Innovation in the Software Industry

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Abstract – This study explores the methodologies and practices that have allowed the software industry leaders to obtain a loyal customer base, prosper financially, and set the standard in their respective fields. The attitude towards innovation, development strategies, and work environments of Apple Inc., Google, and International Business Machines (IBM) are discussed in detail. The similarities and differences between their approaches are compared to provide a general overview of practices within the software industry that have proven successful.

I. INTRODUCTION

There are many factors affecting the success and perceived inventiveness of a company in any industry. In the ever-changing field of software engineering, these factors become even more detrimental, as companies must keep pace with ever increasing rates and variety of demands of their customers, regulatory boards, and the world of technology on the whole.

Due to the broad scope of business management strategies available to companies in software engineering, it is impossible to consider the benefits and shortfalls of them all. For this reason, our research focused on three case-studies, selected for their outstanding innovation achievements and influence. Following a brief review of literature and company histories, we have chosen to evaluate the three companies on their policy and management in the following categories:

• History and impact of innovative products
• Company politics and the ‘driving force’ behind projects
• Office culture
• Outlook for current and future plans

A. Criteria for Evaluation

As previously mentioned, the categories selected for in-depth investigation were picked from the many possible factors affecting a company’s view of and success at innovation. The criteria discussed below were judged most valuable, since their affect either the external, public, view of the company, or directly impact the employee morale and motivation.

B. Innovative products

The innovative ideas, contributive policies, and unique elements of any company show in its products and services. In fact, the output of a company is the only publicly available evidence for objectively judging innovation. For this reason, we found it prudent to first examine the production history of the companies we selected to study. While it is true that this form of historical data gives no insight into the internal structure of a company, it showcases its end results, and so, effectiveness. Furthermore, the product history and its trends can help identify the nature of public relations of a business. A multitude of small projects scattered over a wide range of fields may indicate an ill-defined business objective, or on the contrary, a drive to serve a vast audience. On the other hand, an invariable line of similar products may show general disregard for public opinion, which, depending on the products’ success may or may not be evidence of good management. Another aspect of production worth consideration is the ability of a product (or company) to dominate the market. And this, in itself, can be further analyzed on the type of market and public perception. Whatever the case, the history of production, its trends, and breakdown into innovative, mediocre, or downright failed projects is a great indication of the effectiveness and ultimate success of a company.

C. Company politics

After analyzing the readily available evidence presented by the production history of a company, it is logical to consider the ‘driving force’ behind it. The business model, corporate politics, and, if applicable, hierarchy, are all important in identifying the key elements driving innovation. The approach to generation of ideas and projects can be categorized into either collaborative or authoritative. The former, while typical in traditional businesses, has been discouraged in the malleable field of software, since many possibilities can be easily overlooked by a small group, let alone a single person. Despite this, there are successful and resourceful companies exercising innovation through key individuals at the top of the company hierarchy. Much more in tune with the collaborative trend in software engineering is the cooperative business structure. There is much evidence that allowing tight-knit groups to brainstorm and share ideas without any social or corporate barriers is an effective approach to idea generation. In short, the business model deserves examination since it has direct effect on the company output, and by extension, ultimate success.

D. Office culture

Directly following the business approach of a company is its internal ‘microclimate’. Both team management and office culture play an important role in, if not the generation of ideas for new projects, then the execution of existing plans. It is noteworthy that many companies exercising a free and open environment aim to inspire their employees to
achieve their full potential. This builds on the notion that if creative individuals are left to work on projects they are passionate about, they will be more motivated and productive, raising company morale and contributing to positive working conditions. In contrast, other companies strive to endear existing products and business aims to their employees. With that, they hope to benefit from a selection of motivated, but interchangeable and easy-to-replace, individuals. The office culture, in conclusion, is often detrimental to overall company success, as it influences production, employee loyalty, and public opinion.

E. Outlook

Despite the importance of history and perseverance, innovation is about creating something new and moving forward. As such, current plans and future outlook are not inconsequential. While many companies successful in the past have benefited from consistent demand in their respective fields, they may come short if their business model is lacking in strategies for dealing with technology advancement. For this reason, we considered the approach companies take in dealing with external factors and changes in public interest. Furthermore, we researched any future plans or expectations outlined by company representatives. This information, while not always accurate, is valuable in estimating whether the company’s innovative approach on the whole is effective and fit for emulation.

II. CASE STUDY SELECTION

Much like the evaluation criteria, the selection of companies for in-depth research was also vast. For maximum versatility and to optimize the inclusiveness of results, we selected three companies different in their fields, approach, and history. IBM was chosen for its 102 years of successfully serving its business customers. Apple Inc. was selected to showcase the success of a secretive and almost dictatorial approach to innovation that has won the company significant market share and much praise from critics and general public. Finally, exemplifying rapid success in a multitude of software subfields, Google Inc. was contrasted against the other two companies.

III. CASE STUDY: APPLE INC.

Apple, with its primary tactic of product development secrecy, has developed from an after-school project to the multi-billion dollar company that we know today. In the mid-1970’s Steve Jobs and Stephen Wozniak (Woz) grabbed the computing industry, flipped it upside down, and created an empire. At the time, Steve and Woz did not know that their Apple I and II computers would start a revolution in personal computing. A computer built for use in the home was an unknown concept at the time.

Since the beginning of Apple, the company’s strategy has been based on Steve’s core belief: mediocrity is the enemy of excellence (O’Grady, 2009). The goal of Apple’s founders was to create a work environment where one could work under grinding deadlines, responsibility and pressure without relent because they loved the company (Nocera, 1986). Jobs wanted to ensure that each and every product made by Apple was beautifully designed, inside and out. As a result, the company has eliminated all reliance upon other companies to provide system components that affect the design and development of its own products.

A. The History

In the mid-1970’s Apple began its climb to the top of the software industry, driven by the innovative mind of Steve Jobs. The original Apple Computer, also known as the Apple I, was a personal computer designed and hand-built by Steve Wozniak. With built-in computer terminal circuitry, all one needed was a keyboard and a television set; this was just the beginning of innovation for the little Apple Company.

Apple’s first major failure came in 1983, when technology couldn’t meet the leading-edge concepts that Steve Jobs had in mind at a reasonable price. The result was the Lisa computer that introduced the concepts of a mouse, an icon, and a desktop into the vocabulary of the computing public, but was too expensive to succeed. In 1985 the company was devastated when Apple lost Jobs, their innovative founder, and began a downward spiral towards bankruptcy. Apple lost customers in the years to follow because there was no reason to buy their products. The company was falling behind in progressive development of new ideas and without Jobs had few mechanisms to reverse the trend.

In his absence from Apple, Jobs continued his success, purchasing Pixar Studios and founding NeXT. NeXT was a computer company that developed and manufactured a series of computer workstations intended for the higher education and business markets. Though NeXT computers never caught on, its innovative object-oriented UNIX-derived NeXTSTEP operating system and development environment were highly influential in future computer design. In 1996 Jobs was re-hired as interim CEO at Apple, and upon his return innovation was restored to the company. Apple began their process of restoration by purchasing NeXT, Jobs’ brainchild. NeXT technology became the foundation of the Mac OS X and iOS operating systems. By 2001 Apple was back on track and no longer faced concerns of bankruptcy. They went on to revolutionize the portable digital audio player with the release of the iPod and to modernize the phone industry with the release of the iPhone in 2007.

The history of Apple has proven that the innovative ideas of a single leader can flourish throughout the company and result in a great product. As founder and savior of the little company that started as an after-school project, Jobs’ contribution to the success of Apple has left an indelible mark on the software industry.
B. Office Culture

Job responsibility is an important value that Apple encourages and enforces in its employees. Though monetary rewards are offered to employees, Apple believes that their employees are primarily driven by satisfaction in overcoming challenges and creating excellent products (Lashinsky, 2011). If poor-quality work is exposed in a product, employees are held responsible. In this way, Apple encourages their employees to develop innovative products that will have an immensely satisfying end result.

Tim Cook, current Apple CEO said “We believe in deep collaboration and cross-pollination of our groups, which allows us to innovate in a way that others cannot” (Lashinsky, 2011). Technology author Adam Lashinsky has a different perspective. In a CNN money editorial he claimed that Apple employees are highly specialized and deal only with their own area of expertise. Perhaps the combination of these two ideas is what yields the culture of innovation that Apple thrives upon; small groups of highly specialized employees who can all interact to create brand new products.

Unlike other companies who follow agile development technique, Apple undergoes no market research prior to the release of their products. This is attributed to the effort and attention to detail by employees and their teams; they love to develop simple innovative products. The willingness of employees to devote themselves to Apple’s challenging work environment differs from that of other major corporations. At Apple, teams are separated so that their focus can be solely on their own project. According to Lashinsky (2011), employees who are kept from meddling in one another’s affairs have more time to focus on their own work.

Every employee understands the work environment at Apple. Employees may not be able to take initiative in the direction of their choice, but their love for the company is what is most important. Producing beautiful products is how they show their love for the company.

C. Company Politics

To most other companies in the Silicon Valley, Apple is viewed as being ‘in their own world’. It is understandable for them to feel that way since extensive security and confidentiality measures undertaken by Apple restrict the flow of information in and out of the company. By enforcing strict security, Apple has been able to utilize the element of surprise as its signature tactic in the marketing world.

Apple employees are not only expected to keep quiet about their work, they are also often unaware of the projects going on around them. Inside the company Apple enforces security in the form of lockdown rooms (Lashinsky, 2011). These rooms encapsulate secret projects so that employees not working directly on the project are unaware of specific details. Employees working on secret projects do not expose their project knowledge to other employees. It is intuitively surprising that Apple is able to innovate when employees are kept under such strict guard.

Secrecy is a direct result of simplicity and clarity at Apple. Jobs used to indoctrinate a culture of responsibility by hosting a series of weekly meetings that “act as the metronome setting the beat for the entire company” (Lashinsky, 2011). This began at the ‘Top 100’, a small group that met exclusively with Steve Jobs. Everything about this Top 100 meeting was shrouded in secrecy, starting with its very existence (Lashinsky, 2011). The meeting’s purpose was for Jobs to talk about the future of Apple and dissipate his ideas throughout his close inner circle. The Top 100 was an exclusive group and they were the ones responsible for keeping the vision of Apple rolling forward towards the future.

Through a series of meetings each week and more importantly the annual ‘Top 100’, Jobs was able to share his innovative ideas to a group of ‘A player’ individuals. These individuals were held responsible for carrying out the ideas of a single demagogue throughout the thousands of employees at Apple. Outsiders admire and envy the way ideas of one can flourish through the company without any information seeping out of the Cupertino-based vault.

D. Outlook

The future of Apple is uncertain without their chief innovator, Steve Jobs. If the company continues to innovate in the same way it has in the past, it could remain extremely successful, or it could stumble upon its own vertical business strategy. Apple’s short lifespan to this point has proven to be rocky.

History tells us that the presence of Jobs within the company has been the critical factor in its success. From Apple’s founding until the departure of Jobs in 1984 the company flourished. When we he was absent between 1984 and 1996 the company nearly disappeared from relevance, only to resurge upon his return and become one of the most valuable companies in history. It is nearly impossible to believe that such a vast corporate empire can be built on the mind of a single man, but the shaky historical foundation of the company points to this conclusion. If history is true then the future is bleak for Apple.

However, a stroll down the street past hundreds of iPhone toting customers willing to line up overnight to obtain new products makes the demise of the empire difficult to fathom. The future will tell us whether innovation at Apple is a deep seated culture built to last or the brilliance of a single man who was unable to leave an impression beyond his lifetime.

IV. CASE STUDY: GOOGLE

A. History

In what is often considered the ideal setting for innovation, Google started as the research project of PhD students Larry Page and Sergey Brin. At the time of its birth in 1996, there was already a small search engine in place.
called “RankDex” created by IDD Information Services (Lee, 1998).

Since the initial startup, Google has had many successful projects other than the search engine, but most importantly was 2002 Adwords, which “enables you to create advertisements which will appear on relevant Google search results pages and our network of partner sites” and 2003 Adsense, which allows websites to host Google ads and get paid for the customer traffic generated. While these two project are the major revenue generators for Google with advertisements earning nearly 96% of Google’s total profit (Kim, 2012), their other projects are far better known and contribute to Google’s public image. The variety of these products and services reaches a varied demographic and contributes to a loyal customer base.

B. Culture and Practices

Susan Wojcicki (2011) outlines the “eight pillars of innovation” at Google as a corporate structure designed to provide its employees with all means for exercising their creativity. Specifically, she notes the importance of motivation and continuous activity that achieves goals through an iterative process. Otherwise, the development at Google is facilitated by its culture: from the policy of sharing all corporate decisions, to the concept of “20 percent time” in which employees are encouraged to work on anything but their main project for a full day out of every work week.

In the blog “Stevey’s Blog Rants”, a great amount of insight is provided to the inner-workings of Google. As a passionate employee of Google, Steve Yegge explains (2006) how Google applies “The Good Kind” of agile to create a powerful and innovative work environment. The usual sitting in your cubicle and grinding away at work to receive just another paycheck is far from what happens at Google; employees are given very powerful incentives to create.

First of all, everyone is encouraged to only work on projects that they would like to work on, and those projects are displayed during quarterly meetings. However the process of selecting these projects is also significant. All new ideas, as well currently funded projects, are put up for review and ranked (from 1 to 5, 5 being ‘interesting and low-risk’, 4 being ‘high risk but exciting’, and so on). Those ranked 5 or 4 are funded and assigned to development teams. The development teams, or ‘units’ are made up of three people assigned to single projects - there are no departments. However, for larger enterprise projects units may be assigned to modules rather than the project as a whole (Mayer, 2003).

Financial incentives are common at Google, and range from gift certificates to bonuses and stock grants. To further improve employee morale and reinforce the relaxed and productive work environment intrinsic to small teams, the Google offices are accommodating and comfortable. In short, it’s not difficult to see why employees at Google want to see their company innovate and succeed. On the whole, many employees feel there is so many gratuities that you “feel like you owe it to them for taking such incredibly good care of you” (Yegge, 2006).

The actual development methods used at Google are also geared towards innovation. The aim of any project is to deliver a working product in as short a time as possible, with the best attainable quality. And for this, the principals are customer-oriented and minimalistic in nature. All features included in a project are assessed for their value to the customer, and options are kept open until the end of development, even the ones concerning monetization (Perez, 2006). Waste of any kind is kept to a minimum by working in small closely connected teams and aiming to build-in integrity.

However, the overly favourable reviews and public statements made by Google’s employees can be starkly contrasted with their hiring practices. Much like Apple Inc. and many other successful companies, Google has a policy of only hiring “A-listers”. While Google’s organization is largely transparent and lacks hierarchy or a definitive social structure, this is achieved through limiting their demographic to high-achieving and enthusiastic individuals. As described in The Wall Street Journal by Gary Hamel (2006), while elitism may be out of fashion, “Google understands that companies begin to slide into mediocrity when they start to hire mediocre people. A-level people want to work with A-level people. B-level people are threatened by class-A talent. So if you let a B-lister in the door, he or she will hire equally unremarkable colleagues.”

On the bright side, Google’s hiring practices are also remarkable in that they strive to acquire as many ‘unusually’ qualified specialists as possible. Unique ‘extra’ degrees, deep-seeded interests, non-traditional skills, and hobbies (for example, “italian travel” or “machine learning” expertise) are all considered during the hiring process in an effort to diversify the employee population (Rodriguez, 2003). Furthermore, the teams are allowed to organize themselves, which, coupled with the ability to choose projects, increases employee morale and contributes to a productive and friendly work environment.

C. Outlook

Due to Google’s policy of ongoing idea generation by their employees and their history of buying out startups and small companies launching a new or innovative product, their inventiveness is unlikely to suffer on the whole. Unlike most other companies, Google is neither restricted by scope nor limited to a single ‘area of expertise’. On the contrary, their field is constantly expanding and branching out into related, but previously unoccupied niches.

Google’s current and ‘work-in-progress’ projects are also quite promising. From their ever-popular search engine, to Google Drive (whose eventual competitor will be the Microsoft Office suite), to Google Earth, to Google Hangouts (which offers functionality similar to Skype),
many of their current services are growing in scope and popularity. Even more inventive are Google’s up-and-coming undertakings; the Google Driverless Car, for example, is being tested for adequate integration into regular human-controlled traffic, and Google Glass is prophesied to revolutionize the market of personal electronics. Even more far-fetched ideas are being explored and prototyped at Google’s secret Bay Area labs. Among them - WiFi enabled refrigerators, dining utensils with social network access, personal robots, and elevators going to outer space (Miller & Bilton, 2011).

V. CASE STUDY: INTERNATIONAL BUSINESS MACHINES (IBM)

International Business Machines (IBM) has become the forgotten giant in the forest of global communication and information technology. In a modern era of Internet driven technical innovation, billion dollar companies can be made and unmade in a matter of months. In this landscape of dominant software brands like Apple, Google and Facebook it is easy to forget “Big Blue” and the influence that is has wielded on technology innovation since 1911 (eWeek, 2011). IBM is the only modern computing company with distinct roots going back over a century.

IBM is no longer the dominant brand in devices and software that interact transparently with people, and perhaps that is why it is easily forgotten. However, the scope of IBMs influence is staggering and they remain on of the largest and most profitable IT companies in the world; IBM is the second largest employer in the world, with 433,362 employees in over 170 countries (CNNMoney, 2012). Those employees have collected 5 noble prizes and contributed to IBM holding more US patents than any other company. Between 1993 and 2007 IBM secured 38,000 US patents, investing over $6 billion per year in research (Wikipedia, 2013).

A. History

IBMs history dates back to the 1880s when it was called the Computing Tabulating Recording Company. This name was changed to IBM in 1924 to become more internationally relevant as it expanded outside of the US. The foundation of that business was in technology, and the big break came in 1890 when they secured a contract to provide punch cards to the US Census (Pugh, 1995). This gave them the head start that was needed to lead the punch card industry for the next 80-years as they were the standard for all computer data input.

The company’s growth due to breakthrough service orientation continued when they won the 1935 Social Security Act payroll-reporting contract with the US Government. This was dubbed "the largest bookkeeping operation in the history of the world" (SSA, 2000) and followed on the heels of the Great Depression, during which IBM had been carefully producing and storing massive quantities of punch cards that made them a natural candidate for this job. IBM continued to capitalize and benefit from major national and international events when World War II disrupted normal life, and IBM factories were retooled to produce military rifles and other war supplies. IBM punch cards were used extensively during the Manhattan Project that developed the first atomic bomb (Pugh, 1995). IBMs rapid wartime growth created significant challenges for postwar slowdowns, and IBM made rapid international moves following 1945 to remain relevant.

It was during the cold war following 1945 that IBM made very rapid gains in computer and software technology due to investment from the US government. This is also the period in which IBM began to develop well-funded research laboratories that would lead to innovations that lay the groundwork for a complete computer industry monopoly for nearly 30 years (Pugh, 1995). The SAGE air defense system involved building 5 computers for the US Government in 1952 worth $30M each, and these computers remained in use until 1984 (Pugh, 1995). In 1962 IBM 7090 mainframes became the backbone of the Sabre reservation system built for American Airlines. This system was groundbreaking in its use of phone lines for national network communication and exemplifies the benefits that IBM has gained from collaboration with governments and customers.

By 1969 IBM had become embroiled in antitrust suits claiming monopoly, just as Microsoft was subject to in the 1990’s. Although IBM would win this 13-year case, it fundamentally changed the way they operated and spurred them to unbundle their hardware and software to create separate business entities. This was a groundbreaking move at the time, when hardware and software were still considered inseparable systems (Burton, 2002). This was part of the philosophy shift that gave rise to the personal computer and software revolution between 1975 and 1992. During this period IBM would see their monopoly crumble underneath them as they abandoned their long used vertically integrated strategy and contracted PC components out to contractors such as Microsoft and Intel. This was just the opportunity that such innovative companies needed to erode IBMs market dominance and begin their rise to superpowers of the personal computing age.

In 1995 IBM shifted their focus largely to software, buying Lotus and several other software companies to build their portfolio. IBM also began to apply the massive research knowledge base it had developed in its 11 worldwide research laboratories to make gains in Internet applications, servers and mainframes. This was an area in which IBM could still exert its massive research power despite losing step to user facing companies like Apple and Microsoft. The transition to a service oriented software focus has paid off significantly: in 2010 IBMs revenue from software sales alone was $22.5 billion making it the second largest software company in the world. The idea that IBM is dead could not be further from the truth; Since 2009 the company has seen steady growth second only to Apple in the technology sector, outpacing industry giants such as
Microsoft and Google. This has attracted the attention of Warren Buffet, one of the world’s most successful investors, who now owns approximately 5.5% of the business (Fidelman, 2012).

B. Culture and Practices

Media, executives and employees loudly credit IBMs “social business culture” as the primary reason for recent growth. The term “social business” often refers to altruistic companies with social rather than financial objectives, but in the case of IBM it refers to a culture where employees are empowered by an open communication environment so that they are rewarded and perform optimally. IBM built an innovation empire on three basic principles: invest in individuals, bring people together so they can communicate, and THINK, the slogan of Watson Sr. While theories on the culture that has contributed to recent IBM growth are plentiful, it is the company’s history that provides significant insight into the companies success.

Although “social business” is the latest buzzword that many executives strive for, the reality is that IBM has been successfully implementing social strategies for nearly 100 years. IBM first began implementing employee education programs in 1916 (then as CTR) before this became common in any industry (Pugh, 1995). The focus on employee rights was at the forefront of IBM operations from 1914 to 1956 during the reign of charismatic CEO and president Thomas Watson (New York Times, 1956). Watson made ground breaking moves such as introducing a 40-hour work week in 1933, replacing piece work rates with stable salaries for factory workers in 1934 and hiring a female vice-president in 1943. These practices are commonplace today, but in the first half of the 20th century they were progressive.

Watson’s tenure at the head of IBM ended in 1952 when his son Thomas Watson Jr, became CEO. Watson Jr would continue to operate the company in the spirit of his father, creating the IBM principles of Three Basic Believes, Open Door and Speak Up. The Three Basic Principles included respect for the individual, the best customer service and superior accomplishment of all tasks (IBM, 2013). This demonstrated a basic drive and respect for employees that was also reflected in the Open Door and Speak Up programs promoting a willingness to act on employee feedback (IBM, 1995).

In 1945 Watson Sr oversaw the creation of IBMs first research lab, and this was a move that led to the creation of a huge global network of private labs whose innovation still drives IBM growth. Landmark products, concepts and ideas have come from IBM labs, including Fast Fourier Transforms, magnetic storage disks, relational databases, Dynamic random access memory (DRAM), the barcode and the personal computer (iRise, 2012). Significant investment in research has allowed IBM to maintain a technology edge over many competitors that continues today. It was IBMs risk taking strategies through world changing events such as the great depression and cold war that positioned the company for success and subsequent massive investment in innovation.

C. Outlook

IBM has a long history with intelligent computing dating back to the high profile defeat of chess world champion Garry Kasparov by Deep Blue, a chess playing computer, in 1997. More recently IBM has put its research might behind Watson, an artificial intelligence computer system capable of understanding and answering natural language questions (eWeek, 2011). Like Deep Blue, Watson was launched with a high profile game win, beating Jeopardy champions Brad Rutter and Ken Jennings at the trivia game show. IBM has targeted health care as a market for Watson, although it largely remains an “out of work” supercomputer looking for meaningful employment (Fidelman, 2012).

IBMs recent resurgence has been a result of refocusing on business services, software (middleware and operating systems), intelligent computing and big data management. The focus on business services could be viewed as a move away from software innovation as a core value within the company. Significant of this change was the purchase by IBM of PricewaterhouseCoopers (PwC), a multinational professional services company (Fidelman, 2012). While it might be argued that PwC innovates in some fields, the acquisition of such a company hardly seems likely to lead to software innovation as defined in this analysis.

IBM does however continue to hold sway in the software industry by utilizing decades of experience and knowledge gained through the highly successful IBM Labs. IBM Labs opened their doors over half a century ago and employed the brightest minds in the early computing industry. The benefits of such massive research and development investment can still be seen in products like Watson and in massive Internet backbone infrastructure that will be pushed to evolve over the next decade. This is clearly where IBM has decided to invest itself. New business facing products are also on the horizon, such as the Open Client Offering, which will run on Linux, Microsoft Windows and Apple’s Mac OS X. Open Client Offering is targeted at allowing businesses to run the same software on all of these operating systems, thus removing barriers to migrating between operating systems and licensing agreements (iRise, 2012). Whether this venture can be successful in a landscape where the Internet and web browser based applications are rapidly growing in popularity remains to be seen. Perhaps IBM, in their focus on big business and infrastructure, is again looking in the wrong direction as they were during the personal computer revolution at the end of the last century.

If innovation is measured on a purely monetary scale, then IBM has years of continued dominance on the horizon. One must not forget that IBM remains the 4th most valuable company in the world (Strange, 2011), and as such holds an advantage due to its size alone that will send reverberations
through the software industry for many years to come. The question to be answered is whether or not they can continue to drive innovation in the software industry.

VI. CONCLUSION

After considering the many factors affecting innovation in the software industry it can be concluded there is not a specific solution for success. As mentioned above, different approaches to innovation proved prosperous for Apple, Google, and IBM.

A. History

Apple initialized the idea of computers in a home and went on to develop a definitive line of simple and aesthetically pleasing products. They were able to capture the computing industry on the basis of one man, Steve Jobs, and create their own empire surrounding his ideas and concepts.

Google took an entirely different approach through ongoing idea generation by staff and buying out startups and small companies that have launched a new or innovative product. Unlike Apple, Google never restricted their scope and so was seen exploring a multitude of possibilities at any one time. Furthermore, this policy allowed for the undertaking of many potentially risky projects whose failure would be inconsequential, while other companies, like Apple, perfected and polished single products.

Demonstrating yet another methodology, IBM was able to capitalize on national and international events. IBMs’ biggest gain shadowed the cold war where they made very rapid gains in computer and software technology. They received investments from the government to fund research laboratories that would lead to innovations that laid out the groundwork for a complete computer industry monopoly. This model may or may not be realistic in modern political climates.

In summary, the historical evolution and the timeline of releases at the three companies examined in this study exemplified three very different management practices. While all three were successful and proved profitable, it may be noted that Apple’s reliance on the brilliance of one individual is a high-risk approach, whereas IBM’s utilization of environmental factors requires careful planning and skill; Much less risky, but requiring significant resources and time, is Google’s multitasking approach.

B. Culture

As could be expected from the contrasting approaches to business and production management at the three companies, their work environment and corporate culture was also very different.

Complementing the ‘one man’s vision’ approach to innovation, Apple exercises a secretive and well-structured hierarchy. Their employees are expected, if not required, to be passionate about the company and it’s products, and an emphasis is made on productivity and good work ethic.

While undeniably effective, it could be argued that this approach is somewhat misplaced, and does not justify Apple’s policy of only hiring top talent.

Renowned (and often criticized) for similarly elitist hiring practices, Google has a vested interest in its A-lister staff. The company’s policies, most notably 20% down time, are geared towards gaining the most benefit from the enthusiasm and interest of each individual employee. Ideas for products and services are accepted from everyone and the flat corporate structure and small teams are all used as tools in creating an environment optimal for collaboration and creativity.

Similarly inclined to motivate and inspire it’s employees, IBM’s approach is something of a mix between the strict hierarchy of Apple and the transparent and flat structure at Google. While IBM neither seeks to only hire the best nor requires its employees to be committed to the company vision, it does strive to get the most out of its staff by providing good incentives for excellent effort and good work. Built around the principles of investing in individuals, bringing people together so they can communicate, and THINK(ing), IBM has been a forerunner of collaborative and favorable business environment.

Whatever their differences in approach and management, all three companies are continually faced with failures of varying magnitude. If there is a commonality between them it is that their employees have repeatedly restored success through innovation. Where Apple and IBMs achievements can be traced back to specific individuals, Google’s collaborative and open culture identifies only the contribution of its many teams.

C. Outlook

The three companies examined in this study are very different in both their area of expertise and their business structure. And while unquestionably successful in the past, their methodologies and practices are not without their drawbacks. In short, the probability of future success needs to be assessed to ascertain the companies’ inventiveness as a conscious process and not a consequence of favorable conditions.

While Apple’s founder, Steve Jobs, had an unforgettable impact earning the corporation a title of the most innovative company, many people question its outlook in his absence. Despite Apple’s history of excellence and reputation for quality, its success depends entirely on whether the effort-consuming projects are ‘right’ for the market. In short, Apple’s work ethic will lead them to success only if they can keep releasing products that consumers will want. Unfortunately, this may be a difficult task for a company with no experience in market research.

In contrast, IBM is unlikely to require a change in their business approach. Thomas J. Watson, the chairman and CEO, conceptualized the distinctive management style and corporate culture that turned the company into a highly effective selling organization. Over the course of a hundred
years his approach has been tweaked and polished, allowing IBM to remain among the corporate giants exemplifying the software industry. Having proven their skill in catering to the ever-changing market of technology, IBM will likely remain successful behind the scenes unlike companies like Google, Apple, and Facebook, which strive on immediate public success and rely heavily on the whims of the general public.

As a prime example of these customer-oriented companies, Google has a strategy to combat the unreliable nature of the consumer market and secure it’s place among the most innovative companies. Google’s projects are spread across a wide variety of fields and its thousands of employees are divided into small teams continuously generating and implementing ideas for products and services. This multitude of projects forms a security net for the company, allowing it to take risks and explore new possibilities without significant consequence of failure. Furthermore, with 100 ideas on the go every quarter, Google is unlikely to fall short.

VII. REFERENCES