment across the board is generally low.

Mind the Gap. Science/Technology/Product Development/Manufacturing/Channel Delivery/Customer. Between each stage in the product development life-cycle, there are a lot of gaps. For example, at the university

level, there are a lot of start-ups. These request investment in their technology, when really it is science as it is not yet a scalable commercial technology. There are many steps to reach a product ready for market.

Positioning is really important and relates to the Waitrose/Aldi example earlier. This is an example of positioning for a specific customer. Consider vertically integrated companies. They have an opportunity to offer the lowest cost through the absence of margin stacking. However it leads to very large overheads and liabilities. On the flip side, microprocessors have many markets. The question for any emerging business is where you place yourself in the supply chain. Consider the position of core competence. For example the core competence of Aldi is distribution. They have very thin margins, they are very good at getting them from the supplier at the lowest cost and shifting it to the consumer for the lowest cost at the highest volume. Waitrose have a core competence in service, although there is still a requirement in distribution. What is Apple's core competence? Apple has a strong design competence, whether aesthetic or in the internals or in the user experience. They also have a core competence in marketing, both directly within shops etc and indirectly through building a strong brand. Going back to BA and Microsoft. Microsoft obviously have a core competence in software and BA have a core competence in logistics. Southwest airlines had a core competence in logistics. They were really the first low cost airline. They asked their customers what was the most important thing about airlines, and the response was safety and arriving on-time. Hence they did things like taking away boarding passes. There was no money making issue here it was to stop people turning up late. This gave them an edge allowing them to leave on time consistently. The logistics are improved. Pick core competencies wisely and make the rest consistent.

High volume optical components for fibre optic communications. At first it was very vertically integrated as it was so cutting edge. It took in raw materials and sold to network equipment manufacturers like Cisco. After a while there was increased competition. Reducing costs can only get so low by increasing volume, step changes in cost can be made through inventive steps. The core competence had no clear focus when it was vertically integrated. As the market grew, the company shifted its competence and made sure it was consistent in its behaviour.

SPI Lasers - or Southampton Photonics Incorporated - was spun out of Southampton University to develop the Bragg rating which is a type of optical filter. In 2002 the telecom industry collapsed. Eventually decided to refocus the business strategy. The core competence was in glass fibre with a strong IP portfolio and clever people. However, it had this competence but no market. At the time there was a new emerging market for fiber lasers. The company could apply its core competence in this slightly different market.

Perpetuum example. They developed small energy harvesting generators, for example to run a sensor on a pump or something. However it never sold any products. This was because it was so far down the supply chain, the tech was good but it was too far removed from the customer. Actually selling into the rail industry now which has a real problem with monitoring, ie it had a customer. The core competence was in energy harvesting, but a secondary competence was required to interpret the data. Very heavily protected - adds a barrier to entry as there are no wires. The company used to be a component supplier, but then became a system platform, does the company turn into a full service provider?

Patenting hardware is often very effective, software less slow. Perpetuum made 200k in 2012, then 2mill in 2013, then more maybe this year?

Feanium? Another Uni spin-out. Handful of lasers sold a week, very specialist market segment. Danger of it becoming high volume and how that business model can cope with that?

### *Lecture 3 - Iain Gavin - Managing Director of Amazon Web Services UK and Ireland*

Purveyor of little brown boxes. Amazon group has three bits, Amazon consumer retail business, Amazon seller business and Amazon web services developer business. Choice, availability and great value drive the retail business. If Amazon doesn't have the item directly available, then they put a third party seller into the prime selling position to make sure the customer is satisfied. Analytics under the platform. Jeff Bezzos wants reliable stock prediction for almost instant deliverable. Amazon has 8 UK mega warehouses. One of the things done in the warehouse is pre-sorting to help Royal Mail deliver much quicker. Tens of millions active customer accounts. Many intra-country deliveries.

Third party sellers is a slightly different aspect of the business. This gives a better selection to their customers. They charge around 5-15% commission. By essentially group selling, they get higher volumes and cheaper deals with billing and shipping companies.

The company uses an immense amount of technology to make the best consumer business. How to pick and ship more efficiently. User analytics is very important. Amazon web services powers the other two parts of the business. Takes a high volume low margin approach to technology which is against the flow slightly.

**Cloud Computing** An analogy is the electricity services, a seamless supply of service that the user doesn't even know they are using to some extent. Cloud computing is also a utility service, giving access to technology resources managed by experts and available on demand. Very high security at the data centres. These services are simply accessed over the internet with no up-front costs, just pay as you go along. Protein profiling, Monte Carlo simulation for hedge funds and just massive mathematical computations are all some of the services Amazon offers. "IT spends 80% of its time and resources keeping the lights on." Gartner press release. Provides an alternative to building your own server hub which costs a lot of money and takes a lot of time, Amazon aims to overcome these problems.

Amazon webservice provides the IT for channel 4 and it's 4OD services. Also worked with BBC to broadcast Glastonbury, Amazon transcoded all of the satellite feeds ready for iPlayer. They also transcoded the BBC archive. On a Sunday night, Netflix uses around 30% of all American web traffic to stream movies, which runs on Amazon. Economic synergy with Lovefilm. Spotify runs on Amazon Web Services. Hailo cab also runs on Amazon web services. This is one of those hot start-ups. All the infrastructure is on Amazon web services, so they can focus on signing up the cabbies. Same again with Just Eat.

Compute system has servers available from normal type servers to super amazing computer clusters. Storage is through the S3 system. 2 trillion items stored and then stores 500,000 items per second. Database services are also provided. Other application services are also provided. Bulk secure email delivery is another service, so you can send a huge amounts of messages for a relatively cheap price. This is an enablement platform for innovation. Scale and innovation to drive costs down. Invest in capital, invest in technology, improve efficiency, reduce prices, attract more customers. 41 historical price reductions since 2006. Creates tremendous goodwill from customers. Financial reports always report Amazon as making no profit, Amazon reinvests the profits immediately. This is the trouble for some other public companies. The cycle picks up pace like a flywheel. This is a free cash flow environment. Exponential increase in services and updates. 2 pizza sized teams, you need to feed them with two pizzas.

Gartner - "AWS is the overwhelming market share leader, with more than five times the compute capacity in use than the aggregate total of the other fourteen providers." This is the outcome of a customer focussed business.

AWS encourages innovation. Experiment often and fail without risk. Lower barriers to market these days.